# Higgs Field and a View of the Material World that Makes Sense

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For centuries no concept has been as misunderstood or the subject of so much speculation and investigation as the concept of matter. In earlier times, people drew their views on the nature of matter from ancient religious texts and oral traditions, whether they were indigenous, Eastern, or Western in origin. In the West, the eclipse of these traditional views and their replacement by the dawning of the empirical scientific era began already at the time of the Ancient Greeks but gained momentum only with the advent of mechanics and the science of Galileo.

Further steps along this path came during the early nineteenth century with the ideas of John Dalton—father of the concept of the atom in the form many of us learned in high school—and during the century that followed with the work of a host of scientists and mathematicians. Finally, we arrive at our present century, during which the ideas of the Higgs Field and Boson have made their debut in the popular press. While many people are enamored with the idea of the "smallest particle" (sometimes referred to as "the God-particle"), others read these descriptions and dismiss them as nonsense.

Earlier this year I was finishing work on a book entitled, *Embracing Materialism and Letting It Go: An Experiential Guide to Overcoming an Object-Based World Conception.* While much of the book is intended to help develop a deeper understanding of the basis of our everyday experience, the two central chapters tackle the concept of the atom and suggest a new framework for thinking about the Higgs Boson and Field. A significant portion of these chapters is offered below. A free download of the entire book in PDF format is available at www.sensri.org.

We pick up the historical evolution of the concept of the atom with William Crookes, the first scientist who actually observed experimental evidence that suggested the world might be other than simply "stuff."

Born into an aristocratic family in 1832, William Crookes was an Englishman of considerable means. Recognizing his good fortune, he decided to dedicate himself to the pursuit of science. Since he was also a part of the growing Spiritualist movement of his time, Crookes took a great interest in electrical phenomena, the mysterious and somewhat new emanation that had only recently begun to be harnessed by the early to mid 1800s. It had been found that electrical effects could instill movement in animals and humans, even those that were lifeless. Mary Shelley's *Frankenstein,* recently published in 1818, was based on people's fascination with electrical phenomena. If electrical effects could stir lifeless beings into movement, then perhaps the nature of all life lay hidden in the depths of electricity's secrets. Crookes' interest in science and the spirit had found a worthy subject for investigation.

Over time, Crookes performed a number of different experiments. We will focus on a key one, involving a glass tube in which an electric current is placed across the ends of the tube in order to electrify the air or gas contained inside it. This technique was developed in the late 1860s and early 1870s. When Crookes began these experiments, he noted a faint glow emanating from the tube when an electrical potential was placed across it. He experimented by evacuating the tube so that less gas was present than would normally fill the space. To his surprise, the more gas he evacuated from the tube, the more brilliant became the glow. In fact, Crookes began to notice that the emanations were not simply confined to the tube, but actually appeared outside the tube, as if they were leaving it. The behavior of the gas surprised Crookes greatly. How could any material escape an enclosed glass tube? No solid, liquid or even gas was capable of escaping such a space. Crookes felt that he had discovered a new type of matter. Given that the emanation appeared to radiate out of the tube, Crookes called his discovery "radiant matter."

In effect, Crookes had discovered the first challenge to the so-called corpuscular theory of matter. More interestingly, he had done so by conducting empirical experiments and not simply by stating a new thought or conjecture. While few recognized at the time the implications of his discovery, it was clear that the nature of the material world was far subtler than had previously been thought. Scientists were going to have to come to terms with Crookes' new observations. In time, looking for electrical effects and their manifestation in the material world became a standard means for investigating the essence of the material world.

The late 1800s saw many scientists probing more deeply into the nature of matter, trying hard to find its subtle basis. While many steps were taken in this exploration, we will look at the work of the next Englishman in the series, J.J. Thomson. Like Crookes, Thomson performed many of his investigations and experiments using an electrical apparatus. In time, Thomson was able to find that Crookes' "radiant matter" was not only electrical in production, but that its direction of streaming could be influenced by other electrical effects. The "radiant matter" was either deflected in a different direction as the result of external magnetic effects, or simply left in its original emanating directions if kept from any external effects. Between 1897 and 1904, Thomson was able to determine that the electrical effects happening on a very small scale suggested that the electrical polarity of the field was not uniform. He described the periphery of the fields as generally having negative polarity, while the center contained concentrated bits of positive polarity. Thomson likened his discovery to plum pudding with a gelatinous outer layer and hard bits (plums) in the center.

Thomson's discovery was a huge breakthrough in the evolution of the concept of the atom. "That which cannot be cut"—the original meaning of the Greek word *a-tom*—appeared to have qualities that were more subtle than the discrete ultimate entity that had been postulated by most scientists and philosophers. In other words, the concept of the atom as the ultimate basis of matter, as a fixed entity, was beginning to be challenged.

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Thomson's research was carried on by other individuals, most notably another citizen of the British Empire, Ernest Rutherford. Born in New Zealand, Rutherford was recognized early in his schooling as a boy of talent. He quickly made his way through advanced education and soon began doing research at the Cavendish Labs in Cambridge under J.J. Thomson.

Rutherford's key contribution to the story of the atom is referred to as the Gold Foil Experiment, which he developed with some students in 1911. In this experiment, Rutherford took a piece of gold foil that had been hammered into an incredibly thin surface. The surface was so thin that it was essentially translucent. Gold's unique malleability allows a one-ounce piece, approximately the size of a half dollar, to be hammered so thinly that it covers an area of 100 square feet. Once the gold foil had been prepared, Rutherford took a device that produced "radiant matter" (today we would call these emissions "alpha rays") and placed the gold foil between the electrical device and a piece of specially prepared film that would change color when exposed to this radiant matter. Rutherford further greatly narrowed the scope of the area where the radiant matter could be produced. As a result, individual spots could be observed on the film, even though the gold foil was placed between the film and the electrical device. However, in a few cases, the spots found on the film were at a noticeable angle from the scope of the area created by the electrical device. Furthermore, in a few cases, one in eight thousand, no spot was registered on the film at all.

Eventually, Rutherford, with his graduate assistant, placed a piece of film behind the electrical device. It was then that he was able to record the missing signature of the radiant matter, though it appeared in the opposite direction from where it began. In Rutherford's own words, "It was as if we had shot a bullet at a piece of tissue paper and it bounced back!" It appeared that, in these rare cases, the radiant matter must have left the electrical device and come into close proximity with such a strong electrical interaction that it was repelled backwards and was therefore picked up by the film behind the device. This was truly astounding. Most of the time the radiant matter simply passed through the gold foil but occasionally it was deflected or simply bounced back. Rutherford inferred from these experiments that most of matter must be empty space with small, localized areas of negative (deflected) or positive (repulsed) spatial qualities. The key here was that most of matter now consisted of "nothing." The concept of matter was quickly losing its quality of "thing-ness" and was therefore open to being replaced by a new concept.

Perhaps the best description of the excitement felt by members on the leading edge of science at that time was given by Arthur James Balfour in an address to the British Association for the Advancement of Science at Cambridge on August 17, 1904. A short excerpt is given below:

> But today there are those who regard gross matter, the matter of everyday experience, as the mere appearance of which electricity is the physical basis: who think that the elementary atom of the chemist, itself far beyond the limits of direct perception, is but a connected system of monads or sub-atoms which are not electrified matter, but are electricity itself. …

It is hard to overlook the work of Bohr, Chadwick, Einstein, and Born, but in the interest of keeping to the essential elements of our theme we will press on. In 1925, physics was to begin a tremendously new attempt at defining the nature of matter. Spurred on by the many great minds of the time, only a few of which are mentioned above, three new approaches arrived on the scene.

First, a French physicist named Louis DeBroglie suggested that rather than focusing on a corpuscular model for matter, one could develop a model based on a harmonic wave form, similar to the notes in a musical composition, to distinguish the different qualities of matter. He developed a series of mathematical relationships and termed the resulting waves DeBroglie waves.

The second breakthrough came from a German physicist named Werner Heisenberg, who put forth his famous Uncertainty Principle. Heisenberg stated that, in short, whenever we try to know any particular aspect of a given experiment, simply the act of setting up the experiment or apparatus to observe that particular quality changes the context of the situation we are observing. This principle can be transposed into any aspect of our daily life. In the act of observing, it is impossible to remove the observer from the experiment. (Much more is written about this in later chapters of the aforementioned book, but not published here.)

Finally, the third big breakthrough came from an Austrian physicist named Erwin Schrödinger. Schrödinger took a very pragmatic approach to what had resulted from the physics of the previous twenty years. He became less interested in knowing exactly what matter is, and instead shifted the emphasis to predicting the likelihood (or probability) of a specific event or series of events happening. Along with a number of other scientists, he developed what eventually came to be known as Quantum Mechanics.

All three of these physicists were eventually awarded the Nobel Prize for Physics: DeBroglie in 1929, Heisenberg in 1930, and Schrödinger in 1932.

What is most important here is that, in the minds of the leading physicists of their time, the concept of a material basis for the world had been totally superseded and was no longer in contention as a worldview. This was to last for only a few years, however, until the mid 1930s. Once the threat of another war loomed on the horizon, most of the leading physicists were put on fast-track research projects to develop something other than an understanding of the nature of the physical world. The race to develop the atomic bomb, the ultimate form of destruction, was on, and each country taking part in this race was concerned that the other might achieve this goal first. This focus on "splitting the atom" for the purpose of creating new weaponry was to dominate physics and continue through World War II and into the beginning of the Cold War. It wasn't until the 1960s that a significant number of new research projects was launched, many of them centered around the study of a whole new group of "subatomic particles." The atom, "that which cannot be cut," had already been cut into a nucleus, further cut into positively charged areas of space (protons) and neutrally charged areas of space (neutrons) surrounded by a negatively charged area of space (electrons). Now, each of these "particles" was formed from other entities. Other entities were postulated to exist, and research was funded to find them—namely positrons, hadrons, quarks, and other entities. For a while, it appeared that the formulation of a new concept of matter was hopelessly caught up in a search for smaller and smaller "particles." To be sure, the leading scientists doing the research were often able to describe their work as non-materially based, but the shift to a new worldview seemed to be present in very few, if any, of their daily lives. What was done in the lab was one "thing," what happened in their daily life was "a different matter."

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Finally, toward the very end of the twentieth century and at the beginning of our own, a new view of the material world has begun to rise again. One of these new views is based on the work of Peter Higgs. The Higgs view contains both particles and what is called the Higgs Field. In the case of the latter, we once again stand at the edge of the possibility of a new conception of the material world. In the view of Higgs, there are a number of fields of activity. When the word *field* is used, one should not think of a "thing" but rather conceptualize a spatial area in which one type of phenomena may arise. The Higgs Field way of looking at the world postulates that when the Higgs Field comes into the same spatial area as certain other types of fields, the quality of mass arises in matter. The key to this type of thinking is not to think of a "thing," but instead to imagine a new property or quality arising in a place where no quality existed before.

Thus, matter is ultimately not made of objects; instead, when the qualities of visual opacity and tangibility arise in the same spatial area, we describe the correspondence of qualities as matter. Other sensed qualities may also arise in the same spatial area such as sounds, smells, tastes, and so forth. Matter is not the cause of these sensations but rather the concept that unites the correspondence of sensed qualities.

### Demonstrating the nature of matter

The following demonstration forms part of a course I have been teaching involving scientific or conceptual themes. While the necessary materials are simple, I have found that the demonstration is both effective and surprising. To begin, I invite one of the course participants to serve as assistant. After assuring the volunteer that nothing unsafe will happen, I continue with the following instructions. First, I have the assistant stand before me with eyes closed and hand held out in front. I then say that I will place something into the hand, at which point the assistant is to grasp the object tightly and keep the hand completely still while holding the object.

The rest of the students are instructed to remain silent and observe the assistant, who (with eyes closed) is able only to feel what is happening. No student will have both experiences. What the remaining students see is that I pull out a long metal bolt about four inches in length. Attached to the end of the metal bolt is a series of five disks approximately 3/8″ in diameter (just a bit bigger than the bolt). These are stacked one on top of the other. The bolt is placed in the assistant's hand, with the series of stacked disks facing me.

At this point I pull out five additional stacked concentric cylinders and begin to move them toward the stack on the end of the bolt that the assistant is holding. When the stack I am holding in my hand is pushed within about one inch of the assistant's stack (they are not yet in physical contact), the remaining participants see the assistant's hand move even though the objects do not touch. With a reminder to the assistant to keep the hand still, this process is repeated to the delight of the observers, and often to the mild frustration of the assistant. At no time do the two stacks of disks ever come into physical contact. At this point, the rest of the participants have a fairly good idea what is happening. I continue to move the assistant's hand in this way, and then ask the assistant to open eyes while the movement is occurring. With eyes open, the assistant may utter note of surprise upon realizing what had been happening.

### Commentary on the demonstration

As we review the experience, the assistant—let's call her Jane—usually states that with her eyes closed she believed that the movement of her hand was caused by my grasping the end of the bolt and moving it around. When the assistant opens her eyes and sees that this is not the case, there is an initial surprise as she sees that there is no physical contact between what is in her hand and anything in mine. An invisible relationship has been established between the cylinders in hers and the ones in mine. Almost immediately, the concept of "magnets" comes into the observer's thinking and the mystery is solved. Or is it?

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Now we begin a careful analysis of the demonstration, remembering that the group could see while Jane could only feel. The students could see that the "objects" were moving, yet they were not touching. Upon closer examination, we realize that the observers were not "seeing objects" but, instead, were seeing images that they then conceptualized as being separate objects. They saw an image and out of habit associated it with the tactile, tangible quality of an object. Normally, we would expect no movement between the objects until we saw the images touch. When, as a result of the close proximity of the images, the untouched object and the hand grasping it began to move, the students were confronted with an unexpected observation. Some of them quickly inferred that the metal disks were magnets. Had we begun with an object whose image is red and u-shaped, most people would have immediately recognized that image as being a magnet. It is only because the form of the image and its color were more nondescript that the students were more likely to expect that the objects would not move until their images were actually touching.

The assistant, Jane, had a different experience. She felt the tangible sensation in her hand and assumed that any motion of her hand would be due to the object in her hand being moved. She simply assumed that the tangible quality in her hand was solely the quality of an object. While she was correct in thinking that the initial tangible quality in her hand was the result of an interaction of objects, her assumption became problematic when she assumed that the second tangible experience in her hand was also due to an object interaction. Upon opening her eyes, she realized that the second tangible experience was due to an invisible interaction. The name we usually give to this invisible interaction is magnetic attraction. In this second case, we have a tangible experience with no directly associated visual image; from a visual perspective, the space in between is filled with nothing or no-thing.

The distinction between the various types of visual and tangible interactions can be grouped together in the following manner.

Case 1. *Images by themselves are real experiences.*

In the world of our everyday experience, do we have "real" visual experiences (as opposed to hallucinations, dreams, and so forth) that have no tangible counterpart? Do we ascribe reality to images that can be seen but not touched? Usually with some prodding we arrive at such examples as rainbows and holograms. In both cases, an image is seen but with no tangible counterpart. Students find it fascinating to see an image that has all of the visual attributes of three-dimensional appearance, but that is lacking any tangible attribute at all. The key here is to recognize that no one will ascribe object-like status to the hologram, but most observers will agree that a hologram does indeed have a reality from the perspective of vision. Is a hologram a real experience? Yes, the hologram has a visual quality that can be repeatedly experienced! What makes the hologram a bit uncanny is that the image has no tangible counterpart.

Case 2. *Tangible experiences by themselves are real experiences.*

In our everyday life, do we have tangible experiences (for example, experiences of pressure on the surface of our skin) that have no visible counterpart? Again, with a bit of questioning, students will begin to offer examples of magnetic interactions, some electrical interactions, and even experiences in nature such as wind. With further discussion, most students will report having had an experience of "feeling eyes on them"—that is, having the sensation of being watched, often while walking down a road, by some unseen observer. Here we have a tangible experience (pressure), or the very subtle sensation of someone watching, with no visual image to support the idea that something has come into contact with us. We may be more at ease accepting the idea that the earth is one pole of a magnetic interaction with our handheld compass being the opposite pole. However, few of us follow the implications of such a way of thinking to the end.

Case 3. *Nothing—no tangible or visual sensation*

In this case the situation is quite clear. While we can hear a sound or recognize a specific scent, without an experience that unifies both a visual image and a tangible counterpart to this image, we have nothing: no-thing.

Case 4. *Things—when the visual and tangible sensations are both present!*

Now we have arrived at a central point in our investigation. It has become apparent that we can form the concept of matter—whether as an object or as a thing—only when two or more of our senses are engaged. The two key senses for the concept of an object to arise are touch (we are aware of pressure) and vision (we experience visual opacity—one image appears incomplete as another image appears to take up the space in the visual field where we would assume the first image would continue). Even with transparent substances, we can observe refraction, a shift in the visual field.

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What is important here is that the object does not cause the sensations; in fact, the reverse is the case. We can form the concept of the object only if we experience at least the two sensations of vision and touch. The senses of taste, smell, sound, temperature, and so forth enrich our experience and will result in our forming a more distinct mental picture of the experience. However, we cannot escape the fact that only through an experience of a relationship, through the senses, can we form a concept of the thing "out there" and simultaneously become aware of myself as "in here." The concepts of *self* and *object* arise from the same unity of experience, and ultimately arise out of relationship. Even more intriguing is the realization that the sense of self and sense of object both arise from the same unity of relationship. While we can separate them conceptually, their origin in perception is non-existent. The world exists not as a series of objects, but instead we come to the concept of object as a result of relational experiences.

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Relationship, or *between-ness*, is the necessary precondition for forming or knowing any aspect of existence. The world-I polarity is an expression of *betweens*, in which we express the poles of the experience as *self* and *world*. The idea (and it is an idea) that the world is fundamentally a series of objects interacting suffers from the fallacy that to form the concept of object, I must already have passed—in many cases unconsciously—through the precondition of experiencing.

## Looking Forward

What would our lives be like if, instead of simply recalling the visual form and tactile sensation when we hear the name of an "object," we recalled the myriad sense impressions and relationships that we experienced when we first developed the concept? Imagine if every experience we had was a full host of sensory impressions! This would be the beginning of a new way of being. Life would be a series of relational experiences rather than the serial interactions of objects. This would be the New Physics, a new way of being on earth; it would be a more fully human manner of experiencing existence.

The world of objects is simply a set conceptual mind-frames. The world of experiences is no less real and, in fact, is the basis by which we form the concept of "object" in the first place. The great error is that once we have had a certain number of experiences, we habitually shift to an object orientation and forget about the experience. At that moment, we stop participating in the world and instead experience the world as "out there" and our self as "in here." At that moment, we lose the immediacy of experience we had when we were younger and begin to live in the abstract world of the grown-up. The limitations we place on the world "out there" are matched only by those that we place on our self when we think only in object-like concepts. The thoughts of the separate "self in here" and the "world out there" are the direct result of a worldview in which it is believed that material is the causal element of all existence. We now may come to appreciate how this view is simply wrong. We form the concept of matter based only on a synthesis of experience-based sensations. And yet we go round and round looking for some fixed system of beginnings. Here again, the search for fixed beginnings is also a residue of a materially-based conceptual system.

Another means of conceptualization is possible. The experiences themselves, the *between-ness* we habitually think of as world-I, can lead to *what*? If we can let go of the what, new possibilities arise. It may be that only then, when we let go of the "what," can we truly begin to live.

While the discovery of the "Higgs-like particle," as scientists were careful to call it, was treated by the media as nothing but another triumph of "proper science," the conceptual framework that led to the search for this elusive particle in the first place may well be an important stepping stone towards a much-needed reevaluation of common assumptions about the very nature of reality.

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