ESP
of
QUARKS AND SUPERSTRINGS

STEPHEN M. PHILLIPS

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Dedicated to

Those seeking evidence that we are more than machines,
Those who believe that we are only machines,
And those who say that we can not know which is true.

FOREWORD

The part played by intuition in scientific and other matters has always been a mystery. There have been cases in the basic sciences and mathematics where results have been written down, but the proofs have taken a long time to come. When something is obviously true but cannot be proven, it goes by the name of Godel's theorem in modern scientific terminology. The number of cases in which statements or predictions have been made but their proofs have come only long afterwards clearly shows that deductive rationalism is not the only way to analyze things or acquire knowledge.

The Theosophical Society, an important socio-philosophic organisation was at the height of its intellectual appeal during the early part of this century. In those days, the work of the Theosophical Society was devoted more to mystical matters, and phenomena were discussed not necessarily from a strictly scientific perspective. It is only recently through the work of Dr. Stephen Phillips and discussions with my old friend Dr. M. Srinivasan that my attention was drawn to the fascinating work of Annie Besant and Charles Leadbeater on atomic structure.

It is indeed remarkable how even as early as the turn of the last century when the very existence of atoms, postulated as being the ultimate building blocks of matter, was being debated, the detailed substructure of atomic particles was being discussed by those two savants. For example the list of atoms described by them shows three types of hydrogen, two types of silicon and so on, and this is indeed remarkable considering that their work was first published in 1895 when nuclear physics just did not exist. The work of Besant and Leadbeater clearly shows the existence of Isotopes, years before its discovery by Science. When a copy of their work was sent to Prof. Aston in Cambridge, the discoverer of Isotopes, he brushed it aside saying "I am not interested in Theosophy". At the time when Besant and Leadbeater first published their "findings", the neutron had not yet been discovered and Fundamental Particles such as quarks, could not have even been dreamt of! It is therefore not surprising that the detailed description of the structure of atoms by Besant and Leadbeater was simply dismissed as meaningless speculations by the scientific community. It is of course not possible to say even now whether their work in fact represents the ultimate description of atoms and nuclei, but it is nevertheless very close to the truth as we know it today. The laborious work of Besant and Leadbeater has been studied in great depth by Dr. Stephen Phillips, a qualified theoretical physicist who is fully conversant with the status of modern nuclear physics. Dr. Phillips has taken great pains to show in the present book that the exhaustive studies of Besant and Leadbeater cannot be brushed away lightly.

Now a hundred years after their work was first published we still wonder how Besant and Leadbeater did what they did. It is obvious that these people possessed some form of special "intuitive power". Our ancient books tell us that such intuitive power is something which can be developed by deep concentration or meditation. The very fact that so much information on nuclear structure was provided by Besant and Leadbeater at a time when the study of atomic sciences was in its infancy, itself becomes an important scientific field of inquiry, especially now that study of 'Consciousness' has become accepted as a respectable branch of scientific enquiry. If we are unable to explain consciousness, we are unable to explain intuition too. But when we are presented with facts so close to the truth which excites one's amazement, it raises the question as to whether our consciousness can be deliberately trained to be sharpened to enable the study of scientific phenomena also. After all, all scientific discoveries are made by rare insight which includes some degree of intuition. If knowledge acquired through intuition has stood the test of time even after a hundred years, then it is clear that the methodology employed by these people needs to be critically examined both from the point of view of "disciplined consciousness" as well as the "neurophysiological structure of our brain". This scholarly work of Dr. Stephen Phillips placing the clairvoyant findings of Besant and Leadbeater in the context of modern particle physics, could well serve as the starting point for such exciting studies.

17th April 1997

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PREFACE

Despite the triumph of scientific rationalism (indeed, perhaps as a reaction to its success), interest in the paranormal has never been stronger. The world-wide success of the TV series *The X Files* has stimulated the fascination of the general public in UFOs, ghosts, dreams about the future, psychic healing and a host of other paranormal abilities and phenomena. The waning power of institutional religion to influence what people think has given many permission to believe many ideas once regarded as heretical (*e.g.*, someone may regard himself as a Christian yet believe in reincarnation). Whilst still strongly defended in some quarters, the philosophy of scientism, namely, that *everything* is scientifically explainable (or else it cannot exist!) has been repudiated by many people with first-hand experience of the paranormal who remain unconvinced by the naive arrogance of some scientists who confidently pronounce that psychic phenomena *always* have conventional explanations. But in their rush to embrace unorthodox ideas, 'New Age' enthusiasts all too often ignore the issue of whether strong, scientific evidence really supports their unconventional beliefs. The result is that the debate about the paranormal has become polarised into two irreconcilable camps, each accusing the other of either gullibility or unreasonable scepticism.

However real paranormal experience may be to its percipient, such anecdotal evidence of abilities that contradict the scientific view of the brain as the seat of consciousness remains unconvincing to scientists ever aware that chance misobservation or misreporting might have played some part in creating a false impression that the experience was a psychic one. To eliminate these uncertainties, parapsychologists have conducted under-controlled, laboratory conditions, numerous double-blind tests of paranormal abilities such as clairvoyance, telepathy and precognition. Successful though some of these experiments have been reported to be, they still have not convinced sceptics, who always seem able to find *some* methodological flaw in their design which — however trivial and irrelevant — affords them the excuse to reject what, statistically speaking, were highly significant results.

Does this impasse mean that attempts to establish irrefutable proof of paranormal phenomena are doomed to fail — not because the latter do not exist but because there will never be unanimity among scientists over whether such evidence has been provided? Does the reality of paranormal powers of the mind *have* to remain — like religion or politics — a matter of opinion and unresolved controversy? My book analyses a body of evidence for a psychic ability which is so rare that even most parapsychologists are unfamiliar with it but whose remarkable consistency with scientific facts unknown to anyone at the time can have no other explanation than that it was genuine. Recognised in yoga as one of the eight major "siddhis," or paranormal abilities, that can be acquired by the practice of yoga, it is the faculty to observe microscopic objects beyond the resolution of human eyesight. Over a hundred years ago, the Theosophists Annie Besant and Charles Leadbeater claimed to have used this power to examine the structure of atoms and their constituents. Their book, *Occult Chemistry*, which compiled the results of their clairvoyant investigations into matter, was ignored for many years by scientists fearful of venturing into occult territory traditionally banned from scientific enquiry. In my book *Extra-sensory Perception of Quarks* (Theosophical Publishing House, 1980) I analysed what Besant and Leadbeater claimed were psychically observed atoms of the first twenty elements in the chemical periodic table in terms of simple facts about their nuclei and what is known about quarks, the particles making up the protons and neutrons inside nuclei. A year earlier, my scientific paper proposing a unified theory of particles and forces other than gravity had been published in the physics journal *Physics Letters B*. My theory predicted that quarks are not fundamental (as most physicists believe) but are composed of three more basic particles that I called "omegons". As my analysis of *Occult Chemistry* implied that Besant and Leadbeater had paranormally observed such "subquarks" as well as quarks themselves, I decided to identify these scientifically undiscovered particles as omegons. But I emphasised in my book that, if my theory of omegons proved wrong, this would not invalidate my explanation of the hundreds of observations of subatomic particles appearing in *Occult Chemistry*, because my analysis of what Besant and Leadbeater assumed were atoms, did not use any specific property of subquarks predicted by my model, only occasionally and incidentally referring to the electric charges +5/9 and -4/9 (in terms of the charge of an electron) of the two types of omegon my theory predicted to comprise up and down quarks.

In 1984 (the *annus mirabilis* of superstring theory, which conceives of subatomic particles as like bits of string) I realised for reasons too technical to discuss here that, if superstrings exist, they could not be omegons. On account of this — as well as to forestall false criticism that the case for ESP of subatomic particles presented in my earlier book rests upon the validity of an as yet untested theory of particle physics — I have used neither my omegon model nor any other published subquark model as the theoretical framework of my analysis. Similarly, (and also to avoid technical discussion comprehendible only to particle physicists), I have intentionally avoided making in terms of superstring theory *specific, model-dependent* interpretations of Leadbeater's clairvoyant description of subquarks. I am content to point out its remarkable similarity to the superstring picture.

This book extends my previous analysis of twenty elements to forty-eight elements, which are discussed in chapter 5. Unlike the former, there is no arbitrariness about the latter as a sample for investigation, for they comprise all those elements for which Besant and Leadbeater gave a complete description of the particles making up what they thought were their atoms. The remaining elements that these two Theosophists investigated cannot be analysed thoroughly because *Occult Chemistry* provides insufficient information about certain of these particles to allow complete comparison between scientific facts and clairvoyant observation. Uncertainty in their subquark composition through lack of details about their constituents means that these elements cannot be used to test rigorously any scientific interpretation of their clairvoyant observation, although they *can* still be used to test its *self-consistency* (this, however, will not be discussed here). Chapter 5 presents the core of the evidence supporting the claim of Besant and Leadbeater that they could describe subatomic particles with clairvoyance. It will hopefully make the reader aware of the truly remarkable degree of consistency between these psychic observations and facts about the quark composition of atomic nuclei. In section 6.2 we discuss possible conventional alternatives to a paranormal explanation of this high level of correlation between scientific data and century-old psychic descriptions of subatomic particles. All are found to be either not viable or implausible because they require a degree of fortuitous coincidence verging on the miraculous.

I would like to thank Dr. Srinivasan for his help in publicising my work and facilitating the publication of this book. I am also indebted to Dr. Raja Ramanna for agreeing to write its Foreword. Finally, I remain ever grateful for the encouragement and wise advice provided during the early days of my research into *Occult Chemistry* by the late Dr. E. Lester Smith, F.R.S. (discoverer of vitamin B12), who had a life-long interest in Besant's and Leadbeater's clairvoyant investigations into the atomic structure of matter and who wrote the introduction to my earlier book.

November, 1996 Stephen Phillips

CONTENTS

CHAPTER 1

HISTORY OF CLAIRVOYANT INVESTIGATIONS OF ATOMS

1.1 The basic problem in parapsychology

Over the past few decades, parapsychologists have published many sets of data obtained under controlled laboratory conditions that suggest that paranormal abilities like extrasensory perception (ESP), telepathy (communication of thoughts) and psychokinesis (mind over matter) exist. Despite this accumulation of evidence often of such high statistical significance that it would have been accepted long ago by scientists working in orthodox areas of science, the scientific case for the existence of such faculties remains controversial. However hard parapsychologists try to answer their critics by devising protocols that eliminate every possible sensory clue, sceptics or 'conventional theorists', as the parapsychologist Richard Broughton[1] prefers to call those who believe that psi phenomena can be explained in terms of conventional scientific knowledge, will inevitably discover some aspect of a successful, parapsychological experiment which they think they can fault. Although this flaw may be so minor as to be materially irrelevant to the issue of whether it allowed the psychic under investigation to cheat, it gives the conventional theorists the excuse - however flimsy - to reject what otherwise appears to be irrefutable evidence of human beings exercising a paranormal faculty. If, however, he cannot fault the experiment, the conventional theorist may as a last resort raise doubts about the validity of its results by questioning the honesty of the experimenter or even by attacking his character in order to discredit his work, rather than admit that his evidence is incontestable. Indeed, he may ask: 'How can ephemeral, often unrepeatable, paranormal phenomena ever receive complete scientific validation if it always has to be presupposed without possibility of proof that the researcher did not concoct or alter his data in order to create the impression that he had obtained a significant result?'

For this reason — unreasonable though it may seem to parapsychologists, who are unaccustomed to seeing the probity of scientists challenged in orthodox fields of research just because the latter publish anomalous data - even highly evidential reports of paranormal phenomena will remain inconclusive to anyone who, despite having no evidence to support his suspicion, prefers to doubt the honesty of the researcher rather than to accept as genuine the results of his investigations. It will always be easier for such people to believe that parapsychological evidence is fraudulent or due to methodological error than that human abilities exist which violate basic premises of materialistic science. As justification for their doubts, sceptics might point to the infamous card guessing experiments of Dr Samuel Soal, which seemed to demonstrate precognitive telepathy but which were discredited in 1978 as fraudulent.[2] However cynical their attitude may appear, sceptics and debunkers of the paranormal can get away with their dismissive explanations because replication by independent researchers of significant experiments in parapsychology is notoriously unsuccessful, which means that evidence for psychic abilities in individuals usually stems from the work of just one or two researchers, whose honesty may be open to doubt, instead of numerous workers, whose integrity even sceptics would find it implausible to challenge owing to their sheer number.

Thus does the initial certainty of significant findings by parapsychologists inevitably degenerate into a matter of opinion about whether the psychic or even the experimenter cheated, with the consequence that practically every piece of research claiming to provide evidence of psi phenomena - however brilliant it may be - remains inconclusive and controversial. No amount of use of high technology can avoid this basic problem in parapsychology. It may, indeed, make detection of fraud by the experimenter more difficult, as well as providing more scope for doubt by raising issues about the reliability of performance of electronic apparatus. However computer-automated his experiment may have been, the possibility of a researcher having manipulated his data at some stage of his investigation can never be eliminated, leaving always for those who are sufficiently sceptical an alternative explanation of his significant findings.

Suppose, however, that someone had placed on public record his clairvoyant investigations of certain physical objects many years before science knew anything about them or possessed the technological capability to study these things. This circumstance would eliminate the notoriously uncertain issue in parapsychology of whether the conditions under which ESP allegedly occurred allowed the psychic access to normal information for the obvious reason that no scientific information existed at the time when the psychic published his work to permit in principle the possibility of his cheating. Unsound methodology, possible fraud by the psychic or even the researcher's integrity would then cease to be pertinent questions for sceptics and proponents of the paranormal to argue about. If it turned out that scientific facts established many years after the clairvoyant observations were published confirmed sufficiently large numbers of the latter to make it improbable in the extreme that such a high degree of scientific corroboration could be due merely to constant, lucky guessing by the psychic, a prima facie case for his having exercised a paranormal ability would be established. Moreover, the circumstance of complete scientific ignorance about the things the clairvoyant claimed to see, which made fraud impossible a priori, would mean that this case was free of the fundamental problem facing any successful, laboratory demonstration of paranormal abilities, namely, that, however distinguished and reputable a scientist he may be, the experimenter's honesty has to be assumed, so that the issue of whether his data were genuine or fabricated has to remain uncertain even if in the rare case where the possibility of cheating by the psychic and doubt about the reliability of performance of the researcher's laboratory equipment were eliminated to everyone's satisfaction. Describing aspects of the world that are verified by advances in science many years later (thus making cheating by either the psychic or the experimenter impossible) is, arguably, the most convincing type of demonstration of ESP because such a circumstance prohibits the sceptic's rejection of what seems otherwise irrefutable evidence by his resorting to the suggestion that the researcher himself fabricated the data - an accusation which is easy to make but which may be virtually impossible to disprove. This situation amounts, effectively, to what scientists call 'double-blind' test conditions, which are the most rigorous scientific protocols for testing hypotheses, for neither the psychic nor the experimenter (if there was one) could have had the requisite knowledge to anticipate what the correct description of the world should be. One of the few such cases in the history of parapsychology is the subject of this book.

1.2 Micro-psi

The Vedas, the ancient Hindu scriptures of India, and modern books on Indian yoga mention psychic powers, or 'siddhis,' which a yogi may acquire as a result of meditation, drugs, incantations, or austerities. The *Yoga Sutras*, the earliest exposition of yoga written by Patañjali about 400 B.C., describes eight siddhis, one of which has the Sanskrit name of anima and is usually defined by writers on yoga as 'the power to become as small as an atom, at will'[3]. In Aphorism 3.26 of his *Sutras*, Patañjali states[4] that a yogi can acquire 'knowledge of the small, the hidden or the distant by directing the light of superphysical faculty:'

26. प्रवृत्त्यालोकन्यासात् सूक्ष्मव्यवहितविप्रकृष्टज्ञानम्।

Vibhuti Pada - Yoga Sutras

In parapsychological terms the ability to acquire 'knowledge of the hidden or the distant' is called 'remote viewing.'[5] The ability to obtain 'knowledge of the small' can likewise be interpreted as remote viewing of the microscopic world, although the clairvoyant images are not static, as is normally the case for large-scale remote viewing, but highly dynamic.

The author has given[6] the name 'micro-psi' to this form of ESP. It signifies the ability to enter an altered state of consciousness in which the field of vision of the 'micro-psi observer' can be filled with rapidly changing, vivid images of ostensible microscopic objects present at the time within a few feet of him. (It should be pointed out that these images normally appear only when the micro-psi observer deliberately focuses his attention on the interior of an object *close* to him. It is unknown how critical proximity to the object is for micro-psi to operate). His perception is not that of a passive spectator peering down the eyepiece of a microscope, unable to disturb what he is examining. Instead, the micro-psi observer may, depending on the magnification he operates, experience a sense of being suspended in space amidst particles moving rapidly all around him, rather like a scuba diver floating amongst a shoal of fish. By making an effort of will, he can slow down the motion of individual, particle-like images in his field of view sufficiently to move around them, inspecting them at any angle he chooses, or even to move about inside them.

His ability to mánoeuvre creates for him the subjective impression that his body has shrunk to a size commensurate with the objects he views, although he does not see a body as such, being aware of himself only as a disembodied centre of consciousness. This explains why writers on yoga often define micro-psi as 'the power to become as small as an atom.'

Unlike better known psi abilities, which usually function spontaneously, micro-psi vision can be induced or terminated at will by certain meditative exercises, although its acquisition, which can be accidental or deliberate, may require years of meditative practice. Unlike sleep and trance, it is accompanied by no loss of self-awareness. Nor does the person in this altered state of consciousness notice any reduction of mental skills; logical thought and memory function normally, and he can count, hold a conversation and retain full sensory awareness.

As the micro-psi observer mentally focuses on the interior of some material or chemical substance placed before him, he may become aware of many images flooding into his field of vision. These images persist whether his eyes are open or closed, although in practice his concentration is aided by keeping his eyes closed so as to eliminate distracting optical images. These micro-psi images are three-dimensional, may be coloured and may display extremely rapid and/or complex motion that he cannot at first follow. By a deliberate effort of will, however, the observer can slow down the movement of an image as much he wants.

He can keep an apparently stationary image in his field of vision indefinitely, unless it undergoes spontaneously some kind of unexpected change. Unlike the ephemeral images experienced in clairvoyance or telepathy, micro-psi images persist, and they have a dynamic life of their own that the observer cannot always control, thus differing from images visualized by the imagination. Provided that it is intrinsically stable, an image will remain in view until the observer chooses to look at something else. But he has to make a continuous effort to hold micro-psi images steady in his field of vision, and the length of time this can be sustained is limited by how long the person has been in his altered state of consciousness and by the level of magnification he has operated; more magnified images are generally more taxing to sustain.

This is unsurprising, as the degree of resolution of features in the structure of microscopic objects is limited by the energy of the observational probe: smaller the space-time scale explored, more energy the probe needs.

The intensely interactive, micro-psi experience is akin to a computer-generated 'virtual reality' simulation of a landscape. Whether this terrain conforms to the subatomic world as known to physicists — as its yogic etymology would suggest — or is merely the hallucinatory flora and fauna of some unconscious level of the human psyche is for the reader of this book to decide.

Having focused on the interior of some physical object in front of him, a micro-psi observer may have the sensation of being suspended in a space amidst a profusion of rapidly moving points of light, some brighter than others, which he can zoom down into and lock onto, altering his perspective and distance whenever he chooses. He can move in and around the stereoscopic images surrounding him, selecting whichever one he wishes and moving towards any of its visible features. He can increase at will the degree of magnification of his vision by flying towards ever smaller parts of the image as they become discernible. Unlike with a microscope or telescope, high magnification seems to retard the motion of images automatically, as well as to require more mental effort to maintain. The range of powers of magnification is enormous. Indeed, there *appears* in principle to be no upper limit to the level of magnification attainable, although a practical limit is set by the prowess and experience of the micro-psi observer and by the degree of strain he may begin to feel after viewing highly magnified images for some time.

1.3 Micro-psi investigations

Among the few people known to the author to have claimed to posses micro-psi ability are Annie Besant (1847-1933) and Charles W. Leadbeater (1847-1934), who were early leaders of the Theosophical Society. Annie Besant had found in Theosophy a natural forum for her radical, socialist views. Brought up by her Irish mother as the second of three children after her father died when she was five years old, Annie Besant had a loveless marriage to an Anglican cleric. Leaving him at the age of twenty-five, she took her daughter to London, where she began a career in journalism and joined the company of radicals and atheists, such as Charles Bradlaw, becoming in 1875 the vice-president of the National Secular Society. She collaborated with Bradlaw in publishing a book describing methods of birth control in plain English for working class women, for which she was prosecuted in 1877 for obscenity. Besant's eloquent defence impressed the young writer and playwright George Bernard Shaw, who introduced Annie to his Socialist friends. She became part of the early history of the trade union movement when she led a strike in 1888 by Bryant & May match-girls and achieved a now famous victory against the company, forcing it to improve wages and working conditions. Asked as a newspaper journalist to review a book called *The Secret Doctrine*, written by the Russian aristocrat and occultist Helena Petrovna Blavatsky, Besant was so impressed by what she read that she joined the Theosophical Society in 1889, becoming its second president in 1907. Through her many books on eastern mysticism and the spellbinding eloquence of her public lectures worldwide, Besant was largely responsible for the upsurge of interest in Theosophy during the first two decades of this century. In 1913 she entered Indian politics and became recognized as a nationalist leader. Forming the Home Rule for India League in 1916, she was interned the following year by the British authorities. On her release she became President of the Indian National Congress.

In 1894 Annie Besant met Charles Leadbeater, who was a clergyman in the Church of England and the secretary of the London Lodge of the Theosophical Society. Living by then at 19 Avenue Road, Regents Park, London, the home of Madam Blavatsky, who had passed away in 1891, Annie Besant invited Leadbeater and his Indian colleague C. Jinarajadasa, who was president of the London Lodge, to stay with her. They collaborated in many investigations of the human subtle bodies and its 'chakras,' or centres of psychic energy, described in yogic literature and in books on the occult. Neither was naturally psychic. But Besant and Leadbeater claimed to have developed clairvoyance and other psychic abilities through their training by certain perfected human beings that Hindus generally call 'mahatmas.' They claimed to have achieved these powers by awakening the so-called 'kundalini power,' described in yoga as a cosmic force or energy ('sakti') lying dormant at the base of the spine which, when aroused and carefully directed up the spine, activates the seven major chakras, including the ajna chakra, which is situated between the eyebrows and said to generate clairvoyant sight. Leadbeater stated[7] that, whilst staying at the headquarters of the Theosophical Society in Adyar, a suburb of the city of Madras in India, he took forty-two days to develop clairvoyance by developing the kundalini energy under the tutelage of one of his gurus, further instruction for psychic development then being offered by other gurus during what he said turned out to be a 'year of the hardest work that I have ever known'.[8]

Besant and Leadbeater claimed also to have developed micro-psi vision as a special form of clairvoyance, calling it 'magnifying clairvoyance.' They said little about its modus operandi even in their main publications on the subject. In his book *The Chakras* Leadbeater gave the following all too brief details:

> The centre between the eyebrows is connected with sight in yet another way. It is through it that the power of magnification of minute physical objects is exercised. A tiny flexible tube of etheric matter* is projected from the centre of it, resembling a microscopic snake with something like an eye at the end of it. This is the special organ used in that form of clairvoyance, and the eye

> at the end of it can be expanded or contracted, the effect being to change the power of magnification according to the size of the object which is being examined. This is what is meant in ancient books when mention is made of the capacity to make oneself large or small at will. To examine an atom one develops an organ of vision commensurate in size with the atom. This little snake projecting from the centre of the forehead was symbolized upon the head-dress of the Pharaoh of Egypt, who as the chief priest of his country was supposed to possess this among other occult powers.[9]

Collaborating intermittently from August, 1895 onwards and completing most of their investigations by 1908, the two Theosophists examined with their micro-psi vision what they believed were the atoms of all ninety-two naturally occurring elements in the periodic table from hydrogen to uranium, including some variations which they ascribed to either isotopes or elements which had not been discovered by science at the time they studied their atoms. They also studied an assortment of organic and inorganic compounds. The famous chemist and inventor of the cathode ray tube, Sir William Crookes, who, according to Jinarajadasa[10], was a friend of both the investigators and a member of the Theosophical Society for some years, was asked to provide specimens of elements in their pure state. Besant & Leadbeater would focus their micro-psi vision on what they regarded as individual atoms of an element, make rough sketches of what they saw and pass their diagrams to their colleague, Jinarajadasa, who redrew them more neatly and counted the particles observed in each section of the atom.

Leadbeater began his micro-psi investigations in England when, staying at Jinarajadasa's house, the latter asked him whether he could see a molecule. Leadbeater agreed to try, and Jinarajadasa suggested a molecule (sic) of gold. But, on focussing his clairvoyant vision on this element, Leadbeater found its structure too elaborate to describe readily. Jinarajadasa then suggested an atom of hydrogen as possibly more manageable. Leadbeater tried again and found it much simpler, although Jinarajadasa's account[11] of his initial use of micro-psi does not explain how they came so readily upon a source of hydrogen gas (perhaps it was prepared or obtained and examined on a subsequent occasion). Besant then joined Leadbeater, and the two Theosophists studied hydrogen and what they assumed were atoms of oxygen and nitrogen in the air. They also observed supposed atoms of an element which they thought at first to be helium, having read newspaper articles the previous year about the detection by Sir William Ramsey of this element in the gas liberated from the mineral clevite. For reasons to be given in the analysis of helium in chapter 5, they thought later that this new element was a different gas unknown to science then, calling it 'occultum,' although we shall discover that it was in fact an isotope of helium. Their initial account of these four gases was published in the Theosophical journal *Lucifer* (November, 1895).

Fifty-nine more elements were examined in 1907 during a summer holiday at Weisser-Hirsch, near Dresden, Germany, whose museum Besant & Leadbeater visited to examine mineral specimens on display there. They noticed variations in the supposed atoms of neon, argon, krypton, xenon and platinum even though scientists did not then suspect that an element could have more than one type of atom. For example, they reported in 1908 in volume 29 of the Theosophical journal *The Theosophist* their discovery of a variation of neon

* This is said by Theosophists to be a subtle or invisible form of physical matter.

six years before the English chemist Frederick Soddy gave the name of 'isotopes' to atoms of an element differing in mass, although strong suspicion of their existence developed in 1912 in Soddy's study of radioactivity. Jinarajadasa wrote[12] in 1943 to Professor F.W. Aston, inventor of the mass spectrograph, at Cambridge University, England, informing him that Besant & Leadbeater had discovered by psychic means the neon-22 isotope (which they had called 'meta-neon') in 1907 - six years before the physicist J.J. Thomson separated neon into two fractions differing in atomic weights and thirteen years before Aston separated the neon-20 and neon-22 isotopes with his new spectrograph. Exhibiting no curiosity whatsoever and undoubtedly rejecting this bizarre claim for priority in the discovery of the neon-22 isotope, the distinguished scientist could offer only the cursory reply that he was not interested in Theosophy! The two Theosophists also reported in *The Theosophist* details about three elements which they claimed were unknown to science, giving them the names 'occultum,' 'kalon,' and 'platinum B.' In 1909 they described in volume 30 of *The Theosophist* a group of three transition elements ('X,' 'Y,' and 'Z'), which they thought science had not yet discovered. Radium was examined in 1908 and a diagram purporting to depict its atom appeared in *The Theosophist* for December, 1908.

Besant & Leadbeater summarized their research in their book *Occult Chemistry*.[13] The next year they studied twenty more elements, notably so-called 'illinium.' They noted that it was the sixty-first element, which indicates that it was the element promethium, found by science in 1945. A second edition of *Occult Chemistry* without additional material appeared in 1919.[14] In the same year the first compounds, salt and water, were studied. They were re-examined in 1922 and diagrams drawn of their supposed molecules. Benzene, methane and other organic compounds were examined in 1922, and descriptions of their supposed molecules were published in 1924 in volume 45 of *The Theosophist*. A model of the crystal structure of diamond was published a year later in volume 46 of this journal. In 1926 the hexagonal arrangement of carbon atoms in graphite was correctly described in volume 47.

More material was published in 1932, including descriptions of the purported atoms of so-called 'element 85' (named 'astatine' by science in 1940), 'element 87' (called 'francium' by science in 1939) and 'element 91' (isolated by chemists in 1921 and called 'protactinium'). Besant & Leadbeater had described in 1909 an element they called 'masurium' and had placed it correctly in the periodic table, although they did not publish their account. Leadbeater described it again in 1932, five years before it was detected by science and officially called 'technetium.' Leadbeater reported in the same year finding what he thought were atoms of an element of atomic weight 2. He regarded it as a new element and did not correctly identify it as deuterium, an isotope of hydrogen commonly known as 'heavy hydrogen,' which the American chemist Harold Urey and his colleagues had discovered in the previous year. This mistake occurred because Besant & Leadbeater had interpreted as the molecule of deuterium another object observed during an earlier examination of the gases released by the electrolysis of water. In 1933 - the final year of his micro-psi investigations - Leadbeater published in volume 54 of *The Theosophist* a study of the supposed atoms of all the inert gases and certain of their isotopes. He also reported the existence of two forms of what he had believed to be the hydrogen atom, three isotopic varieties of oxygen, and two species of ozone.

Jinarajadasa compiled the research material accumulated over thirty-eight years and published it in 1951 in a third, enlargened edition of *Occult Chemistry*.[15] It contained purported descriptions of 111 atoms, including fourteen isotopes, and the molecules of twenty-nine inorganic compounds and twenty-two organic compounds.

It is unfortunate that none of the Theosophists' publications specify the identity of the chemical samples they used to examine elements, for this might have shed light on the question of how they could have detected prior to science supposed atoms of promethium, astatine, francium and technetium - unstable elements which occur terrestrially only as very dilute trace contaminants. But to argue that the paucity of their availability would have made even the task of psychic detection impossible begs the question of how micro-psi functions. For example, perhaps many thousands of atoms came under the 'micro-psi microscope' at a given instant, not merely single atoms, and perhaps the random, radioactive decay of one or two atoms from this large sample into unstable atoms of these rare elements was detected by whatever observational apparatus channelled information to the conscious minds of Besant & Leadbeater? Alternatively, perhaps the descriptions of these short-lived elements were based not on single, chance observations but on many, repeated observations of the same chemical specimens containing radioactive elements whose atoms were decaying into these rare elements? As will be explained shortly, the shapes of *clairvoyantly described* atoms are related to the positions in the periodic table of their corresponding elements. Knowing the correct shape of an atom of any rare element they were searching for might have helped them to sift through a large number of images until they came across this shape when they examined elements that decay into such rare elements. According to Jinarajadasa,[16] Leadbeater went to the Dresden museum at least once and, examining the minerals displayed there, *recorded* in some way micro-psi images of their atoms, looking at them later when he returned to Weisser-Hirsch. Maybe, he used this remarkable play-back facility to spot short-lived atoms that could have been missed during a single session of observation in real time. Although observed 'live,' perhaps supposed atoms of some rare, short-lived elements were not *analysed* in real time, in which case Leadbeater could have studied them as long as he wished? In view of these possibilities and in the absence of any information about the modus operandi of micro-psi, it would seem premature to prejudge its capacity to detect very rare elements, however much this may sound like special pleading. The issue is, anyway, more complicated than simply one of detecting very rare atoms because we shall present arguments in chapter 3 that Besant & Leadbeater were wrong in their assumption that they had observed atoms.

Sceptics might argue that, rather than accept that micro-psi vision can now and again detect atoms of rare elements, it is much easier to believe that Besant & Leadbeater concocted their descriptions of these (and other) atoms according to pre-decided rules relating atomic shapes to the positions of elements in the periodic table. But the exact values of the atomic weights of these elements (or rather their mass numbers,[17] for none has stable isotopes) were unknown to science at the time when the two Theosophists published their observations of them and yet the so-called 'number weight' (defined in section 3.1) they calculated for promethium (146.66) is within two units of the mass number 145 of its nuclide Pm-145 with the longest half-life, whilst those of astatine (221.00), francium (222.55) and technetium (100.11) differ from the mass numbers of, respectively, the nuclides At-219, Fr-223 and Tc-99 by, respectively, two, one and one unit. It is implausible that this degree of agreement could have arisen by chance in *every case*. Furthermore, analysis[18] of the supposed atoms of these elements undiscovered by science at the time reveals such a high degree of agreement with the theory presented in this book to explain the micro-psi observations that neither fabrication nor hallucinations possibly influenced by knowledge of the gaps left by these elements in the periodic table are remotely plausible reasons why they could have been described before their scientific detection. These two types of consistency between ostensible clairvoyant observations and facts of nuclear physics established for these elements nearly a decade later indicate that *physical*, not fabricated or hallucinatory, objects must have been responsible for their purported atoms being described before their scientific discovery; there is simply no more realistic alternative that can account for such a measure of agreement, as the reader will conclude when he finishes reading chapter 5, which correlates micro-psi observations of atoms with facts of nuclear and particle physics.

1.4 Micro-psi atoms

Leadbeater would study the shape and structure of atoms, noting what types of particles they contained, how many of each type were present and their arrangement in space, whilst Besant would observe individual particles in more detail, investigating how their constituents were bound together by 'lines of force' and using - so she claimed - what parapsychologists would now call 'psychokinesis' to break up a particle under her observation into simpler particles. On focussing their micro-psi vision on pure samples of an element or on different chemical compounds containing the same element, they experienced similar images which were characteristic of that element in the sense that similar images of these structural units were always experienced whenever different samples were examined. So as not to prejudge the central issue of whether these images were of atoms, they will be called 'micro-psi atoms,' or 'MPAs.' Besant & Leadbeater classified MPAs according to their shapes into seven groups: spike, dumb-bell, tetrahedron, cube, octahedron, bars, and stars (fig. 1.1). These are described in general terms as follows:

spike group

Belonging to this class of MPAs are lithium, fluorine, potassium, manganese, rubidium, technetium, caesium, promethium, thulium, rhenium, and francium. A set of spikes (one in the case of lithium, eight for fluorine, nine for potassium, fourteen for manganese and sixteen for each of the other elements) project from a central globe. Those in the fluorine MPA are cones, its central body being cylindrical (fig. 1.1a);

dumb-bell group

This group comprises sodium, chlorine, copper, bromine, silver, iodine, samarium, erbium, gold, and astatine. The MPA looks like a dumb-bell (fig. 1.1b), being made up of a connecting rod, an upper set of twelve, cone-shaped funnels, which project from a central globe and are arranged regularly in a circle, alternately pointing slightly upwards or downwards out of the plane of the circle, and a lower set of twelve funnels, which radiate from a central globe and are similarly arranged;

tetrahedron group A

The twelve elements in this group are beryllium, oxygen,[19] calcium, chromium, strontium, molybdenum, ytterbium, tungsten, radium, and uranium. The MPA (fig. 1.1c) consists of four

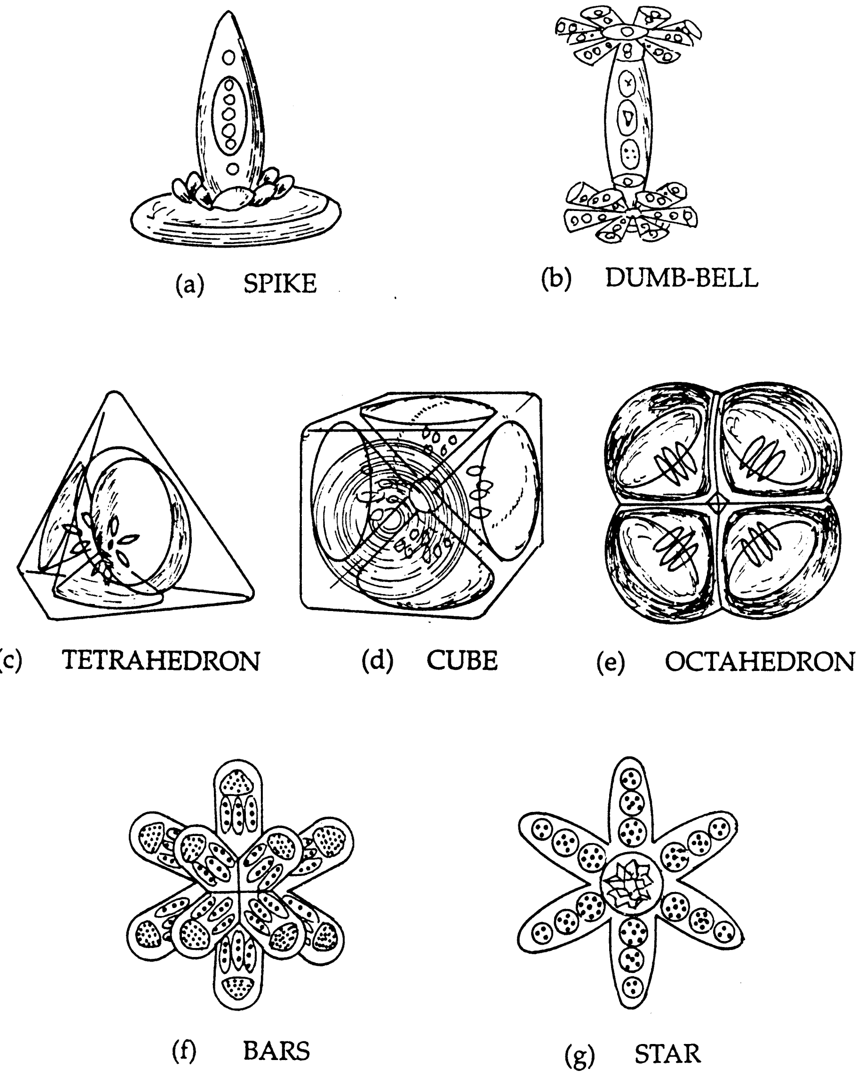


Figure 1.1 : The seven classes of MPAs.

funnels projecting from a central globe towards the faces of an imaginary tetrahedron. The MPAs of radium and uranium add four spikes directed towards the corners of this tetrahedron;

tetrahedron group B

There are ten elements: magnesium, sulphur, zinc, selenium, cadmium, tellurium, europium, holmium, mercury, and polonium. Their MPAs (fig. 1.1c) consist of four funnels opening on the faces of a tetrahedron. The zinc MPA has also four spikes. Elements in this group from zinc onwards have a central globe;

cube group A

These elements comprise boron, nitrogen,[20] scandium, vanadium, ytterbium, niobium, lanthanum, praseodymium, lutecium, tantalum, actinium, and protactinium. Their MPAs (fig. 1.1d) consist of six funnels projecting outwards from a central globe towards the faces of an imaginary cube. Actinium and protactinium also have eight spikes projecting towards the corners of the cube;

cube group B

This comprises aluminium, phosphorus, gallium, arsenic, indium, antimony, gadolinium, dysprosium, thallium, and bismuth. Their MPAs (fig. 1.1d) consist of a face-centred cubic array of six funnels. The elements from gadolinium onwards have a central sphere;

octahedron group A

This contains carbon, titanium, zirconium, cerium, hafnium, and thorium. Their MPAs (fig. 1.1e) consist of eight funnels pointing outwards from a central sphere towards the corners of a cube or, equivalently, the centres of the eight faces of an octahedron. Each MPA is rounded at the octahedral corners and somewhat depressed between the faces in consequence of this rounding, creating what was said to resemble a 'corded bale;'

octahedron group B

This includes silicon, germanium, tin, terbium, and lead. Their MPAs (fig. 1.1e) consist of eight funnels projecting (apart from silicon) from a central sphere and opening on the faces of an octahedron. Tin and terbium have also spikes pointing towards the six corners of the octahedron;

bars group

The elements belonging to this group are iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, and platinum. Also, three elements which Besant & Leadbeater called 'X,' 'Y,' and 'Z' and which they mistakenly believed were undiscovered by science. Their MPAs (fig. 1.1f) consist of fourteen similar bars, six of which point towards the face-centres of a cube and eight of which point towards its corners;

star group

This includes neon, argon, krypton, xenon, and radon. Also, an element which Besant & Leadbeater called 'kalon,' believing it to be unknown to science. Their MPAs (fig. 1.1g) have the appearance of a flat, six-armed star projecting from a central sphere.

Several points should be emphasized concerning the depiction of MPAs. Firstly, the polyhedra mentioned above merely represent the underlying geometry of the arrangement of funnels, spikes, etc.; they were not themselves visible as objects. Secondly, although the micro-psi observer can alter the perspective from which he views an MPA, its intrinsic shape does not change during the period of observation. The natural spinning and vibrational motions of an MPA have to be retarded before a clear image of its shape becomes visible. According to Besant & Leadbeater: 'The object examined, whether an atom or a compound, is seen exactly as it exists normally, that is to say, it is not under any stress caused by an electric or magnetic field. As each object is in rapid motion, the only force brought to bear on it is a special form of will-power, so as to make its movement slow enough to observe the details.'[21] This force mentally exerted by the micro-psi observer in order to reduce the speed of particles under his observation is a form of psychokinesis, mentioned earlier in the context of Besant's ability to manipulate micro-psi images as if she were actually breaking up particles under her observation. Thirdly, the typical pictures of MPAs shown in fig. 1.1 are not drawn to scale, as is true, indeed, for *all* the drawings from *Occult Chemistry* reproduced in this book. Accurately scaled reproduction of complex micro-psi images proves impossible partly because of the difficulty the micro-psi observer has in judging the relative sizes of rapidly moving objects but, more importantly, because not all particles in an MPA are simultanously visible, so that he needs to use vastly different powers of magnification in order to discern particles of very disparate size, any shift of magnification rendering comparison of sizes impossible. The question of scale was referred to in *Occult Chemistry* as follows: 'It should be specially noted that the diagrams are *not drawn to scale*, as such drawings would be impossible in the given space. The dot representing the Anu* is enormously too large compared with the enclosures, which are absurdly too small; a scale drawing would mean an almost invisible dot on a sheet of many yards square.[22]

Comparing the elements found to have MPAs of a given type, Besant & Leadbeater found that - apart from the elements hydrogen, helium, nitrogen, and oxygen, whose uniquely-shaped MPAs do not conform to the seven types of MPAs - the form of an MPA correlates with the position of its corresponding element in the periodic table, i.e. all elements in the same group of the table (and therefore having similar chemical properties) have MPAs with similar shapes (Table 1.1). For example, divalent elements like magnesium and calcium, which are in group IIA of the orthodox periodic table, belong to the tetrahedron group because their MPAs have four funnels opening on the faces of a tetrahedron, whilst the noble gases neon, argon, krypton, xenon, and radon, which have zero valency and which are in group 0 of the periodic table, belong to the star group because their MPAs look like a flat, six-pointed star. Table 1.1 lists all elements up to uranium except hydrogen and helium, whose MPAs do not fit this classification. Element names between quotation marks are those given by Besant & Leadbeater to elements that science had not discovered at the time when they observed their MPAs. The formal nature of the inclusion in Table 1.1 of oxygen and nitrogen, whose MPAs also do not fit the 7-fold classification, is indicated by pairs of brackets around the names of these elements.

Besant & Leadbeater said that they used this correlation to check their identification of newly observed MPAs. Sceptics might argue that it is not in itself evidence of the physical reality of MPAs because the two Theosophists might have used what knowledge of chemistry they had to fabricate the correlation. Alternatively, they might suggest that this knowledge might have influenced the appearance of MPAs as hallucinatory images. But, if Besant's and Leadbeater's preconceptions had *alone* influenced what form their hallucinations assumed, all group IIA elements would be in Tetrahedron Group A (see table 1.1), whereas

* This word signifies the UPA (see section 1.5).

Table 1.1
The micro-psi version of the periodic table

SPIKE GROUP	DUMB-BELL GROUP	TETRAHEDRON GROUP A	TETRAHEDRON GROUP B	CUBE GROUP A	CUBE GROUP B	OCTAHEDRON GROUP A	OCTAHEDRON GROUP B	BARS GROUP	STAR GROUP
IA Lithium	IA Sodium	IIA Beryllium	IIA Magnesium	IIIB Boron	IIIB Aluminum	IVB Carbon	IVB Silicon	VIII Iron	O Neon
VIIB Fluorine	VIIB Chlorine	VIB (Oxygen)	VIB Sulphur	VB (Nitrogen)	VB Phosphorus	IVB Titanium	IVB Germanium	VIII Cobalt	O Argon
IA Potassium	IB Copper	IIA Calcium	IIB Zinc	IIIA Scandium	IIIB Gallium	IVA Zirconium	IVB Tin	VIII Nickel	O Krypton
VIIA Manganese	VIIB Bromine	VIA Chromium	VIB Selenium	VA Vanadium	VB Arsenic	Ln Cerium	Ln Terbium	VIII Ruthenium	O Xenon
IA Rubidium	IB Silver	IIA Strontium	IIB Cadmium	IIIA Yttrium	IIIB Indium	IVB Hafnium	IVB Lead	VIII Rhodium	"Kalon"
VIIA Technetium ("Masurium")	VIIB Iodine	VIA Molybdenum	VIB Tellurium	VA Niobium	VB Antimony	IVA Thorium		VIII Palladium	O Radon
IA Caesium	Ln Samarium	IIA Barium	Ln Europium	IIIA Lanthanum	Ln Gadolinium			Elements 'X', 'Y', and 'Z'	
Ln Promethium ("Illinium")	Ln Erbium	Ln Neodymium	Ln Holmium	Ln Praseodymium	Ln Dysprosium			VIII Osmium	
Ln Thulium	IB Gold	Ln Ytterbium	IIB Mercury	Ln Lutecium	IIIB Thallium			VIII Iridium	
VIIA Rhenium	VIIB Astatine ('85')	VIA Tungsten	VIB Polonium	VA Tantalum	VB Bismuth			VIII Platinum	
IA Francium ('87')		IIA Radium		IIIA Actinium					
		VIA Uranium		V Protactinium					

one of these elements - magnesium - is actually in Tetrahedron Group B, which contains MPAs whose structures are slightly different from those in Tetrahedron Group A. Moreover, all group IIIB elements would be in Cube Group B, whereas one of them - boron - is in Cube Group A, whilst all group IVB elements would be in Octahedron Group B, whereas they appear in both subgroups of the Octahedron Group. The fact that elements in the *same* subgroup of the chemical periodic table do not always occur in the *same* subgroup of the micro-psi version of this table is not what one would expect if the two Theosophists had, consciously or unconsciously, been influenced by their knowledge of chemistry, which could not have provided any reason for spreading their assignments in this way. This is an argument against the view that table 1.1 was either fabricated or based upon hallucinations that were conditioned by expectations.

That MPAs are merely hallucinations is also inconsistent with a quantitative aspect of MPAs. As will be explained in chapter 3, neither fabrication nor hallucinations could have generated the proportionality between the numbers of fundamental constituents of MPAs (to be described shortly) and the mass numbers of their corresponding atomic nuclei - information which physicists began to acquire only in the 1930s, more than twenty years after Besant & Leadbeater had published most of their descriptions of MPAs. It is inconsistent on the one hand to argue that MPAs were merely hallucinations and that their shapes are correlated with the positions of elements in the periodic table because the investigators' chemical knowledge influenced their hallucinations but on the other hand to admit that hallucinations cannot explain a remarkable correlation between ostensible psychic observations and scientific facts about nuclei established years after both Theosophists were dead. Either *all* the details about MPAs are based upon hallucinatory images or none of them are (there would obviously be no need to fabricate images if Besant & Leadbeater genuinely experienced them). The sceptic cannot pick and choose how he interprets different observations. If evidence presented in chapter 5 makes him willing to acknowledge that MPAs do have a conceptual connection with scientific facts about the subatomic world which, because these were unknown at the time even to scientists, could not have manifested in hallucinations, he must also admit that this makes it unnecessary to ascribe the correlation between shapes of MPAs and groups in the periodic table to hallucinations conditioned by the Theosophists' knowledge of chemistry.

MPAs are enclosed in a kind of hole or bubble, whose walls are usually spherical (although sometimes ovoid) and transparent, like glass or stretched, clear, plastic film, appearing as if under tension. The sphere at the centre of many MPAs is usually made up of symmetrically arranged segments, each containing similar sets of particles which are distributed in several layers or shells, like the skins of an onion. Figure 1.2 shows the arrangement of particles inside the central globes of the MPAs of barium, strontium and radium (sectors of circles denote segments of spheres). The funnels, spikes or bars making up an MPA are also kinds of surfaces or walls enclosing many different types of particles (fig. 1.3). They, too, have a translucent quality; the micro-psi observer can see through them and notice other MPAs nearby. Individual particles are themselves surrounded by a spherical or ovoid wall, and several particles, each enclosed in a sphere or ovoid, may be enclosed in a larger sphere or ovoid (fig. 1.4). The shapes of the walls depend on the configurations of particles bound together within them. They do not change shape whilst being observed, but

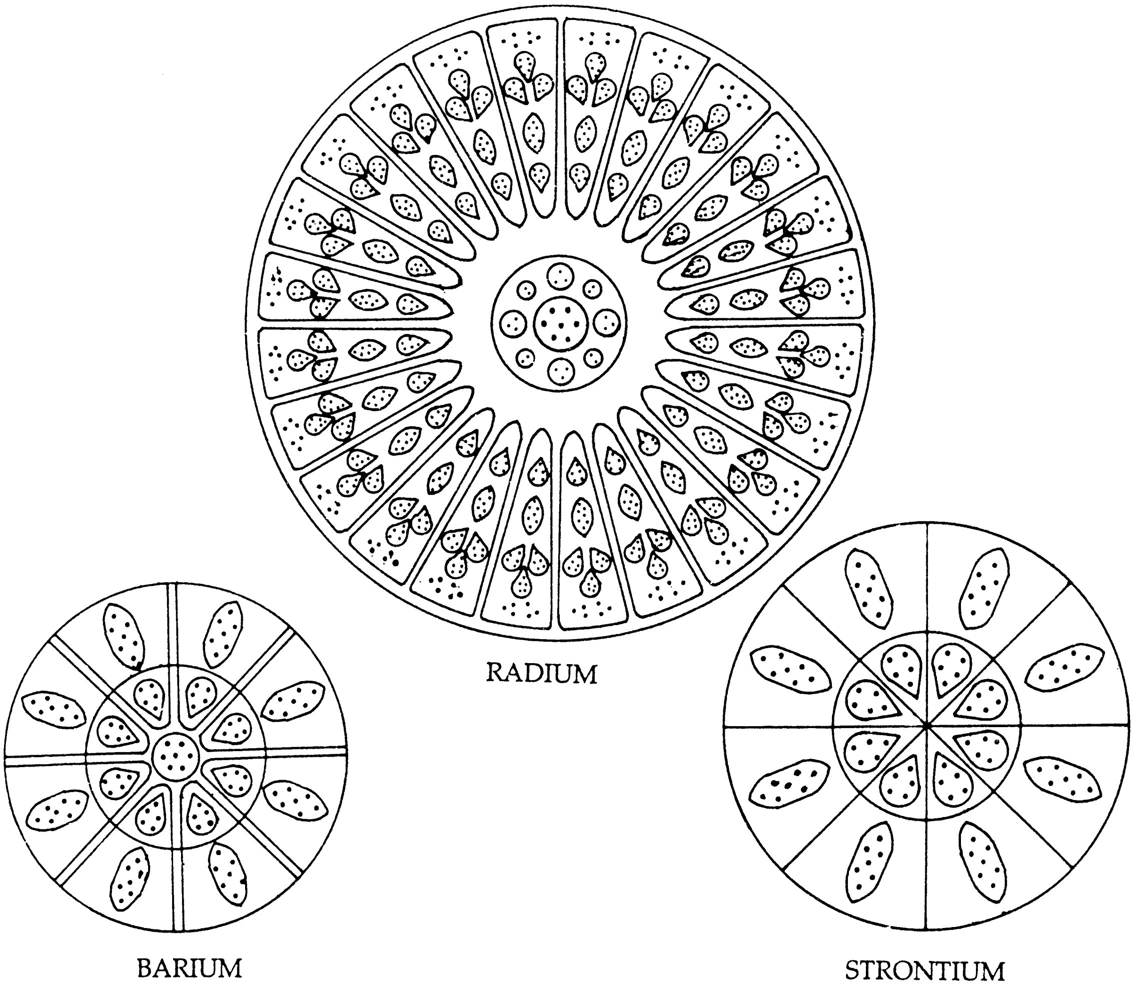


Figure 1.2 : Central globes of the MPAs of barium, strontium, and radium

can be deformed by particles in neighbouring spheres or ovoids. According to Besant & Leadbeater, the constituent particles exert a kind of pressure on their circumambient walls, pushing them back: 'Just as a stream of air under pressure will make a hole on the surface of water, by pushing back the water, so is it with the groups.'[23] They never satisfactorily explained the nature of these walls, as their collaborator Jinarajadasa admitted[24] when he edited the third edition of *Occult Chemistry*, published posthumously in 1951. Referring to a special investigation by Leadbeater to examine the nature of sphere-walls, he remarked: 'Though there was no final conclusions on the matter, it appeared to the investigator as if the sphere-wall was composed of force radiating from the centre, which after travelling a certain distance, returned to the centre. The nature of this radiating force was not analyzed.'[25] An interpretation of sphere-walls and an identification of this force in terms of concepts of particle physics will be made in chapter 4.

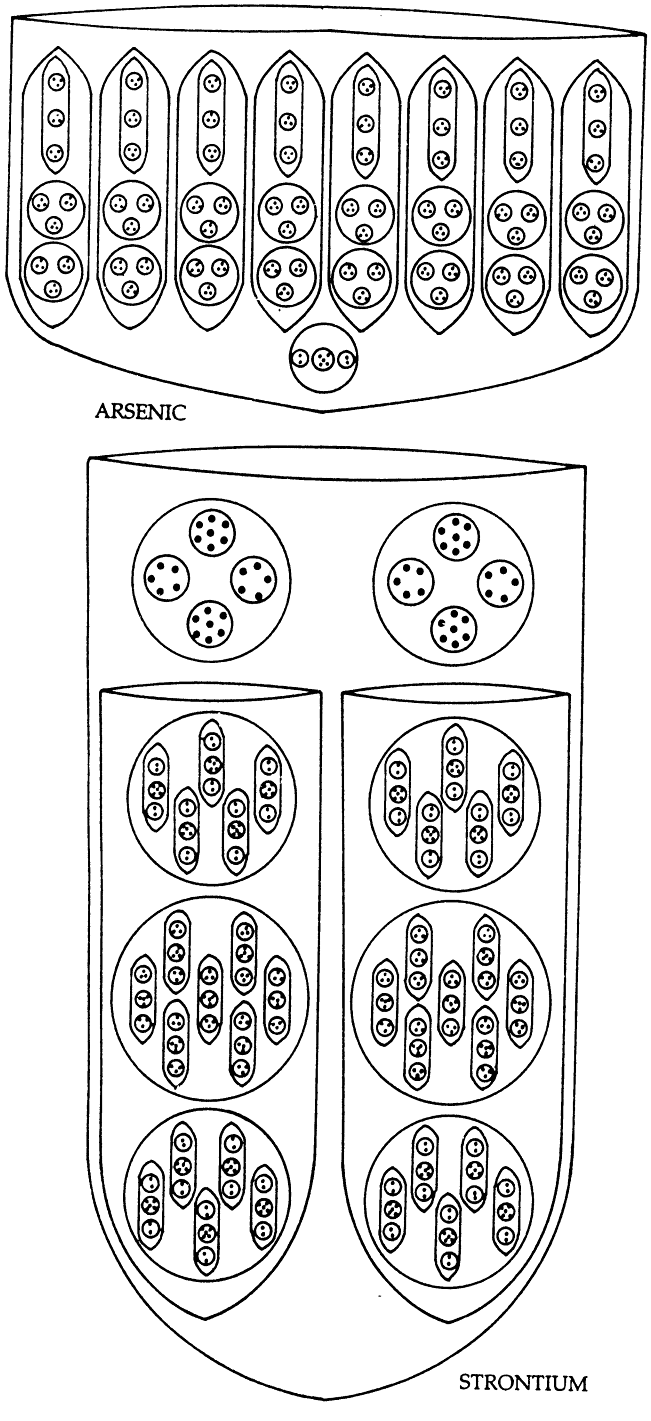


Figure 1.3 : Particles in the funnels of the arsenic and strontium MPAs.

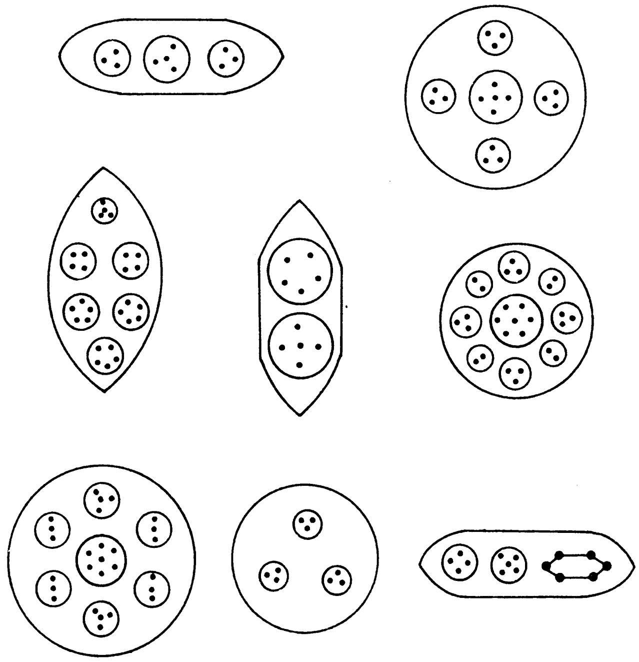
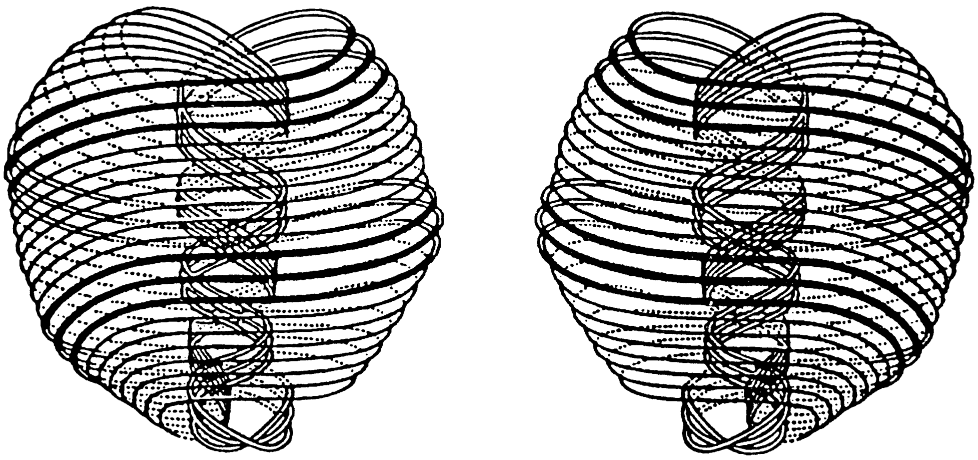


Figure 1.4 : Spherical and ovoid 'cell-walls' enclose particles

1.5 The UPA

Particles in MPAs consist of groups of what appears initially to micro-psi vision to be points of light arranged in many types of rigid geometrical configurations. Higher magnification of these points reveals three-dimensional images of single, particle-like objects (fig. 1.5). Because



POSITIVE NEGATIVE

Figure 1.5 : The fundamental constituent of matter (UPA) revealed by micro-psi

these particles were the basic constituents of MPAs, Besant & Leadbeater called them 'ultimate physical atoms'[26] or 'UPAs', claiming that they were the fundamental, indivisible units of matter. Just as chemists have found some molecules to exist in two chiral forms, one the mirror image of the other, creating so-called 'stereoisomers' with often very different chemical properties, so the two Theosophists noticed two chiral varieties of UPA. The 'positive' type of UPA consists of ten non-touching, closed curves they called 'whorls,' which spiral downwards 2½ times, side by side, around the surface of a deformed sphere in a clockwise direction (seen from the top) and which then split up at the lowest point of the spiral into strands of three and seven whorls that twist upwards 2½ times in opposite directions in an inner helix as they return to the top of the UPA. The whorls in the 'negative' type of UPA spiral in an anticlockwise direction, creating the mirror image of the positive UPA. The set of three whorls, called 'major whorls,' appear brighter and thicker than the other seven 'minor whorls.' Each whorl makes five revolutions, the ten whorls twisting altogether fifty times around the axis of the UPA. The top of the UPA is open, and it is depressed inwards slightly, making the particle heart-shaped. It pulsates and spins rapidly about its axis, which also precesses, giving the UPA the wobbling motion of a spinning top. As it does so, one of the minor whorls may vibrate more actively than the others and radiate what appeared to the micro-psi vision of Besant & Leadbeater to be 'shades of colour' that change as one whorl after another becomes active. Lines of force flow into the heart-shaped depression at the top of a positive or negative UPA and emanate from its pointed end, being 'changed in character by its passage.' These lines of force bind together UPAs in many different configurations. They will be interpreted in chapter 4.

Figure 1.5 is remarkably similar to a diagram shown in figure 1.6 and published in 1878 in a book (long out of print and rare) called *Principles of Light and Colour*. It was written by an American, Edwin Babbitt, who, too, claimed to have developed a type of clairvoyance enabling him to describe atoms, although he was far more reticent about the visions that inspired his theorizing. Besant & Leadbeater mentioned this forerunner of their work in the first edition of *Occult Chemistry*, stating: 'A fairly accurate drawing is given in Babbitt's "Principles of Light and Colour", p. 102. The illustrations there given of atomic combinations are entirely wrong and misleading, but if the stove-pipe run through the centre of the single atom be removed, the picture may be taken as correct, and will give some idea of the complexity of this fundamental unit of the physical universe.'[27] Babbitt did not describe MPAs, being under the mistaken impression that what he had clairvoyantly observed was the chemical atom itself. No doubt conventional theorists will want to argue that, since the two Theosophists knew of Babbitt's book, they could have plagiarized his psychically derived picture of the basic unit of matter (which, as far as these sceptics are concerned, was actually just a product of his imagination), afterwards concocting their elaborate descriptions of MPAs in terms of this imaginary particle. Quite apart from the implausibly and unnecessarily enormous labour this would have entailed (they could have made up far simpler MPAs!) - as becomes obvious to anyone when he peruses the encyclopedic third edition of *Occult Chemistry* - one would not, if this argument were right, expect the details of the Theosophists' observations to exhibit *any* similarity to modern discoveries concerning the structure of subatomic particles and the forces holding them together, or at least none beyond what might be reasonably ascribed to chance. This book, however, will reveal many such remarkable correlations, far too numerous or much too alike to be due to chance. They prove

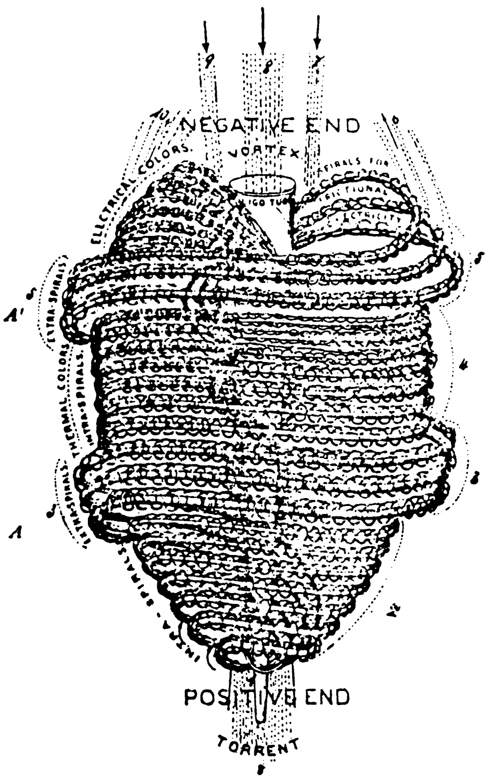


Figure 1.6 : The 'atom' according to Edwin Babbitt.

beyond all reasonable doubt that *Occult Chemistry* cannot be merely a fabricated elaboration of Babbitt's idea. This means that two books published thirty years apart show an astonishing degree of agreement, unaccountable in terms of plagiarism, concerning the structure of fundamental particles allegedly revealed in both cases by psychic means.

The close resemblance between Babbitt's and Leadbeater's pictures of the fundamental unit of matter is far too detailed to be plausibly explained as coincidental, which it would have had to be if these diagrams had depicted what they imagined is the form of this particle. But how can such depictions be almost *identical* if they portray nothing more than hallucinations? How could the brains of two people generate the same hallucinatory image as that recorded by someone thirty years earlier? Even if there were some satisfactory, rational answer to this question, it would still not explain why Babbitt interpreted his hallucinations in the same way as Besant & Leadbeater. Whilst it is true that Babbitt's picture could in principle have influenced the Theosophists, there is no need to assume that it did because the case for the objectivity of the latter's micro-psi observations is established by the evidence discussed in chapters 3,4 and 5. The solution of the puzzle posed by their almost identical pictures is clear and unavoidable: both Babbitt and the two Theosophists must have experienced analogous altered states of consciousness that led them to describe in almost identical ways what they both believed is the fundamental unit of matter. Whether the clairvoyant visions of Besant & Leadbeater were accurate representations of subatomic particles or whether all the images they experienced and described over thirty-eight years were merely abstract or archetypal symbols without any significance to particle physics will be the task of this book to decide.

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12. *Occult Chemistry Investigations,* ed. C. Jinarajadasa (Theosophical Publishing House, Adyar, Madras, India, 1946).
13. *Occult Chemistry* (1st ed.), by Annie Besant and C.W. Leadbeater (Theosophical Publishing House, Adyar, Madras, India, 1908).
14. *Occult Chemistry,* 2nd ed.
15. Reference 10.
16. Reference 10.
17. The mass number of a given nuclide is the number of protons and neutrons in its nucleus.
18. *ESP of Quarks and Subquarks - the Final Evidence,* by Stephen M. Phillips (unpublished).
19. The inclusion of the divalent element oxygen in tetrahedron group A, which contains other divalent elements, is only formal because the shape of its MPA does not fit any of the seven classes of MPAs.
20. Nitrogen is included only formally in cube group A because its shape does not conform to this class of MPAs.
21. *Occult Chemistry,* 3rd ed., p. 1.
22. Ibid., p. 36.
23. Ibid., p. 28.

24. Ibid., p. 15.
25. Ibid, pp. 15,16.
26. They also named them 'Anu,' the Sanskrit word for 'atom.'
27. *Occult Chemistry*, 1st ed., p. 10.

CHAPTER 2

QUARKS, STRINGS AND SUPERSTRINGS

2.1 The atom

The notion of atoms is so familiar to us that it comes as a surprise to learn that many leading physicists and chemists did not believe in the reality of atoms as late as 1900. Influential positivists like the German physicist Ernest Mach, whose philosophy was then having an impact on the young Einstein's development of his Special Theory of Relativity, did not believe in atoms because they had not been observed. Today, scanning transmission electron microscopes can take photographs of single atoms. But atoms had not been 'discovered' at the beginning of this century in the sense that hundreds of subatomic particles have been found by high-energy particle accelerators during the past thirty years. In fact atoms were never detected directly in this sense. Their existence became revealed by the discovery of their constituents.

The theory that matter is composed of definite units is often attributed to the Greek philosopher Democritus (c. 460-370 BC). But he was in fact the great ancient expounder of the atomic theory originally propounded by his teacher Leucippus as a solution of the problem set by the dialectician Zeno against the impossibility of motion. Zeno had argued that the Greek hero Achilles could not overtake a tortoise because he had first to reach the place from which the tortoise started, by which time the tortoise would have moved on a little way, requiring him to traverse that distance, by which time the tortoise would have moved still further ahead, and so on, leaving Achilles always behind. To Leucippus it seemed that to escape the impossibility of Zeno's conclusion one must deny the infinite divisibility of distance implied in his argument. Setting a limit to spatial divisibility led to the concept of atoms, or 'atomos,' the physically 'indivisible.' Surprisingly, 'Zeno's Paradox,' as mathematicians and philosophers came to call this problem, remained unresolved in a logically rigorous way until the mathematician Edward Nelson of Princeton University proposed in 1977 his 'internal set theory,' which provided a proper definition of mathematical quantities called 'infinitesimals' (familiar to anyone who has studied differential calculus), thus enabling a logical solution of Zeno's Paradox to be formulated. As well as giving birth to a belief in atoms, this problem revealed to the ancient Greeks complexities in our intuitive notions of points and lines and raised questions concerning whether time and space are continuous or discrete, issues which persist in theoretical physics even now.

The followers of Pythagoras (c. 556 BC) taught that the universe is compounded from four elements: Earth, Water, Air, and Fire. According to Plato's *Timaeus*, which expounded Pythagorean cosmology, particles of Earth, Water, Air and Fire had the shapes, respectively, of a cube, icosahedron, octahedron and tetrahedron - four of the five regular polyhedra, or so-called 'Platonic solids,' which can exist in three-dimensional space. The doctrine of the four elements is usually attributed to Empedocles in about 440 BC. But he may have borrowed the idea when he was a pupil of Pythagoras, passing it off as his own when he was expelled from the famous Pythagorean academy in Croton, Italy, for breaking the oath sworn by its students not to divulge what they were taught. The doctrine of the four elements, rather than a theory of atoms, dominated the philosophy of the ancient Greeks, for whom the notion of *chemical* elements was unknown. Atomic theory stayed undeveloped in Europe until the beginning of the nineteenth century, when John Dalton gave a quantitative explanation of the proportions by which elements combined to form chemical compounds by assigning, in terms of the hydrogen atom, relative weights to the atoms of the twenty elements he knew of in 1808. In 1869, Dmitry Mendeleyev, professor of chemistry at the University of St Petersburg, proposed his 'Periodic Table' to group the sixty elements he knew of into columns in order of increasing atomic weight, elements having the same chemical and physical properties sharing the same column of the table. Gaps were left corresponding to elements which should exist but which had not yet been discovered. Valuable as it was in predicting new elements like germanium and gallium, it did not explain what properties of atoms generated the observed eight-fold periodicity in the arrangement of elements with similar properties. Its modern version would become finalized only with the discovery of the atomic nucleus.

After the British physicist Sir William Crookes (1832-1919) invented his 'Crookes tube' - the forerunner of the modern cathode ray tube, scientists began to study the rays emanating from its negative electrode, or cathode. Some thought that they were waves, others considered the rays to be made up of particles. In 1895 Jean Perrin in Paris showed that the rays carried negative charge. Then J.J. Thomson (1856-1940) at Cambridge University carried out a series of experiments in 1897 that proved cathode rays to be streams of negatively charged particles. By measuring their motion in both magnetic and electric fields, he found that these particles were about two thousand times lighter than the hydrogen atom, the lightest atom of all. This came as a surprise to physicists who thought that nothing lighter than a hydrogen atom could exist because all atoms were indivisible. This was the first discovery of a subatomic particle - the electron. Thomson already knew that X-rays, discovered accidentally by Wilhelm Röntgen (1845-1923) in 1895, could cause atoms in the air to become positively or negatively charged - so- called 'ions.' So he began to think of positive ions as atoms with one or more of their electrons missing. In 1903 he proposed a model of the atom in which the neutral atom was composed of electrons embedded in a positively-charged sphere, like plums in a pudding.

Ernest Rutherford (1871-1937) conducted experiments which discredited this picture and gave rise to the modern view of the atom. Whilst at McGill University in Canada, he had discovered that the particles emitted by radioactive atoms are positively charged and much heavier than the electron. But he had noticed that these 'alpha particles' could be scattered when passed through thin sheets of mica despite having large velocities. Not even strong electric or magnetic fields could achieve this degree of deflection. Then in 1909 at Manchester University, England, Rutherford and Hans Geiger (1882-1945) scattered alpha particles off gold foil a few hundred atoms thick and, to their amazement, found that 1 in 20,000 of these particles bounced back to where they had come from. According to Rutherford: 'It was as though you had fired a 15-inch shell at a piece of tissue paper and it had bounced back and hit you.' The next year Rutherford calculated how close alpha particles must come to the positive electric charge in atoms before being scattered backwards by the electrostatic force between their charges: about 10^{-12} cm from the atom's centre, that is, one ten thousandth of the radius of the atom. This meant that the positive charge in an atom was not spread out in the atom, as Thomson had proposed in his plum-pudding model, but was confined to the very centre of the whole atom. An atom was more like the solar system, with the positively-charged nucleus taking the role of the sun, around which negatively-charged electrons circulate like planets.

The Danish physicist Niels Bohr (1885-1962), who had met Rutherford whilst working under J.J. Thomson at Cambridge, developed this idea by using new ideas in quantum physics. The problem of Rutherford's model was that, according to the laws of electromagnetism, electrons circulating around the nucleus according to Newtonian mechanics should continuously radiate energy, causing them to fall eventually into it. Bohr solved this by proposing in 1913 that electrons in atoms moved in orbitals with fixed, not arbitrary, amounts of energy, so that they could not gradually lose energy through continuous radiation but must emit it only in discrete, finite-sized amounts, or 'quanta.' Atomic electrons had discrete energies because they occupied 'shells' at certain distances from the nucleus. An electron could 'jump' from one shell to another. If it absorbed energy, it jumped to a shell further from the nucleus; if it radiated energy, it fell to a shell closer to the nucleus. After falling to the shell of lowest energy, it could no longer give up any more energy and therefore could not fall further into the nucleus.

But what did atomic nuclei consist of? By firing alpha particles through hydrogen gas, Rutherford and Ernest Marsden, a young student of Geiger's, detected singly-charged, positive particles, which they argued were hydrogen nuclei, knocked out from hydrogen atoms by their collisions with alpha particles. In 1919, after several years' thorough investigation of the particles knocked out of the atoms of various elements by beams of alpha particles, Rutherford gave them the name of 'protons,' from the Greek for 'first,' being the first identified building blocks of atomic nuclei.

By carefully measuring the energy of X-rays emitted by various elements, Henry Moseley (1884-1915), who was working at Rutherford's physics department at Manchester University, found in 1913 that the positive charge of each nucleus is a whole multiple of the electric charge of the electron. He also discovered that this amount of positive charge increases one unit at a time as one moves from one element to the next in the Periodic Table. The hydrogen nucleus has a positive charge of 1, helium has a positive charge of 2, lithium a charge of 3, and so on through to uranium with a total charge of 92 units. Moseley had discovered what is known as the 'atomic number' of an element, the nuclear parameter determining the sequence of elements in the Periodic Table. As the hydrogen nucleus consists of one proton, an atomic nucleus with Z units of positive charge contains Z protons, i.e. its atomic number is Z. Moseley's work verified Bohr's theory of the atom and confirmed the Rutherford model of the atomic nucleus.

As the proton weighs about 1840 times as much as the electron, most of the mass of an atom must be due to its nucleus. In the 1920s physicists thought that nuclei contain twice as many protons as there are orbiting electrons, as well as the same number of electrons, so that the net electric charge of the nucleus was equal and opposite to the total electric charge carried by all the orbiting electrons. This picture was supported by the phenomenon of beta decay, in which electrons are emitted from the nucleus of a radioactive atom. Rutherford, however, thought that electrically neutral particles - 'neutrons' - accompanied protons in a nucleus. The first evidence supporting his belief came from experiments in 1930 by Walther Bothe and Hans Becker in Germany, who observed the emission of a very penetrating neutral radiation when they bombarded beryllium with alpha particles. But they assumed this radiation were gamma rays, as did Irène Curie (1897-1956), the daughter of Marie and Pierre Curie, and her husband Frédérick Joliot (1900-1958), when they repeated this work. James Chadwick (1891-1974) at the Cavendish Laboratory, Cambridge, England, realized the true significance of their findings, which they published in 1932: the neutral radiation was neutrons. By performing experiments in which the neutral rays collided with various gases, he calculated the masses of the particles to be about the same as the mass of the proton. In this way Chadwick discovered the neutron, the remaining constituent of atomic nuclei. The discovery led the great German physicist Werner Heisenberg (1901-1976) to propose in the same year that atomic nuclei consist of protons and neutrons, not protons and electrons, as had been thought. The number of neutrons in a nucleus is called the 'neutron number' (N). The sum (Z+N) of the atomic number and neutron number is the number of protons and neutrons present in a nucleus. This is called its 'mass number' (A).

The neutron is about 0.1 per cent heavier than the proton but, apart from having no charge, is almost indistinguishable from the proton. Particle physicists now regard them as the two states of a particle called a 'nucleon.' An isolated neutron decays into a proton and an electron on average after about 15 minutes. This is the basis of beta radioactivity. Neutrons in some nuclei also decay, but remain stable in others. Until recently, physicists believed that protons are stable. Theories unifying subatomic particles and their forces require the proton to decay, although only after about 10^{32} years, which is about 10^{22} times longer than the estimated age of the Universe. At the time of writing, no experiments have yielded any evidence of unstable protons.

We shall not enter into a discussion of the many models of the nucleus that have been proposed because they do not have direct relevance to an understanding of the MPAs described by Besant & Leadbeater, evidence and arguments being presented in chapter 3 that MPAs are *not* atomic nuclei.

2.2 The standard model

Consider a spinning top. The experience of our childhood tells us that it can spin at any speed, depending upon how strongly it is whipped into rotation. The reason for this is that a rotating body has an 'angular momentum,' which is a measure of both its speed of rotation and the distribution of its mass in space, and classical mechanics allows the angular momentum of a body such as a spinning top to assume *any* one of a continuous range of values. But human experience and common sense have turned out to have little value in prescribing what the properties of atoms and subatomic particles should be in the quantum world. According to quantum mechanics, the intrinsic angular momentum, or so-called 'spin,' of quantum systems can take values which are only integer multiples of $\frac{1}{2}\hbar$, where $\hbar$ is Planck's constant h divided by 2π. This constant is named after the German physicist Max Planck (1858-1947), who realized in 1900 that objects radiate energy in bundles, or 'quanta,' the quantity of energy E being related to the frequency ν of the radiation by the equation: $E = h\nu$. The basic constituents of matter appear to be what physicists call 'fermions.' A fermion is a particle that behaves as though it carries a spin equal to an odd integer multiple (1, 3, 5, etc) of ½$\hbar$. The basic particles that mediate forces are what they call 'bosons.' A boson has a spin that is an even integer multiple (2, 4, 6, etc) of ½$\hbar$. For convenience, it is conventional to drop the unit $\hbar$ and to speak of a particle with spin ½$\hbar$ as being a 'spin-½' particle, a particle with spin $\hbar$ as being a 'spin-1' particle, and so on. An example of a fermion is the electron, which has spin-½; an example of a boson with spin-1 is the photon, the bundle of electromagnetic radiation predicted by Albert Einstein in 1905. This radiation ranges from gamma rays and X-rays at the short wavelength end of the electromagnetic spectrum, through ultraviolet, visible, and infrared light, to heat, microwaves and radiowaves at the other end of the spectrum;

The distinction between the two types of spin - integer and half-integer multiples of $\hbar$ - is therefore related to the difference between matter fields and force fields. There are four known types of force:

1. the long-range gravitational force. This is a universal force acting upon all types of particles - fermions and bosons alike. It is transmitted by a massless, spin-2 particle called the 'graviton,' which has yet to be detected;
2. the long-range electromagnetic force, which acts only between electrically charged particles. This is transmitted by the massless photon. It binds electrons in their orbits around the positively charged nucleus of an atom;
3. the short-range strong force, which binds protons and neutrons together in atomic nuclei. Over a hundred times stronger than the electromagnetic force, it is transmitted by spin-1 bosons called 'gluons,' which will be discussed shortly;
4. the short-range weak force, which is responsible for the decay of radio-active nuclei, transmuting one atomic nucleus into another by converting neutrons within the nucleus into protons, electrons and neutrinos, as well as the weak decay of subatomic particles. The carriers of the weak force are the W and Z particles, both spin-1 bosons, which are approximately ninety times as heavy as protons and neutrons.

Any particle which interacts with other particles through the strong force is called a 'hadron.' If a hadron decays through the weak force into finally a proton, it is called a 'baryon.' All baryons are fermions. If it decays finally into a particle known as a pion, it is called a 'meson.' All mesons are bosons. Spin-½ particles which do not interact strongly, such as the electron, are called 'leptons'.

Quarks

The proliferation of hadrons discovered in high-energy physics laboratories in the early 1960s and the discovery that all the mesons and baryons then known formed families of hadrons (fig. 2.1) led the American physicist Murray Gell-Mann and the Israeli physicist Yuval Ne'eman to develop in 1962 the classification of hadrons known as 'the Eightfold Way.'[1] This consists of octets of spin-½ baryons, spin-0 and spin-1 mesons and a decuplet of spin-3/2 baryons, their positions being fixed by their values of two quantum numbers called 'isospin' and 'hypercharge,' the meaning of which need not detain us here. They used this scheme to predict successfully the existence of the so-called 'omega-minus' particle (Ω^- in figure 2.1), which was found in 1964.

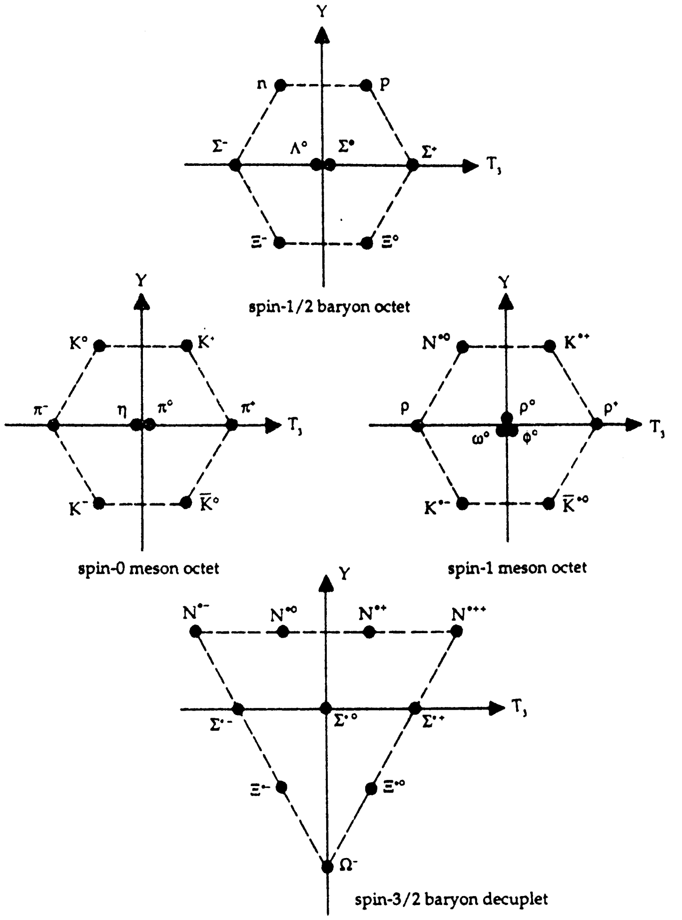


Figure 2.1 : The 'Eight-fold way' classification of baryons and mesons.

As an explanation of these patterns, Gell-Mann and George Zweig proposed in 1964 the existence of three fundamental building blocks of matter called up, down and strange quarks.[2] These are spin-½ fermions which interact with one another strongly to form bound states of either three quarks (baryons) or a quark and its antimatter counterpart, the antiquark (mesons). Figure 2.2 shows the up and down quark composition of the proton and neutron. The former presented a problem, however, in that baryons like the omega-minus in the set of ten baryons shown in figure 2.1 had to consist of three identical quarks. But, according to a basic rule of quantum theory called the 'Exclusion Principle,' no two fermions can be in the same quantum state. The difficulty was overcome in 1964 by physicists Oscar Greenberg, Moo-Young Han and Yoichiro Nambu, who suggested that quarks had three 'colour states,' labelled 'red,' 'blue,' and 'green.' If each of the three quarks forming the omega-minus and other spin-3/2 baryons has a different colour, then they are in different states and the Exclusion Principle is not violated. This led to the formulation of the theory of quantum chromodynamics (QCD),[3] which proposed that a 'colour force' operates between the three colour states of a quark because each possesses three types of colour charge, the sum of which is zero. This charge is regarded as a new kind of charge, analogous to electric charge. Just as electric charge can be positive or negative, so too can be colour charge. Just as electric charges of the same sign repel and opposite charges attract, so do colour charges. Unlike colour charges attract each other, whilst like colour charges repel. For example, red charges attract blue and green, but repel red charges The colour charges of antiquarks are opposite in sign to those of quarks, the former having three colours that are complementary to red, blue and green. As quark-antiquark bound states, mesons therefore have no net colour charge, whilst in baryons the sum of the colour charges of each quark in a different colour state is zero as well, i.e. mesons and baryons are said to be 'colourless,' in analogy to the three primary colours of white light: red, blue and green. According to QCD, *only* colourless combinations of quarks and antiquarks can exist.

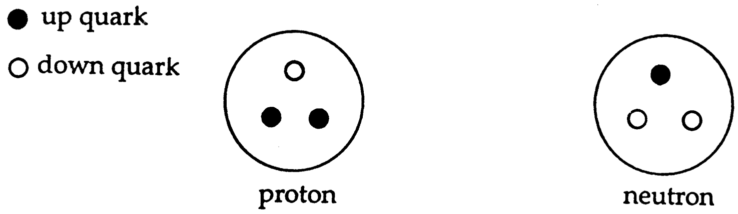


Figure 2.2

The colour force is mediated by eight, massless, spin-1 bosons called 'gluons,' of which six have non-zero colour charges, enabling them to interact strongly with one another. This makes gluons different from the photon, which is electrically neutral and so cannot interact electromagnetically with other photons. The difference manifests in how the force varies with distance. Electromagnetic forces vary inversely with the square of the distance between electric charges, becoming stronger, the shorter their distance apart and weaker, the longer the distance. But the colour force between quarks becomes weaker, the nearer they are, increasing in strength as they move further apart. This explains why searches for free quarks have been unsuccessful: quarks may be permanently inprisoned in hadrons because the colour force holding them together becomes stronger, the further apart they are, although this property has not yet been proved in a mathematically rigorous way, leaving the possibility that they *might* become released at extremely high energies beyond those currently available in particle accelerators.

Gell-Mann's quark model required three kinds of quarks in order to explain the Eight-fold Way classification of hadrons: the up quark (u), with an electric charge of 2/3 (taking the charge of an electron as unity), the down quark (d), which has a charge of - 1/3, and the strange quark (s), which also has a charge of -1/3. The weakness of the theory was that it did not explain why three types of quarks exist. Discovery of the long-lived 'J/psi meson' in 1974 indicated that a fourth, so-called charmed quark (c) exists, which has the same electric charge as the up quark. Physicists began to realize that quark species formed a sequence of two pairs, or 'generations,' which mirrored the two known pairs of leptons: the electron (e^-), the muon (μ^-) (discovered in 1937) and their associated neutrinos (ν_e and ν_μ, respectively). This pattern was required by the electroweak theory, which Abdus Salam, Steven Weinberg and Sheldon Glashow had proposed several years earlier as a unification of electromagnetic and weak forces, two of the four known forces listed earlier. This theory demands the existence of four spin-1 bosons, one of which is the familiar photon, the transmitter of the electromagnetic force. The three others are the two W particles, one positively charged and one negatively charged, and the neutral Z, all of which transmit the weak force, bringing about radioactive decay of nuclei. CERN, the European Particle Physics Laboratory in Geneva, Switzerland, announced the discovery of the two W particles in January 1983, and then of the Z particle in the following May.

The electroweak theory also requires a heavy, spin-0 boson called the 'Higgs boson' to exist in order to be mathematically consistent. This as yet undiscovered particle is believed through its coupling to fundamental particles to generate their masses. It mediates the Higgs field, which is supposed to be a field of constant density permeating all space, that is, the vacuum of outer space is not empty but contains this uniform field.

With the discovery in 1975 of the tau lepton (τ^-) and its associated tau-neutrino (ν_τ), as well as the discovery in 1977 at Fermilab, near Chicago, of the so-called 'upsilon meson,' which is made up of the so-called 'bottom' quark (b) and its antiparticle, a third generation of leptons and quarks was found (table 2.1). Two teams of physicists working at Fermilab, the particle accelerator near Chicago, U.S.A., announced[4] in March, 1995, that their measurements of the mass of the top quark (t) agreed sufficiently to persuade them that they had found the missing member of the third generation of quarks.

Table 2.1

	1st generation	2nd generation	3rd generation
quarks:	$\begin{pmatrix} u \\ d \end{pmatrix}$	$\begin{pmatrix} c \\ s \end{pmatrix}$	$\begin{pmatrix} t \\ b \end{pmatrix}$
leptons:	$\begin{pmatrix} \nu_e \\ e^- \end{pmatrix}$	$\begin{pmatrix} \nu_\mu \\ \mu^- \end{pmatrix}$	$\begin{pmatrix} \nu_\tau \\ \tau^- \end{pmatrix}$

There do not seem to be more generations of leptons and quarks. In August, 1989 the Stanford Linear Accelerator Collider at the University of California at Stanford was able to put a limit on the number of generations at 3.0 ± 0.9, which excludes four families of quark with a level of confidence of about 70%. By September, the Large Electron-Positron Collider (LEP) at CERN established a better limit of 2.7 ± 0.7, excluding four generations with a confidence level of 96%.

The three generations of quarks and leptons, the photon, the eight gluons, the W, Z, and Higgs bosons constitute the 'standard model' of particle physics. Some physicists have constructed composite models for quarks and leptons in the hope of explaining why there appears to be no more than three generations of these particles, of reducing the number of parameters (over twenty) used in the standard model, and of unifying the three interactions. If quarks are not fundamental but are composed of three

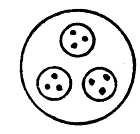


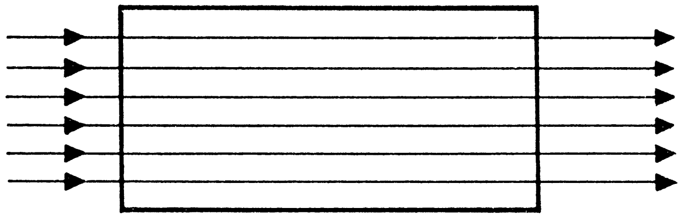
Figure 2.3 : Sub-quark model of baryon.

spin-½ 'subquarks,' then protons and neutrons (and baryons in general) would each consist of nine subquarks (fig. 2.3). As yet there is no direct experimental evidence for these hypothetical basic constituents of quarks. The purpose of this book is, nevertheless, to prove beyond reasonable doubt that they do exist!

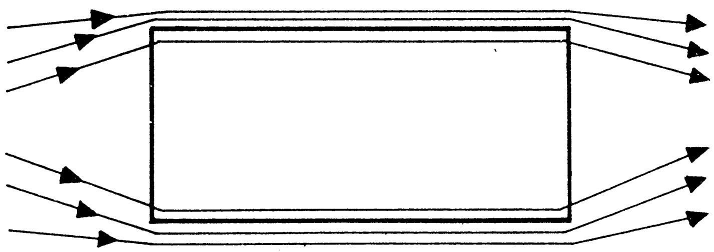
Physicists are currently trying to unify the colour and electroweak forces in a single mathematical formulism. Such 'grand, unified theories' (GUTs) predict that these forces merge at sufficiently high energies into a single force acting between members of a unified family of quarks and leptons. The mathematical symmetry of this common force then breaks down at lower energies in one or more stages to produce the known mathematical symmetries of the colour and electroweak forces. Since the unified force does not discriminate between hadrons and leptons, it can cause quarks to change into leptons. GUTs therefore predict that the lightest baryon - the proton - is unstable, with a half-life (the time taken for half any number of protons to decay) of about 10^{32} years. No experiments have as yet detected rare decays of protons. Until they do, physicists cannot be certain that they are unifying the forces of nature in the right way. Any unified theory that incorporates gravitation is called a 'theory of everything' (TOE). One such TOE is superstring theory, which will be discussed in section 2.5.

2.3 The string model

When cooled to temperatures near absolute zero (about –273° C), many metals lose their electrical resistance and become perfect conductors of electricity. If a magnetic field is then applied to such a material in a 'superconducting state,' the magnetic lines of force, which would have passed through it if it were at room temperature and showing normal electrical resistance, are expelled almost completely from its interior (fig. 2.4). This 'Meissner effect' is caused by the wholesale formation at temperatures below a critical value of large numbers of pairs of electrons, loosely bound to each other by their mutual interaction with atoms in the lattice of the material. The motion of these 'Cooper pairs' in the external magnetic field



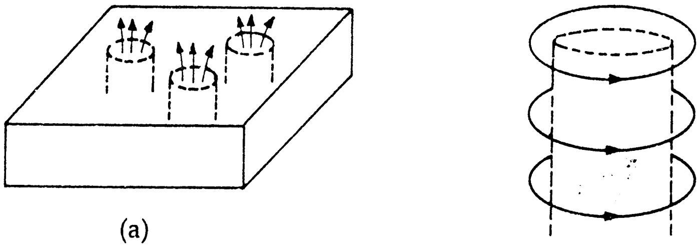
(a) Normal state



(b) Superconductive state

Figure 2.4

produces a local magnetic field which opposes and effectively cancels the applied field everywhere except near the surface of the material, resulting in little penetration of magnetic flux into its interior. In type 1 superconductors, there is complete expulsion of flux; in type 2 superconductors the normal, conducting regions of the material segregate into an array of filaments arranged parallel to the external field and surrounded by the remaining superconducting material (fig. 2.5a). These filaments are extended bundles of flux lines which have been expelled from the ambient, superconducting material through the Meissner effect and are trapped inside cylindrical vortices or whirlpools of electric current of variable current density made up of circulating electrons (fig. 2.5b). The amount of magnetic flux in a vortex is quantized in integer multiples of the Dirac unit of flux $hc/2e = 2 \times 10^{-7}$ gauss cm^2, where h is Planck's constant, c is the speed of light and e is the electric charge of the electron. Most of the flux is in the core of the 'flux tube,' but it extends with exponential decrease into the superconducting region over a distance that is characterized by the 'London penetration depth $\lambda_L = (mc^2/4\pi ne^2)^{1/2}$, where m is the mass of the electron, e is its electric charge, and n is the density of superconducting electrons in the material.


(a)

Vortex of current
of variable density
(b)

Figure 2.5

The short penetration depth of a magnetic field inside a type 2 superconductor is due to massless photons acquiring mass inside superconductors due to the so-called 'Higgs mechanism,' whereby massless bosons transmitting force fields become massive through their coupling to spin-0 Higgs bosons. Nielsen and Olesen pointed out in 1973 a remarkable parallelism between, on the one hand, the Higgs model for inducing breakdown of the mathematical symmetry of forces and the London-Ginzburg theory of superconductivity and, on the other hand, the flux lines inside type 2 superconductors and the 'dual string model' of strong interactions. Their work prompted Nambu to study magnetic monopoles - hypothetical particles with a magnetic charge like the north and south poles of a bar magnet - in a superconducting vacuum, the Higgs field taking over the role of superconducting Cooper pairs. He found that pairs of oppositely charged monopoles were permanently bound together. With quarks identified as magnetic monopoles, mesons would be monopole-antimonopole pairs, thus explaining why mesons cannot break up into free quarks.

This work was generalized to magnetic monopole sources of colour fields. According to the string model of quark confinement, the vacuum is identified with the Higgs field, a type

2 superconductor in which quarks are embedded as monopoles sources of the colour force. In a vacuum without the Higgs field present the flux lines of an isolated, positively charged monopole diverge in all directions (fig. 2.6a). But in the Higgs vacuum they become squeezed together in a bundle within an infinitely long, narrow flux tube (fig. 2.6b), being expelled from the ambient, superconducting vacuum by the Meissner effect. A flux tube is a vortex in

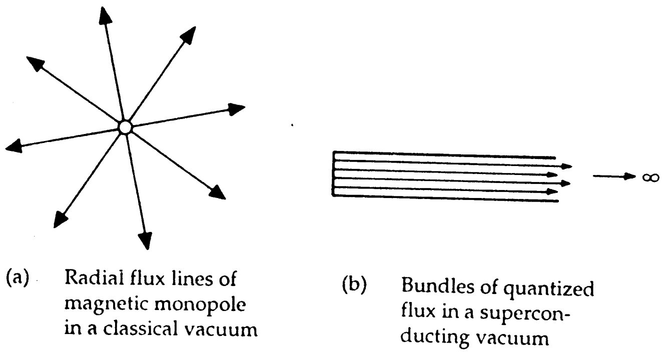


Figure 2.6

the pervasive Higgs field, consisting of currents of Higgs bosons of variable density that circulate about the vortex core, into which most of the flux lines are squeezed. A monopole is the endpoint of this flux tube. Flux lines emanate from the monopole if it is positively charged and converge on it if it is negatively charged. The Higgs field density is constant far from the centre of the vortex and the vacuum is superconducting (fig. 2.7). The density decreases closer to the flux tube, falling to zero at its centre, where the vacuum is in a normal state.

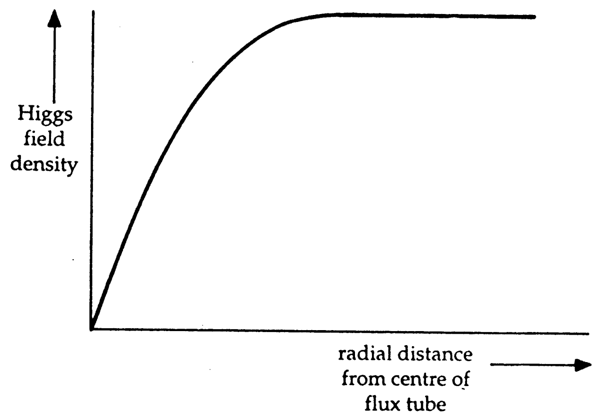


Figure 2.7

As bound states of a quark and an antiquark, mesons are regarded in the string model as flux tubes or strings of finite length ('open strings') (fig. 2.8a), their ends being tied together permanently by a bundle of flux lines that emanate from the monopole (quark) and terminate on the antimonopole (antiquark). As bound states of three quarks, baryons are considered either as Y-shaped strings (fig. 2.8b) terminating on monopoles or as circular strings (fig. 2.8c), two strings emanating from each monopole. Both types of hadrons are surrounded by a cloud of virtual gluons extending a distance $\Lambda = h/m_v c$ from the core of the flux tube, where h is Planck's constant, m_v is the mass of the gluon acquired by its strong coupling to the Higgs field and c is the speed of light.

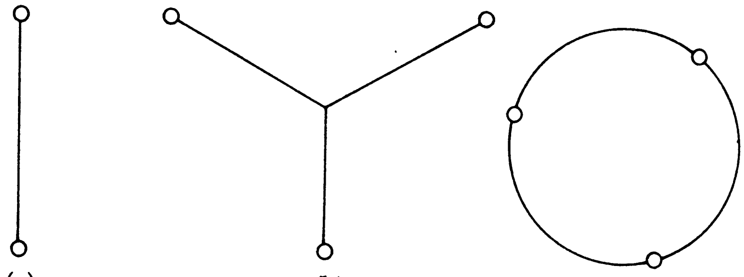


Figure 2.8

The energy of a flux tube is proportional to its length. This means that free quarks cannot exist because an infinite amount of energy would be needed to separate the quark at one end of a string from the antiquark at its other end. If a string is stretched, its potential energy accumulates until a new quark and antiquark materialize out of the energy of the colour field. The new quark then pairs up with the antiquark at the other end of the string, whilst the new antiquark forms a new closed string with the original quark. Effectively, the string snaps in two, forming two strings, so that free ends of strings never exist.

The ideas of the string model are not restricted to coloured quarks. Colour can be generalized to 'hypercolour' in the context of composite models of quarks, an example of which was discussed in the author's book ESPQ (pp. 23-40). The micro-psi observations by Besant & Leadbeater of the force binding UPAs will be shown to indicate that the constituents of quarks are hypercoloured.

2.4 Superstrings and bosonic strings

The following problems with the string model led to its abandonment by most physicists:

1. to be consistent with quantum mechanics, spinless, or 'bosonic,' strings had to have twenty-six dimensions, whereas spinning strings representing fermions needed only ten dimensions. Physicists could not understand how string-like fermions and bosons could co-exist if they required space-times of different dimensionality;
2. string models of hadrons contained massless spin-1 particles and a massless spin-2 particle, neither of which hadrons had been discovered. The only known example of the latter is the graviton. But this transmits the long-range gravitational force. So how could it appear in a theory of strong interactions? In 1974 J. Scherk and J. Schwarz found

evidence that the string model *did* contain Einstein's theory of gravitation as a certain limiting case. But the theory predicted that strings had to be twenty orders of magnitude smaller than the typical size (10^{-13}cm) of hadrons, as well as having excited vibrational modes nineteen orders of magnitude heavier than the typical masses of excited states of hadrons.;

3. the state of least energy of a string was a 'tachyon,' a hypothetical particle which travels faster than light. Although Einstein's Special Theory of Relativity does not forbid the existence of tachyons, disallowing only particles moving slower than light ever to become tachyons, a relativistic quantum theory with tachyons is inconsistent. So the appearance of tachyons in string theories was unwelcome to physicists;
4. quantum chromodynamics, the rival theory of strong forces, became favoured by physicists.

Superstrings

But a few physicists wanted to know whether incorporating 'supersymmetry' might solve some of these problems. This is a mathematical symmetry that treats fermions and bosons as different spin states of a single, fundamental, supersymmetric object. It means that each ordinary fermion should have a superpartner that is a boson and that each ordinary boson should have a partner that is a fermion. In 1976 F. Gliozzi, J. Scherk and D.A. Olive showed that tachyons could be eliminated in the ten-dimensional spinning string theory of fermions developed in 1971 by P. Ramond, A. Neveu and J.H. Schwarz, and they speculated that the new model might be supersymmetric, serving as a model for both fermions and bosons. But it was not until 1980 that J. Schwarz and M. Green began to develop and investigate the properties of strings that incorporate supersymmetry - so- called 'superstrings.'[5] In 1984 they made the surprising and significant discovery that a theory of superstrings formulated in ten-dimensional space-time is free of 'quantum anomalies' (a technical problem that had plagued point-field theories) provided that the unified superstring force is transmitted by 496 spin-1 bosons. Moreover, the infinities that plague calculations based upon point-field theories disappear, at least to the first level of approximation. These virtues of superstring theory led to much renewed interest in string theories.

The superstring is a very different object from the closed strings or magnetic flux tubes which the early string model had depicted hadrons as being. Because they are inherently supersymmetric, superstrings can be either bosons or fermions. Different harmonics or normal modes of vibration of the superstring correspond to different particles. Its tension, about 10^{39} tonnes, sets the mass scale. If its size is the so- called 'Planck length' of 10^{-33}cm (the distance from a gravitating object at which the quantum nature of the gravitational field becomes important enough to render invalid the meaning of distance and time, upon which Einstein's theory of gravitation is based), all excited modes of vibration have masses of about 10^{19} times that of the proton, or larger. Such a mass scale greatly exceeds the energy output that any future particle accelerator will achieve, so that these massive modes of vibration will never be created and detected in the high-energy physics laboratory. All observed (and observable) subatomic particles must contain superstrings in their lowest state of vibrational energy. Higher modes of vibration of superstrings could have been excited only during a period up to about 10^{-43} seconds after the Big Bang, when the temperature of the universe was 10^{32} degrees Celsius. At all energies likely to be achievable by current and planned particle accelerators, superstrings should behave effectively as massless point particles.

There are two types of superstrings:

1. open strings with free endpoints (fig. 2.9a). These interact with one another by joining their ends to create a new string of the same type. They can also split apart to form two new open strings, or the two endpoints of a single string can join to form a single closed string (fig. 2.9b);

Figure 2.9

2. closed strings. These interact by touching at some point and joining to form a new closed string.

It was thought for some time that type 2 superstrings could not be realistic models of fundamental particles because they interact only gravitationally, having no endpoints carrying charges like electric and colour charges. But in 1985 D.J. Gross, J.A. Harvey, E. Martinec and K. Rohm formulated the theory of a new kind of closed superstring called the 'heterctic superstring,' in which the charge sources of the non-gravitational forces predicted by superstring theory are regarded as being smeared out over the entire length of the closed string. In the same year P.G.O. Freund had suggested that a superstring might result from shrinkage to infinitesimally small scales of sixteen of the dimensions of the twenty-six dimensional string originally predicted by quantum mechanics for bosonic strings. Waves can travel around any closed string in two directions. But, according to Gross and his colleagues, the waves that travel in a clockwise direction in a closed, heterotic string are waves of a ten-dimensional superstring theory, whereas the waves travelling anticlockwise are waves of the twenty-six dimensional bosonic string theory. Instead of having no quantum numbers to be associated with particles because it has no endpoints, as was originally thought to be the case for closed strings, the heterotic superstring has its possible quantum numbers circulating around its length.

Compactification

Superstring theory predicts that space-time is ten-dimensional. It requires that six of the nine spatial dimensions of space-time extend over an infinitesimally small scale, leaving the three large-scale dimensions of the universe familiar to us. Because it has not been formulated in a fundamental way, the theory cannot yet specify the geometry and topology of this extremely small, six-dimensional, 'compactified space.' It cannot even predict the necessity for six, and only six, dimensions, to be compactified. Such properties determine how, as a result of the compactification, or curling up, of these six dimensions, the original mathematical symmetry of the superstring force in ten-dimensional space-time broke down into the symmetries of the strong and electroweak forces observed in four-dimensional space-time. Because the unified symmetry is so large compared with the latter, there exist many ways in which it can break down. As a consequence, many kinds of compactified space may be consistent with the standard model of particle physics. If future experiments detect new particles requiring changes to the standard model, this lack of certainty about the compactified space only becomes worse. However, progress has been made in demonstrating that, if the six extra dimensions form what is known as a 'Calabi-Yan' space, the GUT associated with this is consistent with the standard model. But a large number of such spaces are possible and further theoretical restraints have to be investigated. Another model space which theorists have considered is the six-dimensional torus. This is the generalisation in six-dimensional space of the torus (the shape of a ring doughnut), in which each of the six dimensions is a circle. The superstring is pictured in this model as winding in turn around each circular dimension (fig. 2.10), all of which are perpendicular to one another and which may or may not have the same radius. The number of times it wraps itself around a given circular dimension is called a 'winding number.' The six-dimensional torus has been generalized to what are called 'orbifolds.' These are highly curved spaces with holes and singular points, which can trap strings winding through them by preventing them from unlooping. Such topologically trapped strings can manifest the properties of fractionally charged particles - quarks - or of magnetic monopoles. Their topology can lead to a number of generations of particles. A string winding around a hole or singularity can never become one that winds about the compactified space avoiding them. The presence of holes or singularities in an orbifold space has therefore the effect of destroying its basic symmetry, so that the full symmetry of the unified superstring force operating in flat, ten-dimensional space-time can be broken by the process of compactification into a minute six-dimensional orbifold space, leading to the forces and particles described by the standard model. Or at least this is what string theorists hope. The micro-psi evidence presented in chapters 3 and 4 of this book indicates that advocates of superstring theory are going to be surprised!

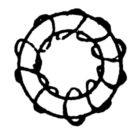


Figure 2.10

References

1. M. Gell-Mann and Y. Ne'eman, *The Eightfold Way* (W.A. Benjamin, Inc., New York, 1964).
2. Non-technical introductions to the quark model are given in the Bibliography.
3. See Bibliography for elementary expositions of QCD.
4. 'The top quark found at long last,' by John Maddox, *Nature*, vol. 374 (9 March, 1995), p. 113; 'Chicago quark hunters come out on top,' by Vincent Kiernan, *New Scientist* (19 March, 1995), p. 6.
5. See Bibliography for non-mathematical introductions to superstring theory.

CHAPTER 3

THE CONNECTION BETWEEN MICRO-PSI AND PARTICLE PHYSICS

3.1 Another correlation with physics

We saw in chapter 1 that Besant & Leadbeater discovered the shapes of MPAs to be related to the positions of their corresponding elements in the periodic table. It was argued that this correlation was neither fabricated nor the result of their supposed hallucinations being conditioned by their knowledge of chemistry because these explanations do not account for the fact that elements in the same subgroup of the periodic table may appear in *different* subgroups of the micro-psi version of this table, whereas they would have been always in the same subgroup if the two Theosophists had - consciously or unconsciously - been influenced by whatever they had known about chemistry. The connection between the geometrical forms of MPAs and the group positions of their elements in the periodic table does not therefore have a satisfactory, conventional explanation. Instead, it must be regarded as a significant finding of the micro-psi investigations that requires deeper understanding.

Another correlation, which emerged soon after Besant & Leadbeater commenced their systematic investigations of MPAs, will now be discussed which further discredits the superficial explanations that their observations were faked or hallucinatory. As Figure 1.1 illustrates, MPAs are symmetrically arranged aggregates of many different types of particles, each of which is composed of clusters of UPAs bound together in stable orbital configurations. For MPAs with funnels, the set of particles enclosed in a given funnel is generally the same as the sets in the other funnels, although some MPAs break this rule by having two types of funnels containing different sets of particles. Similarly, for MPAs with spikes, bars or arms of a six-pointed star, each spike, etc. in a given MPA contains the same set of particles. The variety of particles is generated by different, bound combinations of groups of either two, three, four, five, six, or seven UPAs (rarely more). At least one of these groups is characteristic of the MPA of the element in question in the sense that it is not present in MPAs of elements with smaller atomic numbers. Such 'generic particles,' as we shall call them, appear in numerous other MPAs, some more frequently than others.

The similarity of the particles belonging to each funnel, spike, etc. in an MPA and the widespread presence in MPAs of generic particles seen in other MPAs considerably simplified Besant's and Leadbeater's task of finding how many UPAs an MPA contained, for it meant that they did not have to count every one - a task which would have been impossibly laborious because many MPAs contain several thousand UPAs. Instead, they had merely to identify what types of particles familiar to them from studies of MPAs of other elements were present in, say, a funnel, count how many particles of each type it contained and then multiply the number of each type by the number of UPAs established by earlier studies to comprise each one. Having calculated the number of UPAs in a funnel, they multiplied this

Table 3.1

Element	UPA Population (Y)	Number Weight (Y/18)	Atomic Weight (X)
Hydrogen	18	1	1
*Occultum	54	3	...
Helium	72	4	3.94
Lithium	127	7.06	6.98
Beryllium	164	9.11	9.01
Boron	200	11.11	10.86
Carbon	216	12	11.91
Nitrogen	261	14.50	14.01
Oxygen	290	16.11	15.879
Fluorine	340	18.88	18.90
Neon	360	20	19.9
*Meta-Neon	402	22.33	...
Sodium	418	23.22	22.88
Magnesium	432	24	24.18
Aluminium	486	27	26.91
Silicon	520	28.88	28.18
Phosphorus	558	31	30.77
Sulphur	576	32	31.82
Chlorine	639	35.50	35.473
Potassium	701	38.944	38.85
Argon	714	39.66	39.60
Calcium	720	40	39.74
*Meta-Argon	756	42	...
Scandium	792	44	43.78
Titanium	864	48	47.74
Vanadium	918	51	50.84
Chromium	936	52	51.74
Manganese	992	55.11	54.57
Iron	1,008	56	55.47
Cobalt	1,036	57.55	57.7
Nickel	1,064	59.11	58.30
Copper	1,139	63.277	63.12
Zinc	1,170	65	64.91
Gallium	1,260	70	69.50
Germanium	1,300	72.22	71.93
Arsenic	1,350	75	74.45
Selenium	1,422	79	78.58
Bromine	1,439	79.944	79.953
Krypton	1,464	81.33	81.20
*Meta-Krypton	1,506	83.66	...

Contd...

Contd...

Rubidium	1,530	85	84.85
Strontium	1,568	87.11	86.95
Yttrium	1,606	89.22	88.34
Zirconium	1,624	90.22	89.85
Niobium	1,719	95.50	93.25
Molybdenum	1,746	97	95.26
Ruthenium	1,848	102.66	100.91
Rhodium	1,876	104.22	102.23
Palladium	1,904	105.77	105.74
Silver	1,945	108.055	107.93
Cadmium	2,016	112	111.60
Indium	2,052	114	114.05
Tin	2,124	118	118.10
Antimony	2,169	120.50	119.34
Tellurium	2,223	123.50	126.64
Iodine	2,287	127.055	126.01
Xenon	2,298	127.66	127.10
*Meta-Xenon	2,340	130	...
*Kalon	3,054	169.66	...
*Meta-Kalon	3,096	172	...
Osmium	3,430	190.55	189.55
Iridium	3,458	192.11	191.56
Platinum A	3,486	193.66	193.34
*Platinum B	3,514	195.22	...
Gold	3,546	197	195.74

*Isotopic variation of MPA (except kalon).

number by the number of funnels in order to determine the total number of UPAs in the MPA, separately taking into account if it had a central sphere or other unrepeated feature, as well as any particles unique to this MPA that had to be examined in detail.[1] On comparing the UPA populations of MPAs with the chemical atomic weights of their corresponding elements, it was found that the calculated numbers were approximately proportional to these scientifically determined numbers. For example, noting that the hydrogen MPA contains 18 UPAs, the MPA of helium (with an atomic weight of 4^2) has 72 UPAs, four times that for hydrogen, the MPA of carbon (with an atomic weight of 12) has 216 UPAs, twelve times that for hydrogen and the MPA of oxygen (with an atomic weight of 16) has 290 UPAs, almost sixteen times that of hydrogen. In fact, of the 111 MPAs recorded by Besant & Leadbeater, 39 were found to have populations that were exact, integer multiples of 18, the UPA population of the hydrogen MPA. This approximate, mathematical relationship between populations and atomic weights enabled them to check their identification of MPAs by comparing the so-called 'number weight,' which they defined as:

$$\text{number weight} = \text{UPA population}/18,$$

with scientific tables of atomic weights and by then picking out the element whose atomic weight best agreed with the number weight that they had calculated. Table 3.1, which appears on p. 20 of the second edition of *Occult Chemistry*, is the list of 59 elements (and some of their isotopes) that were examined up till 1908, the year of publication of its first edition.

Elements and isotopes affixed with an asterisk were undiscovered by science at the time. The values of the atomic weights were taken from "the latest lists of atomic weights, the 'International List' of 1905, given in Erdmann's 'Lehrbuch der Unorganischen Chemie."[3] The reader will notice that the number weights listed in table 3.1 are nearly equal to these scientifically determined numbers. The fact that the agreement between them is only approximate is very significant because it represents evidence that Besant & Leadbeater did not invent the rule that number weights should as far as possible be equal to atomic weights in order to concoct an impressive correlation with chemistry. The hypothesis of fraud is not supported by the population data for the 57 elements in table 3.1 both known to science and examined by the two Theosophists for the following reason: if it is assumed that they - for some reason known only to themselves - devised the formula N = 18X in order to fabricate populations (N) for MPAs of elements with atomic weights X, it is found that the best fit is:

$$N = (18.055 \pm 0.014)X.$$

The difference (0.055) between the supposedly *invented* proportionality constant 18 and its 'best fit' value 18.055 is almost four standard deviations, showing that the population data listed in table 3.1 are very poorly fitted by the formula N = 18X. The hypothesis that the data were fabricated with the use of the formula Y = 18X must therefore be rejected because there is less than one chance in ten thousand that it is true. In other words, if they had made up the data, Besant & Leadbeater would have procured much better agreement between number weights and atomic weights than what actually exists.

Because there is very little chance that it could have been fabricated, this second correlation between chemical facts and micro-psi observations is *also* significant and needful of explanation. But the scientifically minded reader might ask how a parameter (UPA population) referring to the MPA of *one* isotope of an element could depend upon another parameter (atomic weight) which refers to all its isotopes, being the average of their atomic masses, with the atomic mass of the carbon-12 isotope taken as 12. Theoretically speaking, the equation:

$$N = 18X$$

does not make sense if X is the atomic weight because it implies - contrary to what one would expect (and, more importantly, to what Besant & Leadbeater actually noticed) - that different isotopes of the same element have MPAs containing the same number of UPAs, this number depending only upon the atomic weight of the element, which does not relate to any single isotope! It is clear that the second correlation must hide a deeper truth that resolves this problem. The reason for the approximate proportionality between UPA populations and atomic weights will be given in section 3.4.

3.2 Problems with science

These two correlations between micro-psi observations and facts of chemistry were, however, about the *only* discoveries made by Besant & Leadbeater which suggested at the time that what they were seeing related to the physical world known to science. Some of the most serious, apparent conflicts with physics and chemistry are:

1. MPAs bear no resemblance to the Rutherford-Bohr model of the atom discussed in chapter 2. Whilst, if their micro-psi vision had automatically focused upon atomic nuclei,

Besant & Leadbeater might be forgiven for not noticing atomic electrons - either as discrete particles or as waves - because physicists know that these particles are many orders of magnitude smaller than atomic nuclei (their actual size is too small to be measured as yet), the numerous types of particles observed inside MPAs are utterly inconsistent with the now well-established idea, proposed by Heisenburg a year before Besant died, that atomic nuclei consist of just two varieties of constituent particles: protons and neutrons;

2. when chemical compounds were examined, different MPAs were seen to combine into larger molecular-type units in the same numbers as their corresponding atoms are known to do in molecules. Yet MPAs appeared in some compounds to be *broken up* into their major structural units, which became *mixed* with the components of other similarly fragmented MPAs belonging to the compound. But every student of chemistry knows that atoms do not split up when they bond together to form molecules! Leadbeater realised, of course, that such observations violated the very foundation of atomic theory when he studied chemical compounds with his micro-psi faculty in the mid-1920s. But it did not inhibit him from claiming that MPAs are atoms. This persistence must be puzzling to the sceptic or conventional theorist because a perverse flying in the face of scientific facts is not the expected behaviour of a psychic fraudster, who would have made sure that his concocted observations were at least consistent with what even laypeople know about atoms combining in chemical reactions before he presented his hoax to the world;

3. in 1924 Leadbeater described in *The Theosophist* (vol. 45) the molecule of the organic chemical benzene as octahedral in shape,[4] whereas chemists knew by then that its six carbon atoms are arranged at the corners of a hexagon. In the same volume of this journal he depicted the molecule of methane also as octahedral,[5] whereas it is tetrahedral. Worse still, in 1925 Leadbeater reported in volume 46 of *The Theosophist* that, instead of the ozone molecule consisting of three *whole* MPAs of oxygen - as it should have done if MPAs were atoms - it was made up of three objects, each of which was one of the two dissimilar halves of an oxygen MPA.[6] In other words, his unwavering belief that MPAs are atoms forced him into having to accept the absurd idea that every molecule of ozone consists of 1½ atoms, not three atoms!;

4. in 1909 Besant & Leadbeater reported in *The Theosophist* (vol. 30) their observation of three MPAs belonging to the bars group, which contains only transition elements. However, these MPAs did not correspond to any known transition element, the sizes of their UPA populations being between those of the two sets of transitions elements ruthenium, rhodium & palladium and osmium, iridium & platinum (see table 1.1). Calling these elements 'X,' 'Y,' and 'Z,' they assumed that scientists would eventually detect these unknown elements whose atoms they believed that they had observed. The number weights of X, Y, and Z are, respectively, 147.00, 148.55, and 150.11, which differ too much from the mass numbers of isotopes of their neighbours in the bars group for it to be possible to identify them as such. They also recorded in 1907 an MPA belonging to the star group whose UPA population placed it between xenon and radon, inert gases which also belong to this group. They called this inert gas 'kalon' (meaning 'beautiful'), believing it not to have been found by science because of the rarity of its atoms, which they described by saying that 'there might be one in the atmosphere of an ordinary-sized room.'[7] Its number weight is 169.67, which differs too much from the mass numbers of

the isotopes of xenon and radon for the MPA to be identifiable with one of the latter. But the periodic table has no room for three still unknown transition elements and an unknown inert gas. According to atomic theory, the elements X,Y,Z, and kalon, which Besant & Leadbeater believed would be eventually found by science, simply cannot exist! This could not have been known to the two Theosophists when they published their observations of these impossible elements because it was only after 1913, through Henry Moseley's measurements of the frequencies of the X-ray spectra of elements between calcium and zinc in the periodic table, that scientists realized that elements are ordered in this table according to their atomic numbers, *not* their atomic weights, making it impossible for elements to exist which are situated in the table between elements with consecutive atomic numbers. It is unknown whether Besant & Leadbeater eventually recognized the scientific impossibility of the existence of X, Y, X, and kalon, which they had reported in the early years of their work. If they did, their realisation never persuaded them to admit anywhere in their voluminous writings that they had been wrong to assume that MPAs were atoms, so confident were they that they had always observed real, physical objects undisturbed by the act of clairvoyant observation.

These scientific problems, as well as other difficulties raised by descriptions in the third edition of *Occult Chemistry* of what the two Theosophists regarded as molecules amount to irrefutable arguments against their interpretation of MPAs as atoms. After Rutherford's famous experiments in 1910 involving the scattering by thin metallic foils of alpha particles, it soon became clear to physicists that nearly all the mass of an atom is concentrated in its centre, or nucleus. But even if, following this discovery, which ushered the era of nuclear physics, the two Theosophists had revised their identification of MPAs as atoms and had proposed, instead, that MPAs were atomic nuclei, this reinterpretation would still not have solved the problems listed above. Atomic nuclei do not disintegrate when their atoms bond together to form molecules because the energy of chemical reactions is millions of times smaller than that required to cause fission of nuclei. Furthermore, no amount of special pleading or resorting to ad hoc models of the modus operandi of micro-psi whilst retaining the view that MPAs are nuclei can eliminate the conflict between established scientific facts and the Theosophists' working assumption that the micro-psi faculty enabled atoms to be observed in their natural state undisturbed by this act of observation. It is stated in *Occult Chemistry* that 'a special form of will-power' had to be exercised to slow down the motions of particles sufficiently for clear micro-psi images to be discernible. Whatever the nature of the retarding, psychokinetic force that Besant & Leadbeater claimed to be able to direct towards individual atoms or molecules, such a preparation procedure would inevitably have altered the quantum state of particles selected for observation. The erroneous assumption that they made was that, in disturbing atoms or molecules to the extent of slowing down their translational, vibrational and rotational modes of motion, they did not change the state or even the nature of these particles. This assumption was a natural one to make during the period 1895-1908, when most of their work was carried out and which was still in the era of classical physics. But in the present era of quantum physics, according to which the act of instrumental observation actually defines the properties of quantum systems, we can see in hindsight that it was fundamentally mistaken.

But what else could Besant & Leadbeater have seen? Suppose that their visions were nothing more than shared hallucinations that continued to be experienced intermittently over a period of thirty-eight years. A duration as long as this, plus the baffling circumstance of two people experiencing and agreeing upon the very same complex set of hallucinations whenever they studied an element, make this scenario thoroughly unlikely, quite apart from the fact that no pathological cause of their visions can be discerned: neither Theosophist is known to have suffered any mental illness during their extremely active and creative lives.

If, instead, the visions were hallucinations induced by meditation, why should Besant have experienced the same set of hallucinatory images as Leadbeater - or at least ones which were similar enough for her to be able to collaborate with him without disagreement ever arising over what they were seeing? There is no satisfactory answer to this question. But let us pursue the psychological explanation further: if all micro-psi images were merely hallucinations, why should the form of an MPA have correlated with the position of its element in the periodic table? Earlier arguments discredited the possibility that this correlation was due to unconscious conditioning of their minds by whatever knowledge of chemistry Besant & Leadbeater, as educated, middle class Victorians, might have been expected to possess. So how can the correlation exist at all if MPAs were merely hallucinations having no causal connection with the element being examined? Furthermore, why should such hallucinations (however they were caused) contain within their features the remarkable regularity that the UPA populations of MPAs are approximately proportional to the values of the atomic weights of their corresponding elements? This is true, remarkably, even for elements like francium and astatine, whose atomic weights must have been unknown to Besant & Leadbeater because science discovered them in, respectively, 1939 and 1940, about seven years after the deaths of the two Theosophists. The number weight calculated for the MPA of francium (element '87'), whose most stable isotope has a mass number of 223, is 222.55.

We can be certain in the case of many MPAs that their assistant, Jinarajadasa, did not tell Besant & Leadbeater what the corresponding atomic weights were *before* they focussed their micro-psi vision on chemical specimens. This is simply because they rarely examined pure samples of elements, mostly minerals and chemical compounds, and therefore they did not know at first what element it was whose MPA they had observed - they would have seen several types of MPAs. The identity of a given MPA might become known only after Jinarajadasa had calculated its number weight from their observational data and compared it with tables of atomic weights, their identification then being checked by an examination of substances known to contain this element to determine whether they saw the same MPA.[8] As they often did not know what element it was whose MPA they had described in detail until *after* its investigation, their brains could not have used *any* information they might have had about its atomic weight to manufacture appropriate hallucinations containing the right numbers of UPAs - at least not until enough MPAs in the chemical specimen had been studied for the elements corresponding to the remaining ones to be deducible from what they might have known about its chemical contents. As they often studied an impure sample of an element, they, as well as their assistant Jinarajadasa, did not know its complete chemical composition and so they could not always be certain beforehand to what element an MPA under their observation referred. In this sense their observations of impure samples of elements were double-blind. Even if they *had* known in some cases the atomic weight of an element before they described its MPA, it is very hard to believe that their brains could experience hallucinatory images of *precisely* the right numbers of different, imaginary particles, each containing appropriate numbers of UPAs, to generate a UPA population that was (give or take a few UPAs), always eighteen times the atomic weight of an element in the chemical under examination. One has only to see in chapter 5 some of the highly complex diagrams of MPAs that were drawn to realise that the brain of Leadbeater, who was mostly responsible for mapping out the structures of MPAs, could have given itself a much simpler task of hallucinating particles with the requisite number of UPAs!

More problematic still is the following question: supposing that their visions were not hallucinations of imaginary things but accurate representations of real objects, why should two correlations between science and psychic observations exist at all if MPAs are *not* really atoms or atomic nuclei, as was concluded earlier? Most important of all is the question of how, *five years before scientists suspected the existence of isotopes*, two scientific laypeople could have anticipated that an element such as neon has more than one type of atom (so-called 'meta-neon,' which they reported in 1908 along with ordinary neon in volume 30 of *The Theosophist*), an MPA, moreover, whose calculated number weight of 22.33 is consistent with their having detected by paranormal means the neon-22 nuclide before it was officially detected by Frederick Aston in 1920, using the mass spectrograph that he had developed? Furthermore, how could this have been at all possible if, as our earlier arguments proved beyond reasonable doubt, MPAs are *not* atoms? We must turn to particle physics for answers to these puzzling questions.

3.3 The hydrogen MPA

It is perhaps unsurprising that the simplest MPA - that of the element hydrogen - should provide the vital clue to the correct interpretation of MPAs. The confining wall of the MPA (fig. 3.1) is egg-shaped and contains two triangular arrays of three spheres. Each array, or

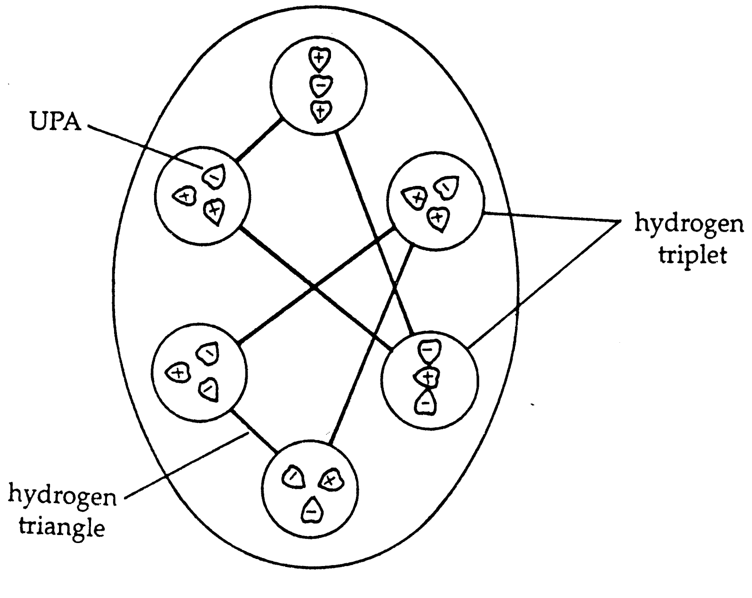


Figure 3.1 : The hydrogen MPA

'hydrogen triangle,' interpenetrates the other. The spheres ('hydrogen triplets') contain groups of three UPAs, which are arranged as triangles ('H3 triplets') in the lower hydrogen triangle and as one H3 group and two linear arrays ('H3' triplets') in the upper hydrogen triangle. In the first edition of *Occult Chemistry* the two linear triplets are shown as being one in each triangle. The third edition states that this form is rare because it was not observed when Leadbeater re-examined hydrogen in 1932. Hydrogen triplets are either 'positive' or 'negative.' Besant & Leadbeater did not explain what they meant by these terms. But they indicated this difference diagrammatically by depicting positive triplets (as they did *for all* positive groups of UPAs) with their heart-shaped UPAs pointing outwards from the centre of the group and by depicting negative triplets (and all negative groups) with their UPAs pointing inwards towards their centres. The upper hydrogen triangle contains one positive (+) H3 triplet, one negative (-) H3' triplet and one H3' triplet of indeterminate polarity because its depiction does not conform to this convention for indicating positivity and negativity, a rule which was otherwise strictly followed by Besant & Leadbeater throughout their researches. The lower hydrogen triangle consists of two positive H3 triplets and one negative H3 triplet.

We saw in section 2.2 that, according to the quark model of particle physics, a proton is made up of two u quarks and one d quark and a neutron is composed of one u quark and two d quarks. If quarks are not fundamental particles but consist of three subquarks, as some physicists have proposed, then protons and neutrons would consist of nine subquarks, bound together as three groups of three subquarks. Compare figure 2.2 with figure 3.1. The lower hydrogen triangle in figure 3.1 consists of two positive hydrogen triplets and one negative hydrogen triplet, whilst a proton is made up of two positively charged u quarks and one negatively charged d quark. This similarity of composition invites the very natural (but provisional) inferences that *a positive triplet is a u quark, a negative triplet is a d quark, the lower hydrogen triangle is a proton and that a UPA is a subquark.* The upper hydrogen triangle contains a positive H3 triplet and two linear H3' triplets, one of which is negative, the other being of indeterminate polarity according to the convention described above. We shall ignore for the time being the different spatial configurations of the subquark orbitals in the H3 and H3' triplets, returning to a discussion of 'orbital excitations' of quarks in the analysis of the hydrogen MPA in chapter 5. If these inferences are correct, the upper hydrogen triangle contains a u quark, a d quark and either a u or d quark (the triplet of uncertain polarity could not be a strange or charmed quark because these short-lived quarks would have decayed into u or d quarks long before observation of the hydrogen MPAs was completed). So this hydrogen triangle could be either a proton or a neutron. But the hydrogen MPA was not reported to be unstable. This rules out the upper hydrogen triangle being a proton because the so-called 'diproton' (a pair of protons strongly interacting with each other) is known to be unstable. One must, however, consider the possibility that the hydrogen MPA was not observed in real time, which would mean that this micro-psi image was a 'played-back recording' - to be examined at leisure - of a brief moment in the short life of a diproton. Although it may seem like special pleading to consider this alternative, it is not an ad hoc idea and deserves consideration. This is because the third edition of *Occult Chemistry* makes it clear that Leadbeater's micro- psi powers allowed him to review micro-psi images that he had experienced and recorded some time previously. It was stated in chapter 1 that, whilst the three Theosophists were spending a summer holiday in Germany, Leadbeater and

Jinarajadasa visited a museum in Dresden to look at minerals on display there. According to Jinarajadasa, Leadbeater 'examined them quickly and obtained a picture of the complex configuration of the mineral in which existed the element he needed. After returning to Weisser-Hirsch he was able at leisure to evoke by clairvoyance the picture he had seen at Dresden'[9]. But it is unlikely that he would have used this recording facility when in 1895 he *first* spotted an MPA of hydrogen in the air, in which case its reported stability was real rather than an illusion because it was noticed during a 'live' observation.

It is more likely therefore that the upper hydrogen triangle is a neutron, which is the only baryon which could form with a proton a stable bound state. This would be possible if the intervention of the micro-psi observer induced for some reason an inelastic collision between the two protons in the hydrogen molecule selected for examination which resulted in one of them changing into a neutron that became bound to the other proton, creating a deuteron, a stable particle:

$$ {}^{1}_{1}H + {}^{1}_{1}H \rightarrow {}^{2}_{1}H + \pi^{+}. $$

The positively charged pion (π^+) would have flown away, thus escaping observation. In view of the process of formation of MPAs to be proposed shortly, this observer-induced nuclear reaction between the two protons in a hydrogen molecule is not as an ad hoc idea as it may seem. On the contrary, given how MPAs will be hypothesized to be formed, this interaction might well be expected. An observation consistent with the hydrogen MPA being a deuteron is that: 'each of the three groups making one half of Hydrogen are linked to each other across space by lines of attraction.'[10] This could be the nuclear force binding the proton and neutron together in a deuteron. The fact that the two hydrogen triangles were noticed to overlap each other further supports the interpretation of the hydrogen MPA as a deuteron because the nuclear force is a short-range force and so it would not have been noticed unless the two nucleons had been sufficiently close for this force to act between them. Discussion of the hydrogen MPA in section 5.6 will present arguments eliminating other possible interpretations of the hydrogen MPA.

3.4 Two hypotheses about MPAs

If the UPA is a subquark, a hydrogen MPA contains the eighteen subquarks originally present in the two protons of a hydrogen molecule - that is, the nuclei of *two* hydrogen atoms. Since Besant & Leadbeater discovered that the number of UPAs in an MPA is approximately eighteen times the atomic weight of its element, consistency with this approximate relationship would lead one to expect that the MPA of any element has the subquark content of two atomic nuclei of that element. If the micro-psi powers of Besant & Leadbeater allowed them to observe not single hydrogen atoms - as they supposed - but a deuteron formed by the inelastic collision of the two protons in a hydrogen molecule, then these powers must more generally have induced prior to observation the formation of an MPA from two atoms of the element. Two hypotheses are proposed:

HYPOTHESIS 1: The UPA is a subquark (positively charged UPAs will be called 'X subquarks' and UPAs with negative electric charge will be called 'Y subquarks');

HYPOTHESIS 2: The MPA of an element is a quasi-nuclear system of quark and subquark matter formed prior to its micro-psi observation from two atomic nuclei of that element.

This is a partial, preliminary statement describing a process of MPA formation which will be described in more detail in chapter 5. It suffices for the present task of comparing the micro-psi data with the mathematical consequences of hypotheses 1 and 2, which are now described: since, according to hypothesis 1, both protons and neutrons contain nine UPAs, the number of UPAs predicted by hypothesis 2 to be in an MPA formed from nuclei of two nuclides of an element with mass numbers A_1 and A_2 is

$$N(A_1, A_2) = 9A_1 + 9A_2 = 9(A_1 + A_2).$$

If the nuclides are identical and have a mass number A, the number of UPAs predicted by hypothesis 2 to be in its MPA is

$$N(A) = 18A.$$

The number weight is therefore predicted to be

$$N(A)/18 = A.$$

As most elements have stable nuclides with mass numbers within one or two units range of their atomic weights, *this would explain why Besant & Leadbeater found their calculated number weight for each element to be approximately equal to its atomic weight.* Although comparison of number weights with atomic weights was incorrect, theoretically speaking, it was accurate in practice as a means of identifying which element corresponded to a given MPA. As many as thirty-nine of the total sample of 111 MPAs have UPA populations which are exactly eighteen times the mass numbers of (usually) the most abundant nuclide of their corresponding element. Except for hydrogen, none of the atomic weights listed in table 3.1, which the investigators referred to when they compared number weights with these values, is an integer, let alone one that is an integer multiple of 18. This means that these scientifically determined numbers gave them no reason to make populations multiples of 18. Yet such multiples occur in a significant fraction (about one-third) of the MPAs. Let us suppose that, intent on fabricating their data, they had decided for some reason that the hydrogen MPA should have eighteen UPAs and that - in order to procure the best agreement between atomic weights and their concocted number weights - they had fabricated population sizes by choosing integers nearest to the fractional value of the product of 18 and the relevant atomic weight. It is extremely improbable that such a large proportion of populations would have turned out by chance to be exact multiples of 18. Indeed, we saw in section 3.1 that choosing 18 as the constant of proportionality in a supposed, concocted relationship of proportionality between population sizes N and atomic weights X gives a very poor fit to the data accumulated by 1908, there being less than one chance in ten thousand that the data could have been fabricated in this way.

One may suppose that, as well-educated Victorians, Besant & Leadbeater knew of Prout's hypothesis that atoms are made up of hydrogen atoms. This idea was formulated at the beginning of the last century and (by then) had been long discredited by the discovery of elements like chlorine with fractional atomic weights. But, even if they had devised populations that were often multiples of 18 in order to provide support for what they may not have known was a defunct scientific idea, it would have been far easier, as well as more consistent with this picture of atoms, to fabricate MPAs made up of pairs of hydrogen triangles - hydrogen MPAs - than to invent dozens of types of groups of UPAs in such numbers as to make the total UPA population as near as possible an exact multiple of 18. Why, if intent on making up psychic observations that agree with science, should the two Theosophists have made up data which supported an idea which any contemporary chemistry textbook would have told them was no longer believed by chemists? Whether or not they knew Prout's hypothesis to be wrong, their depiction of MPAs consisting of *numerous* types of particles (never, apart from helium, hydrogen MPAs and rarely hydrogen triangles) is inconsistent with the suggestion that they may have been influenced by it. Indeed, the very absence of hydrogen MPAs in the MPAs of nearly every other element and the presence, instead, of many types of particles other than the three-quark bound states of protons and neutrons provide irrefutable evidence that MPAs are NOT even atomic nuclei, let alone fabricated representations of atoms.

The difference

$$e = N - N(A)$$

between the population N determined by Besant, Leadbeater and their colleague Jinarajadasa and the predicted number N(A) of UPAs must represent either the gross error made up of one or more random errors of observation or - as more often turns out to be the case - the net error due to undercounting of UPAs in some components of MPAs and to overcounting in others. Even after they became familiar with the concept of isotopes, the investigators could not be certain in the case of every MPA which isotope of an element it was whose atoms they believed they had seen paranormally. This had to be deduced or guessed. As most elements have more than one isotope, a choice has therefore to be made of the isotope they most likely examined. To avoid creating the false impression that the nuclide assumed to form a given MPA has been chosen merely to minimise the predicted error e so as to make agreement between theory and observation as impressive as possible, three criteria for selecting the most probable nuclide will be followed:

1. **Abundance**. The nuclide of an element with the greatest terrestrial abundance is normally chosen because its atoms are the most likely to be examined, assuming selection of atoms by the micro-psi observer is a random process. If this choice conflicts with criteria 2 or 3 stated below, the next most abundant nuclide satisfying all the criteria is chosen;
2. **Stability**. Unless the element is naturally radioactive, the nuclide must be stable. All choices refer to the ground state of the nuclide;
3. **Plausibility of error**. The absolute magnitude of e implied by a given choice of nuclide must be compatible with the geometrical symmetry of the MPA. This is because Besant & Leadbeater did not count every UPA in an MPA - often there were just too many - but, instead, calculated this number, firstly, by counting the number in a component of the MPA, such as a funnel, using the numbers of UPAs in individual groups established during analyses of other MPAs, and, secondly, by multiplying this number by the number of identical components, repeating this calculation for the remaining structural components of the MPA. They applied a similar procedure to MPAs with spikes, arms, or bars as structural components. They regarded this expedient as reliable because, as the result of many observations, they had noticed that all structural components in a given MPA had identical sets of particles (with the exception of a few elements, which they

treated differently). But this procedure magnifies any error of counting made during the examination of an individual component, so that the total error predicted for all the components must contain the value of this individual error as a factor. The net error for the whole MPA may be compounded from magnified errors associated with its various sets of identical components, so that its value must be compatible with the numbers of these components. If the net error be implied by a particular choice of nuclide is incompatible with the symmetry of the MPA, which determines these numbers, this nuclide must be rejected as an unrealistic choice even if it is the most abundant nuclide of the element in question. For example, a nuclide is not a plausible candidate if it predicts an error e = 3 for an MPA consisting of four identical parts because only one part would have been examined, so that any miscounting of UPAs in this one would lead to a net error that was a multiple of 4. In a number of cases criterion 3 is found to conflict with criterion 1, necessitating a realistic selection of a less abundant nuclide.

Table 3.2

Element	Nuclide	N	N(A)	Error e
Hydrogen	^{1}H	18	18	0
Deuterium (Adyarium)	^{2}H	36	36	0
Occultum	^{3}He	54	54	0
Helium	^{4}He	72	72	0
Lithium	^{7}Li	127	126	+1
Beryllium	^{9}Be	164	162	+2
Boron	^{11}B	200	198	+2
Carbon	^{12}C	216	216	0
Oxygen	^{16}O	290	288	+2
	^{17}O	310	306	+4
Fluorine	^{19}F	340	342	−2
Neon	^{20}Ne	360	360	0
Neon (meta)*	^{22}Ne	402	396	+6
Sodium	^{23}Na	418	414	+4
Magnesium	^{24}Mg	432	432	0
Aluminium	^{27}Al	486	486	0
Silicon	^{28}Si	520	504	+16
Phosphorus	^{31}P	558	558	0

Contd...

Contd...

Sulphur	^{32}S	576	576	0
Chlorine	^{35}Cl	639	630	+9
	^{37}Cl	667	666	+1
Argon	^{40}Ar	714	720	–6
Potassium	^{39}K	701	702	–1
Calcium	^{40}Ca	720	720	0
Scandium	^{45}Sc	792	810	–18
Titanium	^{48}Ti	864	864	0
Vanadium	^{51}V	918	918	0
Chromium	^{52}Cr	936	936	0
Manganese	^{55}Mn	992	990	+2
Iron	^{56}Fe	1,008	1,008	0
Cobalt	^{59}Co	1,036	1,062	–26
Nickel	^{60}Ni	1,064	1,080	–16
Copper	^{63}Cu	1,139	1,134	+5
Germanium	^{72}Ge	1,300	1,296	+4
Arsenic	^{75}As	1,350	1,350	0
Bromine	^{79}Br	1,439	1,422	+17
Krypton	^{82}Kr	1,464	1,476	–12
Krypton (meta)	^{84}Kr	1,506	1,512	–6
Rubidium	^{85}Rb	1,530	1,530	0
Strontium	^{89}Sr	1,568	1,584	–16
Yttrium	^{89}Y	1,606	1,602	+4
Zirconium	^{90}Zr	1,624	1,620	+4
Niobium	^{93}Nb	1,719	1,674	+45
Molybdenum	^{97}Mo	1,746	1,746	0
Technetium	^{99}Tc	1,802	1,782	+20
Ruthenium	^{102}Ru	1,848	1,836	+12
Rhodium	^{103}Rh	1,876	1,854	+22

Contd...

Contd...

Palladium	^{106}Pd	1,904	1,908	–4
Cadmium	^{112}Cd	2,016	2,016	0
Tin	^{118}Sn	2,124	2,124	0
Antimony	^{121}Sb	2,169	2,178	–9
Iodine	^{127}I	2,287	2,286	+1
Xenon	^{129}Xe	2,298	2,322	–24
Xenon (meta)	^{130}Xe	2,340	2,340	0
Calsium	^{133}Cs	2,376	2,394	–18
Barium	^{136}Ba	2,455	2,448	+7
Lanthanum	^{139}La	2,482	2,502	–20
Cerium	^{140}Ce	2,511	2,520	–9
Prasedymium	^{141}Pr	2,527	2,538	–11
Neodymium	^{143}Nd	2,575	2,574	+1
Promethium	^{147}Pm	2,640	2,646	–6
Promethium (meta)	^{151}Pm	2,736	2,718	+18
Samarium	^{154}Sm	2,794	2,772	+22
Europium	^{158}Eu	2,843	2,754	+89
Gadolinium	^{160}Gd	2,880	2,880	0
Terbium	^{159}Tb	2,916	2,862	+54
Dysprosium	^{164}Dy	2,979	2,952	+27
Holmium	^{165}Ho	3,004	2,970	+34
Erbium	^{168}Er	3,029	3,024	+5
Thulium	^{169}Tm	3,096	3,042	+54
Ytterbium	^{174}Yb	3,131	3,132	–1
Lutecium	^{175}Lu	3,171	3,150	+21
Hafnium	^{178}Hf	3,211	3,204	+7
Tantalum	^{181}Ta	3,279	3,258	+21
Tungsten	^{183}W	3,299	3,294	+5
Rhenium	^{187}Re	3,368	3,366	+2

Contd...

Contd...

Iridium	^{193}Ir	3,458	3,474	–16
Platinum (A)	^{194}Pt	3,486	3,492	–6
Platinum (B)	^{196}Pt	3,514	3,528	–14
Gold	^{197}Au	3,546	3,546	0
Mercury (A)	^{199}Hg	3,576	3,582	–6
Mercury (B)	^{200}Hg	3,600	3,600	0
Thallium	^{205}Tl	3,678	3,690	–12
Lead	^{207}Pb	3,727	3,726	+1
Bismuth	^{209}Bi	3,753	3,762	–9
Polonium	^{210}Po	3,789	3,780	+9
Astatine (85)	^{219}At	3,978	3,942	+36
Emanation	^{222}Em	3,990	3,996	–6
Emanation (meta)	^{220}Em	4,032	3,960	+72
Francium (87)	^{223}Fr	4,006	4,014	–8
Radium	^{226}Ra	4,087	4,068	+19
Actinium	^{228}Ac	4,140	4,104	+36
Thorium	^{232}Th	4,187	4,176	+11
Protactinium	^{234}Pa	4,227	4,212	+15
Uranium	^{238}U	4,267	4,284	–17

* 'meta' denotes isotopic variation.

For most MPAs. these criteria eliminate ambiguity of choice for the most likely nuclide corresponding to an MPA. Uncertainty remains only for a very few elements (such as tellurium) that possess many stable isotopes, none of which has an MPA with the same number of predicted subquarks as the determined number of UPAs. As more than one isotope may satisfy all three criteria for these elements, there is no unique choice for the most probable nuclide correponding to the MPA. Fortunately, such ambiguous elements are very few.

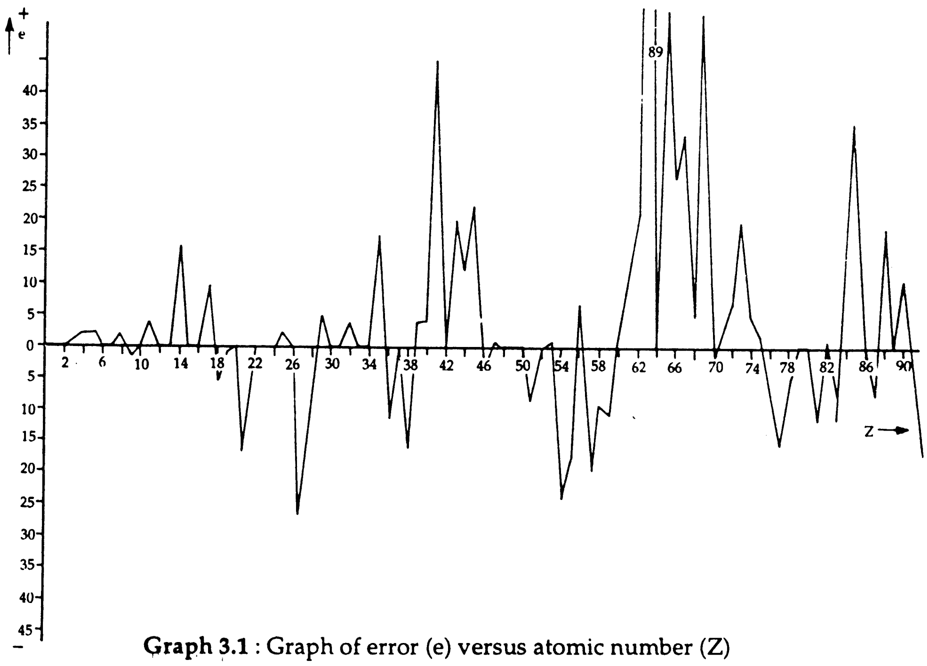
Table 3.2 lists the 95 MPAs whose subquark populations are predicted by hypotheses 1 and 2 to be that of two *similar* atomic nuclei of their corresponding elements. For a few other elements, a zero net error e is found for a radioactive isotope whose mass number is exactly halfway between the mass numbers of two stable isotopes. For example, exact agreement between predicted and counted UPA populations is found for the radioactive isctope ^{65}Zn of zinc, whose mass number is mid-way between those of the common, stable isotopes ^{64}Zn and ^{66}Zn. As suggested in ESPQ,[11] such cases arise when the MPA was formed from two *different,* stable isotopes of the element with mass numbers A_1 and A_2 that have an arithmetic mean that *happens* to coincide with the mass number of one of its radioactive isotopes, that is,

$$N(A_1, A_2) = 9(A_1 + A_2) = 18A_3,$$

where A_3, the arithmetic mean of A_1 and A_2, is the mass number of a radioactive isotope. Other examples are gallium, selenium, and indium, which are listed in table 3.3, together with the MPAs of nitrogen, proto- and meta-argon, silver, tellurium, and osmium. Apart from nitrogen, these elements do not have a single nuclide satisfying the three criteria and therefore must have been formed from two different nuclides. (The reason for considering nitrogen as one of these special cases will be discussed when it is analysed in chapter 5).

Table 3.3 : MPAs formed from two different nuclides

Element	Nuclides	N	$N(A_1, A_2)$	e
Nitrogen	$^{14}N + ^{15}N$	261	261	0
Proto-argon	$^{36}Ar + ^{40}Ar$	672	684	-12
Meta-argon	$^{38}Ar + ^{40}Ar$	756	702	+54
Zinc	$^{64}Zn + ^{66}Zn$	1,170	1,170	0
Gallium	$^{69}Ga + ^{71}Ga$	1,260	1,260	0
Selenium	$^{78}Se + ^{80}Se$	1,422	1,422	0
Silver	$^{107}Ag + ^{109}Ag$	1,945	1,944	+1
Indium	$^{113}In + ^{115}In$	2,052	2,052	0
Tellurium	$^{125}Te + ^{130}Te$	2,223	2,295	-72
Osmium	$^{190}Os + ^{192}Os$	3,430	3,438	-8



Graph 3.1 : Graph of error (e) versus atomic number (Z)

It can be seen from the error column in tables 3.2 and 3.3 that the level of agreement between predicted and counted UPA populations is excellent, discrepancies being usually less than one per cent. The few cases with relatively large errors, e.g. europium and terbium, are readily explainable and are not as serious for hypotheses 1 and 2 as they appear at first sight. For example, the MPA of europium, which has an error of +89, belongs to the tetrahedron group, and each of its four funnels contains a group of twelve identical bodies and two groups each of nine similar bodies. A mere overcounting of the UPAs inside one of these bodies by 1 or 2 would lead to a total error of +48 or +96 for the first type of body and an error of +36 or +72 for the second type because Besant & Leadbeater did not bother to examine the bodies in every funnel of an MPA, so that any error made in counting UPAs in one funnel would apply to them all. Similarly, the terbium MPA, which has a predicted error of +54, belongs to the octahedron group, and each of its eight funnels is made up partly of a group of four identical bodies. If one of these were overcounted by merely 1 or 2, the total error would be +32 or +64. It is clear that the errors shown in tables 3.2 and 3.3 represent the accumulated, net error, not the errors of counting actually made by Besant & Leadbeater during their examination of MPAs. The latter individual errors were magnified by their counting procedure, namely, that of multiplying the number of UPAs within a group inside a funnel by the number of funnels in the MPA (and similarly for groups inside spikes, bars, etc.). Analysis of MPAs in chapter 5 confirms that actual observational errors are generally much smaller than the largest numbers in the error column.

Graph 3.1 shows the predicted errors

$$e = N - N(A) = N - 18A$$

in the UPA populations plotted against the atomic numbers of the elements. The most important feature to notice is the random scatter of points about the zero-error axis. The error changes sign randomly from one element to the next, the scatter of points being biased neither towards positive nor towards negative values. This is what would be expected if these errors were due to mistakes of counting UPAs randomly made by the two investigators, although Leadbeater was mostly responsible for this task. As most MPAs contain several thousand UPAs, it was inevitable that some miscounting took place. Some MPAs may have predicted errors even though no mistakes may have been actually made when their particles were examined! The reason for this is that, by observing in detail not every structural component of an MPA but only one representative component, the investigators introduced a source of systematic error into their work whereby any mistakes in counting the UPAs in generic particles would be automatically repeated for any MPA they examined afterwards containing similar particles, the original mistake going unnoticed because it was their habit not to re-examine particles already familiar to them. In this way the same mistakes would have been perpetuated in the determination of UPA populations for *all* elements subsequently found to have these misobserved particles. Analysis of MPAs in chapter 5 will reveal examples of this systematic repetition of errors in MPAs containing particles in common which, when corrected for by taking into account their predicted miscounting in other MPAs, yields populations which are in exact agreement with prediction.

By not examining generic particles whenever they examined a new type of MPA, Besant & Leadbeater introduced another source of systematic error that plausibly accounts for the minor discrepancies between predicted and determined UPA populations. They noticed that some generic particles appearing in MPAs of many elements sometimes differed slightly from what they had observed on previous occasions, but they did not systematically check the number of UPAs in every generic particle in newly observed MPAs: 'In the heavier elements, such as gold, with 3,546 Anu, it would have been impossible to count each Anu without quite unnecessary waste of time, when making a preliminary investigation. Later, it may be worth while to count each division separately, as in some we noticed that two groups, at first sight alike, differed by 1 or 2 Anu.'[12] Analysis of MPAs in chapter 5 will uncover many examples of such unnoticed variations. They may be forgiven for bringing unwittingly these two forms of systematic error into their investigations, in view of the herculean task they would have faced in counting every one of the possibly thousands of UPAs in an MPA. Despite this, it is remarkable that predicted errors of counting UPAs in *individual* particles are as small as theory predicts and as infrequent as analysis indicates. It is a testament to the accuracy of Leadbeater's ability to describe the complex arrangement of particles in MPAs.

A fundamental deficiency in this theory would have appeared in graph 3.1 as a systematic variation in plotted errors with increasing atomic number, with no even dispersion of points about the zero-error axis. Instead, the variation is random. The absolute magnitude of the net error increases slightly with increasing atomic number. This feature is consistent with miscounting becoming more probable the more UPAs that had to be counted and with elements of higher atomic weight having more generic particles that may have been misobserved.

Graph 3.2 shows that the population data of the 95 MPAs listed in table 3.2 (the largest sample for which hypothesis 2 is applicable) is best fitted by the straight line

$$N = (0.48 \pm 3.99) + (18.03 \pm 0.03)A,$$

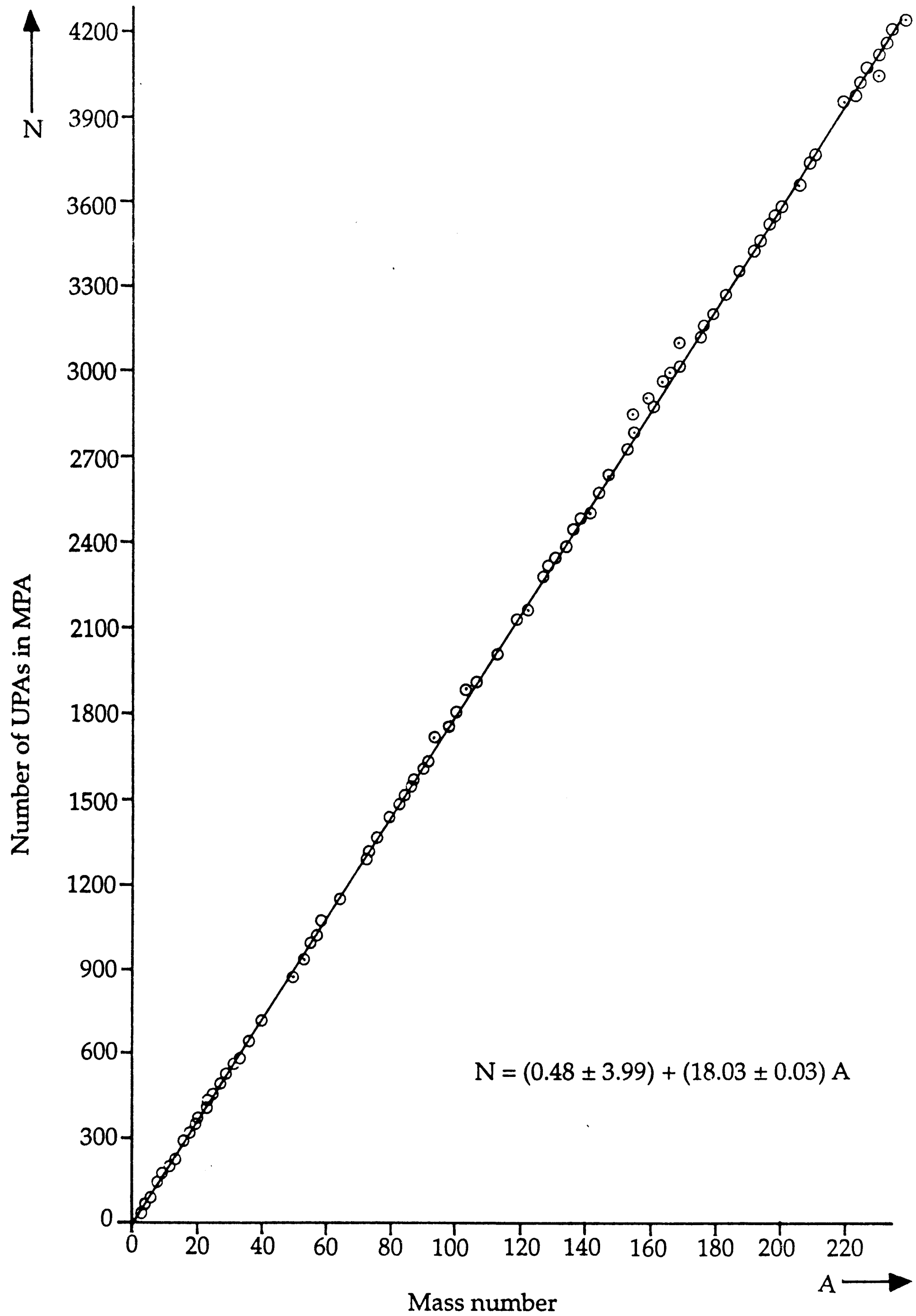
which confirms the theoretical prediction $N = 18A$ at the 5% confidence level. The fact that the most probable nuclides forming each MPA in this test sample were chosen by three objective criteria refutes any suggestion that the selection was self-servingly carried out in order to make the fit of the data to the theory as good as possible. It is of course true that the identity of the nuclide corresponding to a given MPA is not known but has to be inferred *a posteriori* by using three rules. But many elements have stable nuclides with mass numbers within a few units of one another, and for those with mass numbers over 100, the selection of a different nuclide would have shifted the predicted UPA population (and hence the ordinate in graph 3.2) by only one or two per cent, negligibly altering the linearity of the distribution of data points in graph 3.2.

The identification of MPAs of elements with only one isotope with 100% terrestrial abundance is free of ambiguity because it is absolutely certain that Besant & Leadbeater would have examined only the single, naturally occurring isotope of these elements. The twenty-three nuclides with 100% abundance:

^{9}Be, ^{19}F, ^{23}Na, ^{27}Al, ^{31}P, ^{45}Sc, ^{55}Mn, ^{59}Co, ^{75}As, ^{89}Y, ^{93}Nb, ^{103}Rh, ^{127}I, ^{133}Cs, ^{141}Pr, ^{159}Tb, ^{165}Ho, ^{169}Tm, ^{197}Au, ^{209}Bi, ^{232}Th, ^{231}Pa, and ^{238}U

provide the best fit:

$$N = (18.042 \pm 0.044)A,$$



Graph 3.2 : MPA population (N) versus mass number (A).

the proportionality constant differing from the theoretical value 18 by less than one standard deviation. MPAs of elements with only one stable isotope therefore give strong support to hypotheses 1 and 2.

3.5 Elements X, Y, Z, and kalon

It was stated in section 3.2 that, as a result of their examination of the three triads of transition elements:

iron	cobalt	nickel
ruthenium	rhodium	palladium
osmium	iridium	platinum

belonging to Group VIII of the periodic table, Besant & Leadbeater reported in 1907 their observation of three MPAs similar to those of the elements above, which they placed in the bars group. Not being able to associate them with any element then known, they labelled the MPAs 'X,' 'Y,' and 'Z,' believing that they had seen atoms of new elements not at that time discovered by science. Their belief was strengthened by their discovery that, when the MPAs of the known elements were arranged according to their shapes, they fell into groups that were arranged in the same way that elements were classified in the periodic table proposed by Sir William Crookes, the famous chemist and inventor of the cathode-ray tube. X, Y, and Z also fitted this scheme of classification, and Besant, Leadbeater and their colleague Jinarajadasa even formulated a version of Crookes' table[13] that provided natural positions for these 'missing elements.' But Crookes' table is incorrect, and atomic theory does not allow the existence of a group of three transition elements missing from the modern periodic table. There can be no element that corresponds to any of these MPAs. This, of course, provides an irrefutable argument against the interpretation of an MPA as an atom or atomic nucleus. So what can X, Y, and Z be? By comparing their UPA populations N listed in table 3.4 with those listed in table 3.2 of the MPAs of the three triads of transition elements given above, it can be seen that the differences are too large for X, Y, and Z to be merely isotopic variations of these elements. Since they cannot be formed from two nuclei of the *same* element, the only other possibility is that they were formed from nuclei of two *different* nuclei. It was proposed in ESPQ[14] that X, Y, and Z are 'hybrid MPAs' that happened to be formed from nuclei of two *different* triad elements at the time when Besant & Leadbeater examined chemical compounds containing the latter.

The following evidence supports such an interpretation: it can be seen from tables 3.2 and 3.4 that the UPA populations of the MPAs of X, Y, and Z are almost exactly the arithmetic mean of those of the MPAs, respectively, of ruthenium and osmium, rhodium and iridium, and palladium and platinum - just what one would expect if they had been formed from nuclei of each pair of elements. The MPA of X has 2,646 UPAs, which is precisely the number it would have if it had been formed from nuclei of the isotopes ^{102}Ru and ^{192}Os of, respectively, ruthenium and osmium - transition elements whose compounds might have been simultaneously present in impure samples examined by the two investigators. Good agreement is also found for Y, Z, and the isotopic variation of Z (see table 3.4).

Table 3.4 : Hybrid MPAs

MPA	Nuclides	N	$N(A_1, A_2)$	e
X	$^{102}Ru + ^{192}Os$	2,646	2,646	0
Y	$^{103}Rh + ^{191}Ir$	2,674	2,664	+10
Z	$^{108}Pd + ^{194}Pt$	2,702	2,718	−16
Z isotope	$^{106}Pd + ^{194}Pt$	2,716	2,700	+16
Kalon	$^{124}Xe + ^{222}Em$	3,054	3,114	−60
Meta-kalon	$^{124}Xe + ^{220}Em$	3,096	3,096	0

What about the scientifically impossible inert gas kalon, mentioned in section 3.2? Its UPA population of 3,054 places it between xenon and emanation in terms of its number weight, which is, effectively, its mass number. This population number is almost exactly the arithmetic mean of the populations of the xenon and emanation MPAs (2,298 and 3,990, respectively), implying an effective mass number of about 169 or 170. But the kalon MPA cannot have been formed from two nuclei of either element because neither has isotopes with such mass numbers. As proposed in ESPQ,[15] the kalon MPA is another hybrid, formed from nuclei of xenon and emanation during an investigation by Besant & Leadbeater in 1907 of the inert gases. The very low availability of these gases in the earth's atmosphere would explain the reported rarity of the kalon MPA, which was possibly formed from an ^{124}Xe nucleus and an ^{222}Em nucleus. Meta-kalon, an isotopic variation of the kalon MPA with 3,096 UPAs, was probably formed from an ^{124}Xe nucleus and an ^{220}Em (thoron) nucleus. The predicted discrepancy between theory and observation for kalon is -60; for meta-kalon it is 0. The former is an integer multiple of 6 and is therefore consistent with the fact that the investigators determined the populations of the MPAs in the star group by examining only one arm of the star-shaped MPA (as well as its central core), so that any mistake made in studying particles in this arm would have been amplified by a factor of 6, creating a net error for the whole MPA that is a multiple of 6.

In conclusion, the serious conflicts with chemistry, atomic and nuclear physics entailed by Besant's and Leadbeater's assumption that their micro-psi vision revealed atoms means that this view must be abandoned. Comparison of the hydrogen MPA with the quark structure of protons and neutrons and with a subquark generalization of the quark model leads to an identification of UPAs as subquark states of up and down quarks and to a reinterpretation of the MPA as a quasi-nuclear system of quark and subquark matter formed by the fusion of two atomic nuclei - a process induced (perhaps automatically) by the intervention of the micro-psi observer. A statistically significant level of agreement was found between the UPA populations of 95 MPAs and their predicted values. A generalization of the hypothesis of MPA formation from two nuclei of the same element led to a natural explanation of several MPAs without corresponding elements as hybrid MPAs formed from nuclei of two different elements.

The MPAs of forty-eight elements will be analysed in chapter 5 on the basis of hypotheses 1 and 2. This discussion provides the main body of evidence supporting the claim of the two Theosophists to have described subatomic particles with ESP.

References

1. According to the third edition of *Occult Chemistry* (pp. 3, 30), Jinarajadasa did these calculations during investigations of MPAs.
2. The fact that modern values of atomic weights are based upon the ^{12}C nucleus as the unit of atomic mass and not upon the hydrogen atom - as it was during the period of the micro-psi investigations - does not alter the significance of this numerical correlation which, being only approximate, is hardly affected by this change of scale of mass.
3. *Occult Chemistry*, 2nd ed., p. 19.
4. *Extra-Sensory Perception of Quarks*, p. 229.
5. Ibid., p. 223.
6. Ibid., p. 232.
7. *Occult Chemistry*, 3rd ed., p. 249.
8. Ibid., p.30.
9. Ibid., p. 3.
10. Ibid, p.38.
11. *Extra-Sensory Perception of Quarks*, p. 50.
12. Ibid., p. 30.
13. Ibid., p. 33, fig. 12.
14. *Extra-Sensory Perception of Quarks*, p. 64.
15. Ibid. pp. 64, 65.

CHAPTER 4

MICRO-PSI CONFIRMATION OF STRING & SUPERSTRING THEORIES

4.1 The string model

According to *Occult Chemistry*,[1] each time Besant & Leadbeater investigated the structure of an MPA, Besant performed the tasks, firstly, of studying the configuration of what they called 'lines of force' linking UPAs together in small groups and, secondly, of breaking up each type of group into smaller components, noting at each stage the new configurations assumed by these lines, until only pairs (so-called 'duads') or triplets of bound UPAs remained. This systematic dismantling of an MPA and the disintegration of its particles enabled her to label the components of complex bound states of UPAs as either positive or negative by using the diagrammatic convention described in section 3.3 to depict this distinction. We saw there that this information embodied in disintegration diagrams proved useful in correlating the positive and negative hydrogen triplets in the hydrogen MPA with, respectively, positively charged up quarks and negatively charged down quarks. Its vital importance to testing the theory that MPAs are formed from two atomic nuclei will become clear in the analysis of MPAs in chapter 5. But Besant's depiction in disintegration diagrams of the lines of force joining duads and triplets of UPAs also provides striking evidence of the objective nature of the two Theosophists' micro-psi vision, as will now be explained.

We saw in chapter 2 that, according to the string model of strongly interacting subatomic particles, mesons are, as bound states of a quark and an antiquark, strings or colour flux tubes of finite length, one end of the string being a quark monopole 'source' of the colour flux and the other end being an antiquark antimonopole 'sink,' into which the flux flows. A cloud of 'virtual'[2] gluons surrounds a meson, extending a distance $\Lambda \sim h/m_v c$, where m_v is the mass of the gluon. Let us now compare the string model picture of the meson with three diagrams (fig. 4.1) depicting duads of UPAs that appear[3] in the first edition of *Occult Chemistry*. Of these and other groups of bound UPAs, it was said: 'The molecules* show all kinds of possible combinations; the combinations spin, turn head over heels, and gyrate in endless ways. Each aggregation is surrounded with an apparent cell-wall, the circle** or oval, due to the pressure on the surrounding matter caused by its whirling motion; they strike on each other† and rebound, dart hither and thither, for reasons we have not distinguished.[4] There are three similar features: firstly, the egg-shaped 'wall' enclosing the duad of UPAs is similar to the envelope of colour flux lines joining the quark and antiquark in figure 4.1a; secondly, the single 'line of force' linking the two UPAs is similar to the colour flux tube or

* By 'molecules' is meant the groups of UPAs bound by lines of force.

** Circles enclosing other groups of UPAs denote spherical cell-walls.

† Added here is the foot-note: 'That is, the surrounding magnetic fields strike on each other.'

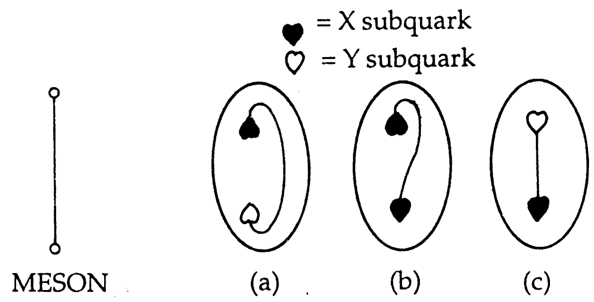


Figure 4.1

string bonding the quark and antiquark in a meson; thirdly, the line of force has a UPA at each end, just as a string has a quark and an antiquark at its ends. These identical features constitute evidence that micro-psi confirms the string model and indicate that UPAs are bound by strings through the Meissner Effect, i.e. the confinement mechanism holding subquarks together is exactly the same as that binding quarks according to the string model. The 'surrounding magnetic fields' quoted in the last footnote are simply the hypercolour gauge fields emanating from the hypercoloured subquarks and squeezed by the surrounding, superconducting Higgs field into tubes of hypercolour flux that penetrates some distance into the surrounding Higgs field. Figure 4.2 shows examples of duads of UPAs bound by two or more lines of force. Positive pairs of UPAs pointing away from the centre of the ovoid are X-X disubquarks, negative pairs pointing inwards are Y-Y disubquarks, and pairs that point in opposite directions are X-Y disubquarks (for more details, see ESPQ, pp. 75-76).

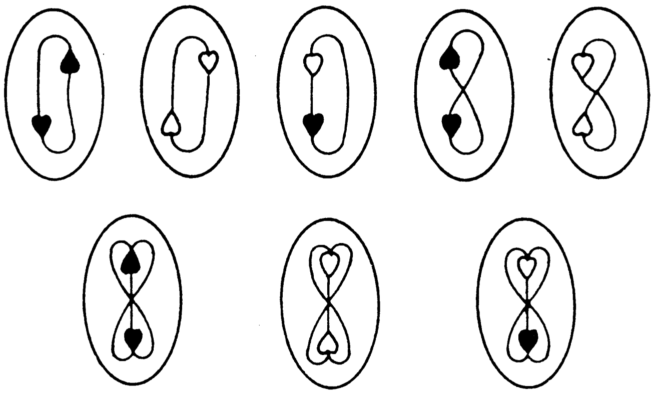


Figure 4.2 : Examples of duads of UPAs bound by two or three lines of force.

The reader may, however, be puzzled, firstly, by how a model of quark confinement can apply to subquarks, secondly, by the fact that two UPAs can exist as the ends of a single string and yet one is not the *antimatter* counterpart of any of the possible subquark states of the other (as is the case for the string model of mesons) and, thirdly, how duads could even exist, given that quantum chromodynamics allows only bound states of either three quarks or a quark and antiquark. As discussed in ESPQ,[5] the string model is applicable in principle to hypercolour generalizations of quantum chromodynamics and thus to hypercoloured subquarks as well as to coloured quarks. The string model requires one end of a finite string to be in the antihypercolour state of the other end so that the bound state is hypercolourless, not that it should be the complete antimatter version of the other end. In principle some of the hypercolour states of a subquark can be the antimatter counterparts of other hypercolour states. But we do not believe this is the reason why duads of UPAs were observed. The true reason is too technical to present here and the reader is referred to the explanation given on page 75 of ESPQ.

In both (+) and (-) UPAs it was noticed that: 'Force pours into the heart-shaped depression at the top of the Anu, and issues from the point, and is changed in character by its passage'[6] (fig. 4.3). The two types of UPAs were said to be 'alike in everything save the direction of their whorls and of the force which pours through them. In the one case force pours in from the 'outside,' from fourth-dimensional space, the Astral plane,* and passing through the Anu, pours into the physical world. In the second, it pours in from the physical world, and out through the Anu into the 'outside' again, i.e. vanishes from the physical world. The one is like a spring, from which water bubbles out; the other is like a hole, into which water disappears.'[7] In the modern terminology of fluid mechanics and particle physics, positive and negative UPAs are, respectively, 'sources' and 'sinks' of hypercolour gauge forces, i.e., respectively, positive and negative magnetic monopoles. The lines of force are vortices in the ambient, superconducting Higgs superfluid, which squeezes the flux emanating from the UPA/monopole into bundles of quantized flux, which is confined mostly along the cores of these vortices. As will be seen shortly, the UPAs making up a proton or neutron are, as subquarks, bound by strings both inside a constituent quark and externally to subquarks in the two other quarks. This means that they are monopole sources and sinks of two different types of hypercolour gauge fields, one responsible for confinement of subquarks in quarks, the other responsible for confinement of quarks in baryons like protons and neutrons. The reported 'change in character' of the force binding UPAs together as it enters and leaves a UPA may be due to these two different hypercolour gauge fields. It may also in part be due to the difference in hypercolour flux densities inside two or more flux tubes terminating on the monopole, these tubes carrying *different* quanta of hypercolour flux because the monopole acts as a source or sink of flux (see ESPQ, p. 74).

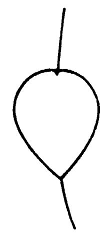


Figure 4.3 : One or more lines of force enter the depressed end of the UPA and leave from its pointed end.

Besant & Leadbeater said that each type of UPA was 'surrounded by a field.'[8] According to the string model, a monopole is the end-point of a vortical excitation of the Higgs field, the vortex consisting of circulating currents of Higgs bosons. This observation therefore probably refers to the Higgs field. According to quantum field theory, subatomic particles are surrounded by a field of virtual particles, which spontaneously materialize from the vacuum, briefly borrowing their energy from the vacuum and then annihilating one another and returning their energy to the vacuum. Although all these fields except the field of virtual

* Leadbeater thought that four-dimensional space (a popular notion promoted by writers such as Charles Hinton) could be identified with the Theosophists' 'astral plane.'

electron-positron pairs around an electrically charged particle are a short-range field of virtual particles, they are not the likely explanation for the field observed around a UPA because virtual particles exist only momentarily and cannot be observed directly, according to the uncertainty principle.

4.2 Internal string structure of quarks

We saw in section 2.3 that, as bound states of three quarks, baryons have been pictured by some string theorists as either Y-shaped or circular strings terminating on quark monopoles. Compare this with figure 4.4, showing the lines of force linking the constituent UPAs of *free* hydrogen triplets depicted in the disintegration diagrams of *Occult Chemistry*. Figure 4.4a[9] shows a positive hydrogen triplet surrounded by a spherical cell-wall, each UPA being the end-point of a Y-shaped configuration of three lines of force. Its resemblance to fig. 2.8b is evidence of how Besant's micro-psi observations confirm the basic ideas of the string model. This conclusion is supported by figure 4.4b,[10] which shows a hydrogen triplet with a circular configuration of lines of force: compare this with figure 2.8c. The string configurations of the other triplets observed in the free state were often recorded when the particles in MPAs were broken up, as the disintegration diagrams discussed in chapter 5 will illustrate. Most string

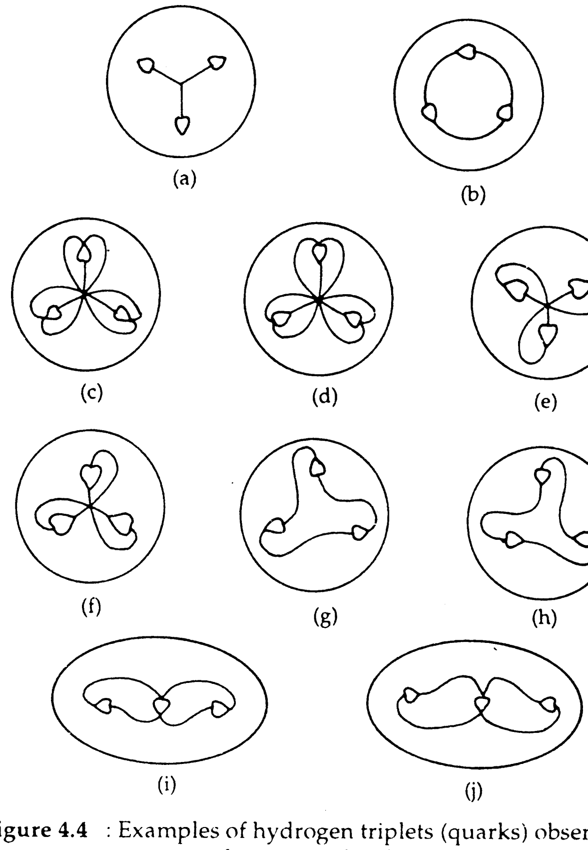


Figure 4.4 : Examples of hydrogen triplets (quarks) observed in the free (unconfined) state.

configurations of hydrogen triplets are depicted as either propeller-shaped (figs. 4.4e & 4.4f), that is, three UPAs linked by two Y-shaped strings, or variations of the circular variety (figs. 4.4g & 4.4h).

Figure 4.5 shows examples of bound states of UPAs where one or more UPAs are monopole end-points of *single* strings. Such string configurations do not appear often in the disintegration diagrams of the MPAs of the elements. Whilst these pictures are certainly unambiguous evidence for the string model, it raises the question of why UPAs at the ends of single strings were rarely observed compared with those emanating two or more strings - string configurations also allowed by the string model. This issue is too technical to be addressed here.

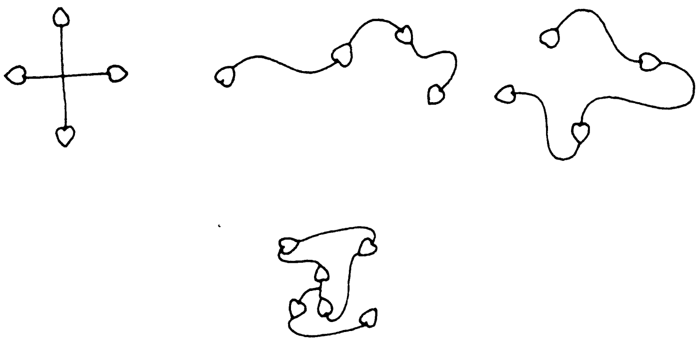


Figure 4.5 : Examples of configurations of lines of force terminating on UPAs.

The nature of the cell-walls enclosing bound states of UPAs was never satisfactorily investigated by Besant & Leadbeater. They remarked that a 'wall' is the pressed back 'space.' As said in 1895 of the chemical atom, the force 'clears itself a space, pressing back the undifferentiated matter of the plane, and making to itself a whirling wall of this matter'. The wall belongs to space, not to the atom.'[11] But Jinarajadasa added a note in the third edition of *Occult Chemistry,* stating that he found Besant's Theosophical phrase 'undifferentiated matter of the plane' problematic since it signified UPAs themselves, and the notion of UPAs being surrounded by an invisible sea of UPAs was self-evidently wrong. Referring to the spherical cell-wall enclosing MPAs, the investigators said: 'A sphere-wall is a temporary effect, caused by one or more Anu in rotation. Just as a stream of air under pressure will make a hole in the surface of water, by pushing back that water, so it is with the groups. As they revolve, the force of their motion drives back the circumambient medium.'[12] Jinarajadasa added: 'It was only later that a special investigation was made to examine the nature of the sphere-wall of the Anu. Though there was no final conclusion on the matter, it appeared to the investigators as if the sphere-wall was composed of forces radiating from the centre, which after travelling a certain distance, returned to the centre. The nature of this radiating force was not analyzed.'[13] It was explained in ESPQ that a cell-wall denotes the boundary between domains ('cells') containing different phases of the Higgs field, i.e the 'circumambient medium' referred to above is just the all-pervasive, Higgs superfluid. The shape of this phase boundary or wall is determined by the type of orbital in which the subquarks move. The Higgs field interacts strongly with the gluons and hypergluons transmitting the hypercolour force between subquarks. Because of this coupling, the Higgs field is disturbed by the orbital motion of subquarks. A bound state of three subquarks moving in what physicists call an 'S state' (one with zero orbital angular momentum) will be embedded as a triangular H3 hydrogen triplet in a spherical Higgs domain because the wave function of such a bound state is spherically symmetrical, that is, the probability of each subquark being at any point on the surface of a sphere is the same for all points on this sphere. Two subquarks bound to a third as nucleus may occupy either an S orbital or what physicists call a 'P orbital,' occupation of which generates one unit of orbital angular momentum. A linear H3' triplet of the former type will be surrounded by a spherical Higgs domain, examples being the two linear triplets of the hydrogen MPA shown in figure 3.1, the latter type will be surrounded by an ellipsoidal Higgs domain, observed examples of which are displayed in figure 4.4.

According to quantum chromodynamics, the strength of the colour force between quarks increases indefinitely with distance, permanently trapping quarks in baryons and mesons so that they never exist as free particles. Whilst the negative results of many experimental searches for free quarks seem to confirm this, it remains as yet an unproved, yet unquestioned, dogma of the theory. We shall discover in chapter 5 that many disintegration diagrams appear to indicate that hydrogen triplets in MPAs were not always bound by lines of force to other triplets, that is, they are - strictly speaking - free quarks, although still bound to other particles by non-string forces. Whilst this may not have been true in every case because Besant did not always indicate in her diagrams whether lines of force extended between groups of UPAs belonging to larger composite states, the fact that she depicted hydrogen triplets released from other particles very definitely on their own as free particles does indicate that under certain conditions quarks can become free. Physicists believe that, shortly after the big bang, which created all the matter in the universe, this matter existed briefly as a plasma of free quarks and gluons, the former then condensing into protons and neutrons as the universe expanded and cooled. This is because the strength of the colour force between quarks is strongly dependent on their energy - larger the energy, weaker the force. Does this therefore mean that, by the application of psychokinetic forces to individual subatomic particles, Besant managed what powerful atom-smashing machines may only now be starting to accomplish, namely, reproducing the extremely hot conditions of the early universe by causing the transition from nuclear matter made up of distinct three-quark bound states (nucleons) to a plasma of free quarks? There seems no alternative explanation of her disintegration diagrams.

This question is related to the problem of why so many particles composed of differing numbers of subquarks were observed in MPAs. According to quantum chromodynamics, only 'colourless' bound states of quarks and antiquarks exist, that is, quarks (q) exist in groups of three (q-q-q) or as quark-antiquark pairs (q-$\bar{q}$), although more exotic, colourless combinations, such as q-q-q-q-$\bar{q}$ are not ruled out. Under what physical conditions can some hypercolour degrees of freedom be suppressed, so that the effective number of hypercolour states of subquarks becomes variable, leading to different combinations of subquarks, all equally hypercolourless? This technical question will not be addressed here.

The fact that (as chapter 5 will prove) Besant could manipulate micro-psi images in a way that turns out to be remarkably consistent with their physical identification in terms of the X and Y subquarks making up the up and down quarks in two atomic nuclei further discredits the possibility that these images were nothing more than hallucinations causally unconnected to the atoms in the chemical samples that she examined. Our analysis of MPAs in chapter 5 will uncover such a degree of correlation between theory and observation that there can be no more plausible explanation than that a causal link between the micro-psi images and the subatomic world (albeit one radically disturbed by the act of micro-psi observation) did, indeed, exist.

4.3 String structure of nucleons

Figure 4.6 shows the hydrogen MPA (assigned to the 'gas' level) as observed in 1895, together with its successive products of disintegration at the E_4, E_3, E_2, and E_1 stages. Comparison with

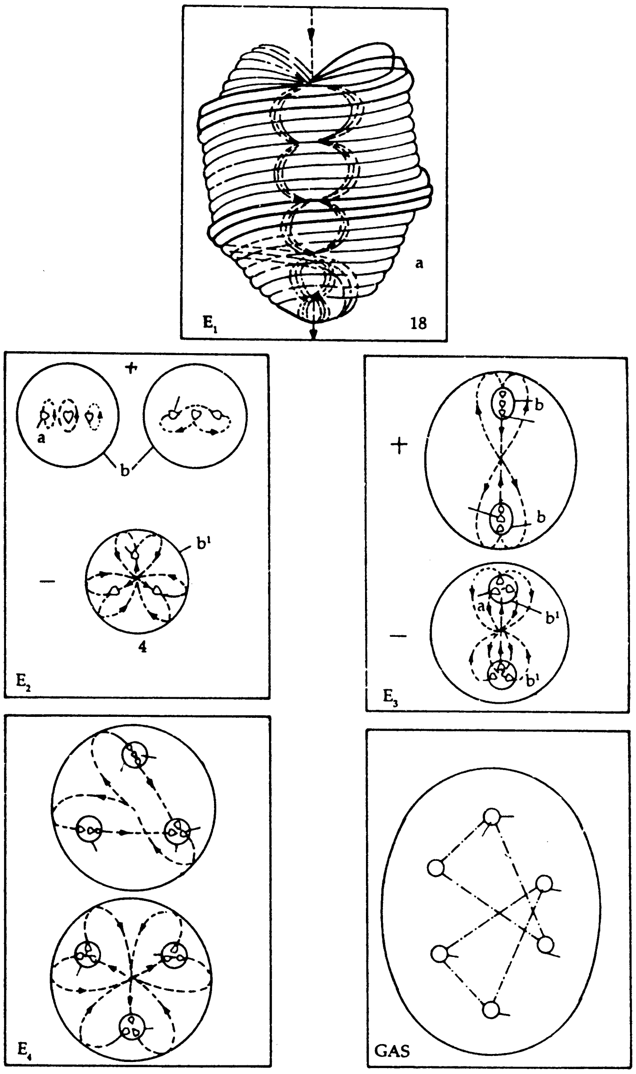


Figure 4.6 : The hydrogen MPA observed in 1895

figure 3.1, which portrays the hydrogen MPA observed by Leadbeater in 1932, reveals the following difference: in the earlier version, the two linear H3' triplets (marked 'b') belonged to different hydrogen triangles, whereas in the later version they were seen only in the upper hydrogen triangle. Leadbeater did not observe the earlier one when he re-examined hydrogen in 1932, and so he regarded it as a rare form of the hydrogen MPA. However, since MPAs are artefacts formed from pairs of atomic nuclei by the intervention of the micro-psi observer, according to the theory proposed in this book, the earlier version must be one which is rarely formed when micro-psi vision is focused on hydrogen atoms. This is probably because the two linear triplets originally belonged to the same nucleon, for this would make their staying together in the same hydrogen triangle during the formation of the MPA more likely than their separation to become parts of two different hydrogen triangles. (The very fact that two versions of the hydrogen MPA were recorded that differ in the distribution of two hydrogen triplets is itself evidence supporting the scenario proposed in ESPQ for formation[14] of MPAs from the quarks released from two atomic nuclei, because such a process of recombination of six quarks from the protons in the two original hydrogen atoms might well be expected to create more than one type of composite particle).

Comparing figures 3.1 and 4.6, it is evident that the linear H3' triplet at the bottom of the lower hydrogen triangle in figure 4.6 has exchanged places with the H3 triplet at the lowest corner of the upper hydrogen triangle. As both triplets were identified in section 3.3 as d quarks, this exchange is physically possible because it *does not alter the quark composition of each hydrogen triangle*, which means that, if the later version of the hydrogen MPA is a deuteron, then - as one would expect - so is the earlier version, i.e. the (+) set of three triplets in figure 4.6 released at the E_4 stage must be a neutron. Evidence that the two linear triplets did, indeed, belong to the *same* original nucleon is seen in the products of disintegration of the MPA at the E_4 stage: the (+) group of three triplets contains the two linear triplets. As figure 3.1 shows, the (+) and (-) hydrogen triangles are identical in their triplet compositions to those released at the E_4 stage from the later version of the hydrogen MPA. It was concluded in section 3.3 that the (-) hydrogen triangle is a proton because it comprises two (+) triplets (u quarks) and one (-) triplet (d quark). (In passing, it must be pointed out that the plus and minus signs assigned to the two hydrogen triangles has nothing to do with the 'positive' and 'negative' labels Besant & Leadbeater gave to bound states of UPAs, which analysis of MPAs in chapter 5 proves denote the sign of the electric charge of particles. These assignments were made on the basis of the net number of (+) or (-) UPAs in each hydrogen triangle, as the following statement indicates: '...it will be seen that the positive half or triangle is composed of 5 positive Anu and 4 negative, thus making it preponderatingly positive; and that the negative half or triangle is composed of 5 negative Anu and 4 positive, thus making it preponderatingly negative').[15]

The dotted lines in figure 4.6 denote the lines of force linking UPAs, the arrows indicating the direction of this force. In the (-) hydrogen triangle released at the E_4 stage, each UPA in a triplet is joined to the other two UPAs by a Y-shaped string, whilst nine strings terminating on UPAs join up at the centre of the hydrogen triangle. In the (+) hydrogen triangle (neutron), three strings joining at the centre of the bound state terminate on UPAs in three different triplets, whilst one UPA in each linear triplet is joined by a string to UPAs in the H3 triplet. The (-) pair of bound triplets released from the (-) hydrogen triangle at the E_3 stage is a u-u diquark because the two b' triplets are positive triplets, according to figure 3.1. The

(-) pair of bound triplets shown at the E_3 stage is a d-d diquark if the hydrogen MPA is a deuteron because the b triplets would then be d quarks. If - less plausibly - the MPA denotes a 'snapshot' picture of the unstable diproton, the (-) pair of triplets is a u-d diquark because the b triplet in the upper hydrogen triangle would then be a u quark. As pointed out in section 3.3, the b triplet shown on the left in figure 4.6 to be released at the E_2 stage is not a quark but one broken up by mistake into free subquarks (or at least subquarks no longer bound by hypercolour forces) - purely an artefact of observation. This is because, for each UPA in the b triplet, a line of force both leaves and enters the same, instead of another, UPA, which was always the way in which Besant denoted free UPAs in her disintegration diagrams (see chapter 5). Because of this unfortunate error, its depiction does not conform to the convention she followed for portraying positive and negative groups of UPAs and it must remain uncertain whether it is a u or d quark. Both the text of the first edition of *Occult Chemistry* and figure 4.6 indicate that the two linear triplets were regarded as positive and that all the triangular triplets were negative. However, this must be wrong, because on page 43 of this edition the four H3 triplets are shown as consisting of three positive triplets and one negative triplet because of the way their UPAs are depicted to point. The plus and minus signs shown in figure 4.6, which was published in 1895, are inconsistent with the sense of positivity and negativity followed throughout later investigations, this signifying the electric polarity of particles, as analysis of MPAs presented in chapter 5 will prove. This conclusion was implied by the earlier deduction that the (-) hydrogen triangle in the hydrogen MPA is the *positively* charged proton.

Another inconsistency exists between the disintegration diagrams of the hydrogen MPA published in the first and third editions. According to figure 3.1, the two linear triplets in the hydrogen triangle remain intact when it is broken up at the E_3 stage into a diquark and free quark, the diquark then dissociating into the self-same, linear triplets. According, however, to both the text and the disintegration diagram (fig. 4.7) in the first edition, the UPAs in the two linear triplets (marked 'a' and 'b') regroup themselves in the bound state of six UPAs released at the E_4 stage, which then breaks up at the E_2 stage not into the original pair of linear triplets but into two *new*, linear triplets, one composed of a UPA from triplet a and two

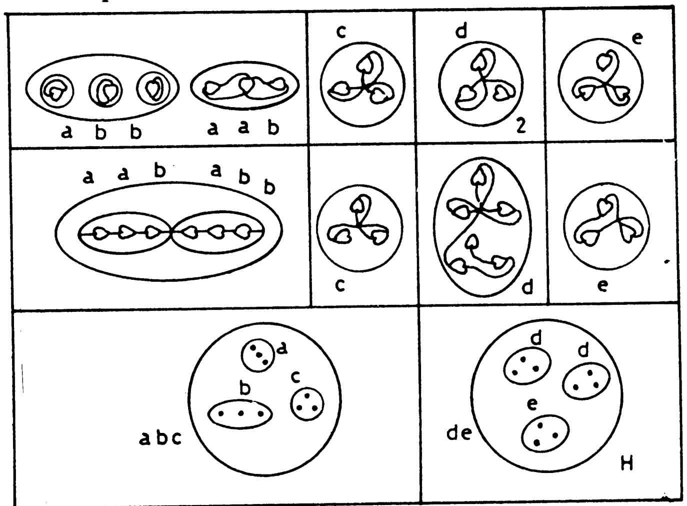


Figure 4.7

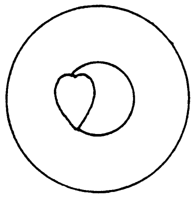


Figure 4.8

UPAs from triplet b and the other composed of two UPAs from triplet a and one UPA from triplet b. This difference, which is merely a variation in the process of disintegration observed on each occasion, causes no inconsistency in the assignment of (+) and (-) UPAs: the negative linear triplet in the hydrogen triangle and the negative triplet released at the E_2 stage still consist of one (+) UPA and two (-) UPAs despite the fact that they are not the same particle, according to the first edition of *Occult Chemistry*. It is unfortunate that we are not told whether triplet a is positive or negative (similarly for triplet b). If we had been, it would have enabled the UPAs in the triplet broken up by mistake to be identified in terms of X and Y subquarks, thus making known whether it was a u or d quark and settling the issue of whether the upper hydrogen triangle is a proton or neutron.

It must be emphasized that these micro-psi drawings of the strings between quarks and subquarks - like all diagrams published in *Occult Chemistry* - are not to scale. The investigators remarked: 'It should be specifically noted that the diagrams are not drawn to scale, as such drawings would be impossible in the given space. The dot representing the Anu is enormously too large compared with the enclosures, which are absurdly too small; a scale drawing would mean an almost invisible dot on a sheet of many square yards.'[16] Also: 'It must be remembered that the bodies shown diagrammatically in no way indicate relative size; as a body is raised from one substate* to the one immediately above it, it is enormously magnified for the purpose of investigation.'[17]

The string model forbids the existence of free quarks because it conceives a quark as the end-point of a string, which would have to be infinitely long, if the quark were unbound to other quarks, and therefore of infinite mass, the energy of a string increasing indefinitely with its length. Even allowing for the fact that the model actually applies to subquarks, not quarks, how *in principle* (quite apart from in practice) could Besant have systematically broken up subatomic particles into free quarks and subquarks? The clue to the solution of this problem comes from the depiction of free UPAs at the final E_1 stage of disintegration (fig. 4.8). Instead of observing infinitely long strings, which would have been impossible because an infinite amount of energy would have been needed to create them, the investigators described a free UPA as being enclosed in a spherical cell-wall with a more or less circular line of force passing out of its pointed end and then returning into it at its depressed end. It is as if the UPA had turned into a bar magnet with its magnetic lines of force leaving its north pole and returning to its south pole along paths which are familiar to every school child. Perhaps this is precisely what a subquark observed by micro-psi to be in a free state effectively becomes. The following explanation is offered: as the confinement of subquarks in quarks is simply that due to the string model mechanism, this binding must be permanent. Hence the disintegration of quarks into subquarks cannot be mechanical: the brute force of psychokinesis would never be strong enough. Instead, one may speculate that the micro-psi observer psychokinetically injects a large amount of energy into the particle to be split apart. As string forces weaken with increasing energy of motion, the strong coupling between the subquarks in the particle weakens to a point where they move almost freely. But this alone could not account for how Besant could break up bound states of subquarks in a controlled, systematic way leading to ever simpler bound states. Suppose, however, that some of the energy supplied by the micro- psi observer heats up the Higgs field in the neighbourhood of

* A reference to the four Theosophical 'etheric subplanes,' on which Besant & Leadbeater believed the constituents of MPAs existed when they broke up the latter.

the particle until this field is no longer in a superconducting state (it is well-known to physicists that a superconductor heated above its so-called 'critical temperature' becomes a normal conductor). The vortices in the Higgs field exist only because the latter behaves as a superconductor, expelling hypercolour flux and squeezing it into narrow flux tubes. This change to a normally conducting state would therefore destroy the string bonds between the subquarks in the particle, destroying the confining property of the hypercolour force, which would no longer become stronger, further apart they were. The particle would break up if its constituent subquarks were moving fast enough. This region of the Higgs field would then start to cool down, although not necessarily everywhere at the same rate, with the consequent reappearance of strings when the temperature fell below the critical value. If, however, the critical temperature of a Higgs field depends on the number of hypercolour states that it can confine, being higher the fewer the number of confined states, subquarks in cooler domains of the affected region would recombine into simpler groups bound by string forces because these domains would have become superconducting again, whereas subquarks in hotter, still normal, domains would remain unconfined by string forces until these domains cooled below the critical temperature of a Higgs field whose vortices confine two or more subquarks, after which their subquarks would become bound again by strings.

This is precisely what appeared to happen in the stage-by-stage dissociation of composite particles initiated by Besant. According to the disintegration diagrams of MPAs, their released constituents usually remained separate but sometimes they immediately recombined to form new bound states. Single UPAs were not always freed at the same stage of disintegration. By controlling how much she psychokinetically heated up the Higgs vacuum in which the UPA monopoles were embedded, Besant would have been able to regulate the systematic break-up of the composite particle. Having completed her observations of the types of duads and triplets of UPAs into which a given particle had been finally broken up, she would have released these particles and so would not have noticed their recombination once they had disappeared from her field of vision. She provided no significant information concerning how she performed these manipulations of the images she experienced. What is so remarkable about her descriptions of the successive stages of disintegration is the pattern of *physical coherence* running through them, as chapter 5 will demonstrate. How could so many thousands of these pictures turn out to be consistent with the theory of MPAs presented in this book if they were nothing more than hallucinations unconnected to the nucleonic composition of atomic nuclei and to the quark composition of nucleons?

The spherical cell-wall surrounding a free UPA represents a phase boundary between a normally conducting region of the Higgs field and the ambient, superconducting field. Because the Higgs field inside the cell-wall is in a normal state, no string emanates from the UPA - in accordance with observation. Instead, the observer notices the dipolar magnetic field of the spinning, electrically charged subquark, the geometry of which is similar to the shape of the loop shown in figure 4.8.

The cell-walls were regarded as enclosing 'holes.'[18] This apt metaphor is consistent with the cell-wall being a boundary between the ambient Higgs field, which has a constant density, and the inhomogeneous Higgs field in the region of the strings between UPAs, the density of which rapidly decreases to zero at the core of each string (see figure 2.7.), i.e. the density of the field decreases inside the cell, creating the impression of a hole.

4.4 The UPA as superstring

We saw in section 1.5 that the positive and negative UPAs are mirror images of each other, their ten whorls each making five clockwise revolutions in the former and five anticlockwise revolutions in the latter. According to Leadbeater, who made a special study of the UPA, each whorl is a helical coil that winds 1680 times around the surface of a torus (fig. 4.9). The helical nature of whorls is also depicted in Babbitt's picture of the UPA (see fig. 1.6). Leadbeater checked this number by counting the number of turns in a whorl in 135 different UPAs.[19] Each circular turn, or so-called '1st-order spirilla,' is another coil made up of seven

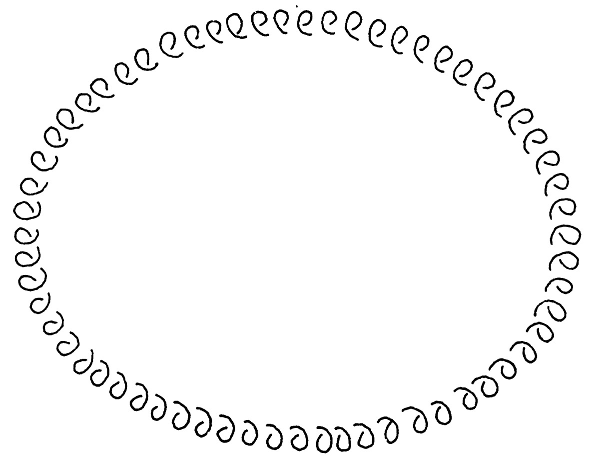


Figure 4.9 : A whorl is a helical coil with 1680 turns, or '1st-order spirillae.'

smaller, circular turns, or '2nd-order spirillae,' which wind around a torus (fig. 4.10). Each 2nd-order spirilla is another helical coil with seven still smaller turns, or '3rd-order spirillae,' and so on. There are seven orders of spirillae, each finer than the preceding one and made up of seven circular coils that form a turn of the next lower order of spirilla (fig. 4.11). Each spirilla winds in a circle whose plane *is perpendicular to the direction in which the preceding order of spirilla winds at that point*. The 7th-order spirilla consists of seven spherical[20] 'bubbles' spaced evenly along the circumference of a circle. Figure 4.11, which is taken from the third edition of *Occult Chemistry*,[21] depicts the helical winding of the fifth, sixth and seventh orders of spirilla. Rather than a soap bubble, whose film has both an inner and an outer surface, the bubbles making up the last order of spirilla are more like bubbles of air in a liquid, which have only one surface. Leadbeater said that space is filled with an invisible plenum or substance akin to the aether. Calling it 'koilon,'* he claimed that both types of UPA are ultimately composed of bubbles or holes in this substance, i.e. the fundamental constituents of matter are really a kind of void, an absence of the all-pervasive koilon. The bubbles seemed to contain nothing, as far as the highest magnifying powers of the two investigators' micro-psi vision could discern. Drawing an analogy with air bubbles in water (admittedly, not a perfect analogy because such bubbles still contain air), Leadbeater remarked: 'Just as the bubbles are not water, but precisely the spots from which water is absent, so these units

* A Greek word, meaning 'hollow.'

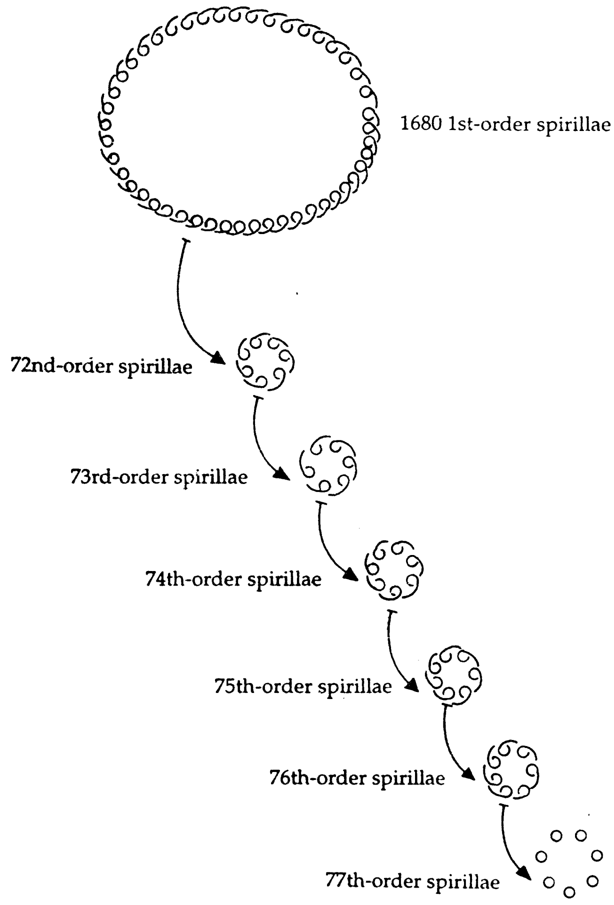


Figure 4.10 : The seven orders of spirillae

are not koilon but the absence of koilon - the only spots where it is not - specks of nothingness floating in it, so to speak, for the interior of these space-bubbles is an absolute void to the highest powers of vision that we can turn upon them.'[22] Leadbeater was, effectively, declaring that the basic units of nuclear matter are made up of myriads of infinitesimal pockets of empty space, which are surrounded by a 'physical' vacuum permeated by some kind of homogeneous 'field' whose nature he could not discern.

Referring to each whorl of the UPA as a 'wire,' Leadbeater remarked:

> If one of these wires be taken away from the atom,** and as it were unfitted from its peculiar spiral shape and laid out on a flat surface,† it will be seen

**A reference to the ultimate physical atom (UPA).

† Leadbeater is speaking here metaphorically, of course.

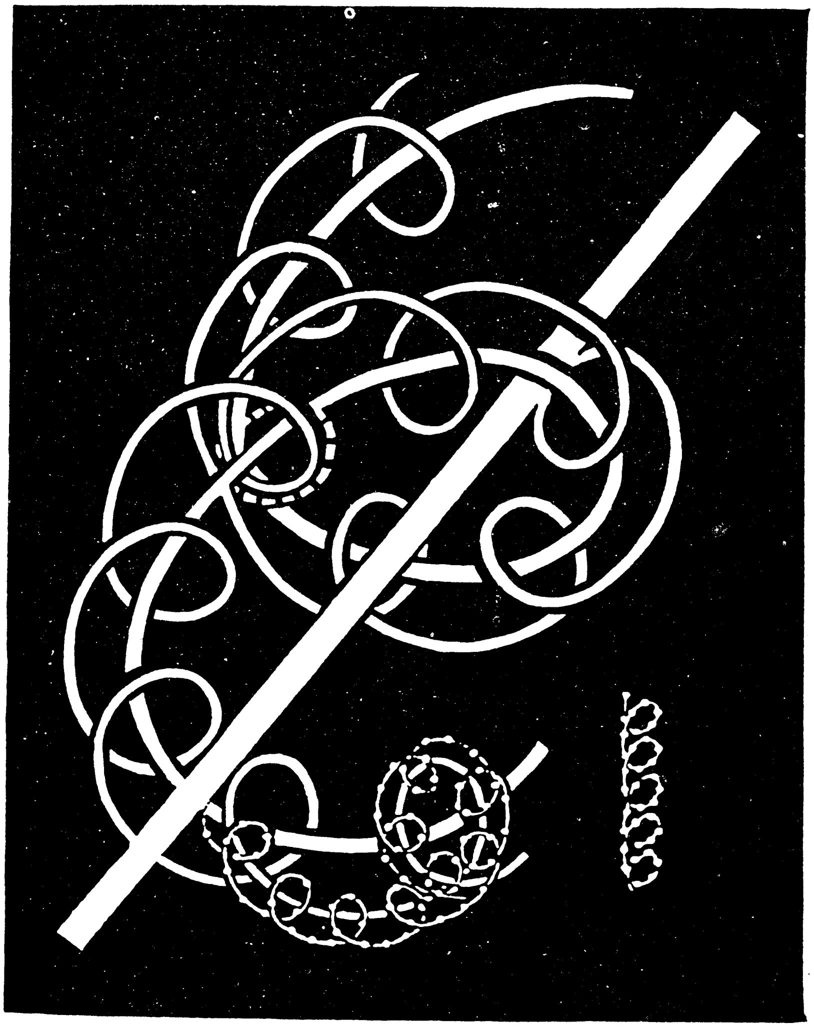


Figure 4.11 : Toroidal winding of 5th-, 6th- and 7th-order spirillae.

that it is a complete *circle* — a tightly twisted endless coil. This coil is itself a spiral containing 1680 turns; it can be unwound, and it will then make a much larger *circle*. There are in each wire seven sets of such coils or spirillae, each finer than the preceding coil, to which *its axis lies at right angles*. The process of unwinding them in succession may be continued until we have nothing but an enormous *circle* of the tiniest imaginable dots lying like pearls upon an invisible *string*.'[23]

(Note the words italicized by the author. Their significance will become apparent shortly). The 'dots' referred to above are the 'bubbles in koilon' making up the 7th-order spirillae. On the basis of this account of the seven-fold multiplication of successive orders of spirillae in a whorl, it is straightforward to calculate that over a billion bubbles are evenly strung along each closed curve or whorl.

The stringy whorls wrap themselves over a surface which is topologically equivalent to what mathematicians call a 'one-fold torus,' i.e. it can be deformed continuously into the shape of a doughnut. In completing 2½ revolutions as it wraps itself around the outer circumference of the torus and then 2½ more revolutions around its inner circumference, a whorl winds 1680 times around another torus. By imagining its coils straightened out, a new, larger loop is formed. This becomes the axis of another torus, around whose surface 2nd-order spirillae wind, and so on.

The winding is slightly more complicated for the major whorls for the following reason: each circular nth-order spirilla in a minor whorl is composed of 7 circular (n+1)th-order spirillae, so that 100 nth-order spirillae consist of 700 (n+1)th-order spirillae. But Leadbeater noticed that 100 nth-order spirillae in a major whorl consist of 704 (n+1)th-order spirillae, i.e. four extra spirillae of the next higher order are present in every 100 spirillae of a given order. This addition continues in the same proportion for every order of spirilla up to the 7th-order spirilla, every 100 of which consist of 704 bubbles in koilon, whereas in a minor whorl every 100 7th-order spirillae comprise 700 bubbles because each 7th-order spirilla is a set of seven bubbles arranged evenly along a circle. Instead of being composed of exactly 7 circular turns, each order of spirilla in a major whorl consists of 7.04 turns, an (n+1)th-order spirilla winding an extra 1/25th of a revolution by the time it forms 25 turns. The presence of extra spirillae of every order above the 1st-order is what makes the major whorls 'thicker and more prominent' than the minor whorls. Every 25 nth-order spirillae in a minor whorl are composed of 175 (n+1)th-order spirillae, whereas in a major whorl they consist of 176 (n+1)th-order spirillae. A simple calculation based upon this information shows that the UPA contains approximately 14 billion bubbles, each major whorl consisting of about 56 million more bubbles than a minor whorl.

Let us now compare Leadbeater's description of the whorls and their spirillae with the picture of closed, bosonic strings and superstrings discussed in section 2.4 and with the six-dimensional torus model of the compactified space of superstrings. Three remarkable similarities between the micro-psi picture and string-theoretical ideas are listed below:

	WHORL	STRING
1.	Closed curve;	1. Closed curve;
2.	Circular (n+1)th-order spirillae wind 7 times around each circular nth-order spirilla (n = 1,2,3,4,5,6);	2. Winds N_n times around nth circular dimension (n = 1,2,3,4,5,6; N_n is winding number for nth compactified dimension);
3.	(n+1)th-order spirillae wind in circles whose planes are at right angles to plane containing circular nth-order spirillae (n = 1,2,3,4,5,6).	3. Compactified 6-d torus has six perpendicular circular dimensions.

These correspondences suggest:

1. A whorl is a closed string. The reported existence of *spherical*, i.e. 3-dimensional, 'bubbles in koilon' in 7th-order spirillae implies that whorls extend *beyond* the sixth compactified dimension, so that they must be 26-, not 10-, dimensional strings;[24]
2. The 2nd-7th orders of spirillae are the winding of a closed, 26-dimensional string about the six circular dimensions of a 6-dimensional torus, or its orbifold generalisation, the winding number $N_n = 7$ being independent of the compactified dimension;
3. The UPA is the subquark state of a superstring made up of TEN 26-dimensional strings, i.e. *the superstring is itself a composite object.*

The string-like nature of whorls and their toroidal winding about six higher, circular dimensions suggest that positive and negative UPAs are subquark states of superstrings of opposite chirality. If this interpretation is right, it means that a 10-dimensional superstring is the result of the compactification of sixteen dimensions not of a single 26-dimensional string, as some string theorists currently conceive, but of a bundle of ten such strings. Why this number? The profound reason for this multiplicity of strings in the composite superstring has been given elsewhere[25] by the author and will not be discussed here. Such an implication of this interpretation of Leadbeater's description of the UPA may seem too radical for most string theorists to countenance. Considering, however, that superstring theory is still in its infancy, having no fundamental formulation as yet which solves all the outstanding problems of particle physics, such dismissal of the possibility of 10-dimensional superstrings being built out of more fundamental, 26-dimensional strings would seem premature.

The reader should now be able to appreciate the significance of the italicized words in the passage from *Occult Chemistry* quoted above. Firstly, just as closed strings are circles, topologically speaking, so are whorls. Secondly, just as the dimensions of a 6-dimensional torus are perpendicular to one another, so are the axes of successive orders of spirillae. Thirdly, it is quite extraordinary that Leadbeater used in 1907 the very metaphor 'string' that appears frequently in the pages of current research journals of theoretical physics! Such close matching between the central idea of a scientific theory and paranormal descriptions of the structure of fundamental particles is strong evidence of the objective nature of Leadbeater's micro-psi experiences. For reasons to be given in section 6.2, neither precognition nor prescience of the kind the science-fiction writers H.G. Wells and Jules Verne are known to have exhibited in their books is a plausible, alternative explanation of the string-like description of UPAs. It is highly improbable that the three significant features of the micro-psi picture of UPAs: closed curves, six higher orders of spirillae winding toroidally at right angles to one another, and the apt use of the word 'string,' could have come about by chance in any account which was either fabricated or based upon hallucinations reflecting merely the contents of Leadbeater's mind.

The sizes of each compactified dimension are defined by the radii of the circular spirillae. Leadbeater did not estimate the relative sizes of these radii (figure 4.11 is not to scale), nor did he indicate whether successive orders of spirillae decrease by a constant or variable proportion. This would have been difficult to judge because any sense of relative size might have been lost when he shifted the focus of his micro-psi vision from the perspective of one compactified dimension to that of another. It is significant, however, vis-à-vis higher-dimensional theories of particle physics such as superstring theory that Besant & Leadbeater reported their awareness of an aspect of the UPA which is higher-dimensional in the strict mathematical sense of this word. Referring to the three major and seven minor whorls, they said: 'Each of the three coarser whorls, flattened out, makes a closed circle; each of the seven finer ones, similarly flattened out, makes a closed circle. The forces which flow in them again comes from 'outside,' from a fourth-dimensional space.'[26] Another reference to a fourth dimension as the origin of the force binding UPAs together was quoted in section 4.1.

In conclusion, the descriptions by Besant & Leadbeater of the lines of force holding UPAs together bear a remarkable resemblance to certain basic ideas of the string model of quark confinement. That *many different* numbers (rather than the same number) of UPAs should be bound by string forces in MPAs poses a problem for which the explanation was offered that these exotic particles are embedded in domains of various phases of the Higgs field having vortices with different confinement properties, this inhomogeneous state being the result of non-uniform heating of the superconducting ground state of the Higgs field during the process of formation of the MPA from the subquarks in two atomic nuclei prior to its observation. The resemblance of the whorls of the UPA to closed strings and the similarity between the higher-order spirilla structure of whorls and the 6-dimensional torus (or its orbifold generalization) - one of the model compactified spaces of superstrings that physicists have considered - are too close to have the conventional explanation that they are due to chance. Even if it had been plausible in the context of the UPA, such an explanation would still be inadequate because coincidence cannot remotely account also for the numerous other connections demonstrated in this book to exist between micro-psi observations and nuclear and particle physics, in particular, the vast degree of correlation between features of MPAs described in the next chapter and predictions of the theory that MPAs were formed from the quarks making up two atomic nuclei of the corresponding element. Rather, this remarkable correspondence simply indicates that superstrings were described paranormally 100 years ago. There is no adequate alternative that can be said to be less miraculous.

References

1. *Occult Chemistry*, 3rd ed., p. 381.
2. Subatomic particles are said to be virtual if for brief moments they carry energy and momentum whose values violate Heisenberg's uncertainty principle governing how accurately these properties may be simultaneously known.
3. Figures 4.1a and 4.1b appear on p. 25 and figure 4.1c appears on p. 96.
4. *Occult Chemistry*, 1st ed., p. 25.
5. *Extra-Sensory Perception of Quarks*, pp. 31-4.
6. *Occult Chemistry*, 3rd ed., p. 14.
7. Ibid., p. 13.
8. Ibid.
9. *Occult Chemistry*, 1st ed., p. 96.
10. Ibid.
11. *Occult Chemistry*, 3rd ed., p. 15.

12. Ibid., p. 28.
13. Ibid., pp.15-16.
14. *Extra-sensory Perception of Quarks*, pp. 102-104.
15. *Occult Chemistry*, 3rd ed., p. 38.
16. *Occult Chemistry*, 3rd ed., p. 36.
17. Ibid., p. 10.
18. Ibid.
19. Ibid., p. 23.
20. Recent investigations by the author with a clairvoyant claiming micro-psi powers indicate that these bubbles are not spheres but tori with a relatively minute central hole, which presumably went undetected by Leadbeater. This unpublished report is available from the author.
21. Ibid., fig. 5a, opp. p. 20.
22. Ibid., p. 17.
23. Ibid.
24. According to ref. 20, the bubbles are not spheres but tori. This, however, unaffects the inference that whorls must be 26-dimensional because they consist of objects with at least two dimensions extending beyond the sixth, circular dimension of a 6-dimensional torus.
25. *The Image of God in Matter*, by Stephen M. Phillips (to be published by the Bharatiya Vidya Bhavan, Mumbai, India).
26. *Occult Chemistry*, 3rd ed., p. 14.