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Modern Physics and Subtle Realms: Not Mutually Exclusive

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Abstract—One facet of the change in worldview ushered in by the quantum mechanical revolution was DeBroglie's discovery that all particles are actually wavelike and that because of this, a plurality of particles can occupy the same region of space, at the same time. This well accepted and empirically validated principle is explored in the context of the quantum field theory of force field/particle coupling. It is then shown that subtle (nonphysical) realms could readily exist without being in any way contradictory to, or inconsistent with, modern physics.

Keywords: interactions—coupling—subtle realms—four forces—other universes

There is a common misconception, held by many scientists and nonscientists alike, that the laws of physics preclude the existence of nonphysical entities and any concomitant metaphysical realms. This viewpoint, as it turns out, is a vestige of pre-quantum mechanical scientific thinking and in no way represents a constraint imposed on reality by the postclassical physics of our modern age.

A general pre-twentieth century scientific adage (even an axiom) held that no two objects could occupy the same place, at the same time. It was therefore implicit that apparitions and similar entities having the property of coexisting in time and space with physical structures such as doors and walls could not possibly exist.

DeBroglie's discovery of the wavelike nature of matter changed that perspective dramatically. Today, physicists regularly deal with wave functions of leptons, quarks, photons, and the like, which overlap and share identical regions of space and time. Just as two waves rolling over the ocean heading in opposite directions can pass through each other unscathed, though occupying for a time the same area of the water surface, so too can two subatomic wave/particles pass through one another unaltered, coexisting for a time in the same space. Trapped particles can, in fact, share a common "trap" indefinitely.

If two such wave/particles jointly occupy a particular region of space-time and do not interact with each another, then neither changes in any way. Often, however, they do interact, and such interaction can change their energies, momenta, charge, and other properties. Interactions are mediated by force fields between the particles, and these force fields carry properties such as energy, momentum, and charge from one particle to the other.

In quantum field theory these force fields, the carriers of the properties between particles, are actually propagating waves. Because waves and particles are essentially one and the same, we commonly refer to the force fields as particles, or more precisely, as *virtual* particles. They are called virtual (in contrast to the *real* particles whose interactions they mediate) in part because they are singularly evanescent. For example, a first real particle such as an electron can emit a virtual particle such as a photon, which subsequently is absorbed by a second real particle such as a second electron. The two electrons change energy and momenta (*i.e.,* each recoils from the other), and we can measure those changes. The photon on the other hand exists only very briefly, long enough for it to carry the appropriate amounts of energy and momentum from electron one to electron two. We can never measure the photon physically and so distinguish it from the real particles by calling it virtual. According to our current understanding, all forces are mediated by such virtual particles.

But particles are really waves, and these "wavicles" make up the entire universe. The reason our universe isn't simply an uninteresting collection of independent waves continually passing through one another unimpaired and immutable is that the various waves are coupled to one another via interactions (forces). The wavelike particles making up your hand do not pass through an object such as a door because the electrons (waves) in your hand and the electrons in the door interact; that is, they continually exchange copious numbers of virtual photons that effectively push the door away when the hand "touches" it. Without this interaction (the coupling of particles in the hand to other particles in the door), the hand would simply pass directly through the door, never feeling the sensation of touch and in fact never knowing the door was there.

It turns out that there are four interactions, or forces, known to modern physics. Two of these—the electromagnetic and gravitational interactions—are familiar in our macroscopic world, and two—the strong and weak forces—are predominantly subatomic. We presently believe that each of these four forces is mediated by a different type of virtual particle. The photon mediates the electromagnetic force; the graviton, the gravitational force; the gluon, the strong force; and intermediate vector bosons, the weak force.

It is important to recognize that we know a particle exists (actually that anything at all exists) only because of the coupling (interactions) between particles. For example, an electron interacts with an electron detector by exchanging virtual photons with that detector. A detection signal occurs only because the electron being detected is coupled via the electromagnetic force to the electrons in the electronic circuitry of the detector. Similarly, if we feel a door with our hands, or perceive through any of our senses, it is only because the particles in our sense organs are coupled to the particles transmitting particular properties (information) from the object we perceive. If there is no coupling, there is no perception.

A real world exemplar of this principle is the neutrino, a particle that has no electric charge and that therefore is not coupled to any charged particle via the electromagnetic force. A human skin cell or a particle detector that responds to virtual photons (*i.e.*, is coupled to the electromagnetic force) could have many neutrinos passing through it but would never register a thing. Similarly, neutrinos have no coupling with the strong force. So a detector that might be sensitive to virtual gluons would likewise be transparent to, and unable to detect, neutrinos.

The various particles in creation are coupled in different ways via different combinations of the four forces. For example, the electron has electromagnetic, gravitational, and weak coupling, but not strong coupling. Quarks are coupled to all four forces. Neutrinos, because they are massless, or extremely close to massless, have gravitational coupling that is far too small to measure, and hence they effectively possess only weak coupling.

This singular characteristic of neutrinos makes them not only interesting, but also particularly relevant to the theme of this article. Note that the only way we can detect neutrinos is via the weak force. But the weak force is so named because it is feeble. In fact, it is so extremely feeble that more than 200 billion neutrinos have passed through your thumbnail in the time it has taken to read this sentence, yet you felt nothing. The weak force (the only way your nervous system could have detected the neutrinos' presence) is so slight that none of those neutrinos interacted with a single atom in your nail. In fact, the only way neutrinos are actually detected in experiments is by using huge volumes of matter over long periods of time. In typical experiments, a mere handful of actual interactions is detected over many months.

This near imperceptibility of weakly interacting neutrinos makes them almost ghostlike. They pass through matter virtually without our being aware of their presence. More remarkably, another property of the weak force may make certain neutrinos even more tenuous and even less a part of what we consider our universe.

The weak force is restricted to particles physicists designate as having "left-handed chirality." In oversimplified terms, one can think of an electron, neutrino, or quark as spinning, typically with the spin aligned in the direction of travel (velocity). Consider that the spin can be thought of as either clockwise (right-handed) around that direction or counterclockwise (left-handed). Peculiar as it may seem, only left-handed neutrinos couple with the weak force. Right-handed ones are immune, and hence transparent, to its effects. So only a left-handed neutrino could interact via the weak force with another particle such as a quark, electron, or other neutrino.

The key point is this: Right-handed electrons and quarks exist. We know because they have been detected via the electromagnetic force. But we can not detect right-handed neutrinos in such a way because they do not interact electromagnetically. Because we can not detect right-handed neutrinos weakly, there is essentially no way to know if these particles even exist. Yet, there could be untold trillions of them passing every minute through each of us and through every known detector. If left-handed neutrinos are almost ghostlike, then right-handed neutrinos are fully so.

Consider then that conscious beings in our universe are aware of each other, the rest of the universe, and at least some aspects of their own selves only because of interactions between the particles/waves of which physical objects are made. As noted, these interactions, as far as we know, are limited to four.

Consider further the possible existence of a new family of diverse particles, similar to right-handed neutrinos in that none of them interacts via any of the four forces dominating our reality. This new family could consist of a limited number of types, each of which fills our known universe in immense numbers leading to significant densities. Consider further that this family might have three or four or five different interactions of its own, coupling its members in various ways. This family and its set of interactions could then behave in generally similar fashion to our own family of particles and force fields, although it would have unique types of interactions manifesting as a complexity and chemistry all its own. It might evolve, grow, and perhaps even produce intelligent beings.

And it would never be detected by any of us—at least through our physical senses. We would coexist in the same space and time, yet because all quantum waves in that system would pass unperturbed through, and without perturbation of, our system, we would live our lives oblivious to this other independent cosmos.

If there is one such other family, why not many? In fact, why not a great many? The universe certainly favors unimaginably large numbers. If, as we suppose, there are an uncountable number of galaxies (including those beyond our horizon of visibility) and as many theorists propose, an uncountable number of other possible universes, then why not an uncountable number of other independent particle families? In the very place where you now sit, there may now also sit a plethora of other sentient beings, some of whom might also be pondering the sensory limitations of their particular version of quantum field theory.

In this context, the proposition that a heaven or hell coexists in space with us might start to seem rather plausible. So might reports of close UFO encounters in which alleged advanced civilizations seem capable of manipulating and moving between physical and nonphysical realms.

The list readily expands to near-death tunnels, spirits, angels, auras, astral planes, other "dimensions," and various other concepts relegated by many mainstream scientists to the arena of fantasy. When certain individuals assert they perceive such things, perhaps the proper scientific response should be investigation, rather than the more common practice of disparagement and dismissal. Something in these peoples' physiologies may be somehow coupled, in presumably delicate fashion, to one or more other worldly force fields. We know individual consciousness and its attendant physical body interact in ways we still do not fully understand. Could that same consciousness not also interact, in still less understood ways, with all but impalpable, but nontheless equally real, trans-physical bodies?

In concluding, we note that we certainly have not proven that subtle realms actually exist. Yet we must bear in mind that in the long history of mankind's numerous metamorphoses in paradigm, the universe has repeatedly surprised us by being far more extraordinary and expansive in every regard than we had previously imagined (or even, as some have said, than we *can* imagine). Given such a history, it would seem prudent to proceed carefully and without prejudice in matters of purported metaphysical nature and draw conclusions based on empiricism alone. In particular, no proponent of materialism should ever denounce as scientifically indefensible claims made by others regarding the possible existence of nonphysical realms. As we have seen, modern physics imposes neither a limit on the probability for existence of such transcendental worlds, nor restrictions on their nature, total number, or ultimate extent.