

## **Finding the Most Simple**

### **– Introduction –**

"Fundamental", as it applies to the realm of physics, will be taken to mean the most simple foundational level at which a constructive physically real meaning for all of physics can possibly exist. Physically real will be taken to mean both material and physically imaginable. An understanding both of the Cosmos and of particles and quantum interactions must emerge from the same most "Fundamental" beginning.

Paradoxically, understanding the most Fundamental level of physics may not be possible through the discipline of physics as it is practiced. The understanding may need to come from the joint efforts of physicists and of philosophers or metaphysicists.

### **– Digging Deeper –**

Physics has numerous areas each with their foundational underpinnings. Frequently we see relationships between the underpinnings. We do not see a solid, physically real, base foundation from which each of these underpinnings emerge.

The "Big Bang" has been around for almost a century. It forms the foundation for much of our understanding of the Cosmos. Does this foundation share a common ancestor with other foundations? How can it be most simple?

Quantum mechanics provides tools that allow predictions of behavior on a very small probabilistic scale. Does quantum mechanics provide us with the deepest possible understanding of fundamental behaviors? Can physics of the Cosmos be built from it?

The phrase "fundamental force" is used. Are fundamental forces building blocks or are they some yet to be understood dynamic of real building blocks?

The Standard Model organizes, categorizes and predicts the behavior of elementary particles. Different flavours and quantum numbers provide us with appealing names for descriptions of behavior. They do not possess an inherent physical meaning to us. They organize rather than simplify. Does the Standard Model tell what an electron is physically? Has it converged on a single simple entity; or, does it require ever more attributes to describe particles and their behaviors?

What is the fabric of space? Can it be physically real?

A single underlying physically real basis explaining all of physics has not been recognized. If it were then we might understand the meaning of most "Fundamental".

### **– Beyond Observable –**

Those who would realize the most from a Fundamental understanding may be the very ones who defeat discovery of it. A physical theory is judged by the predictions it makes that are verifiable by new observations. We will focus on "observations".

Observable, or measureable, physics can be extended by conjecture (theories). Useful theories usually provide predictions and lack contradictions. They extend our understanding of relationships in Observable Physics, but they are not most Fundamental.

Conjecture has limits on how far it can extend our understanding beyond Observable Physics. Conjecture is not physically real. It may provide a basis upon which to build, albeit a basis in which we must place some limit on our confidence.

If most fundamental turns out to be beyond the limits of conjecture, how will we find it? The alternative would be to start with the most Fundamental and build upwards. We must speculate about what constitutes "most Fundamental". If our speculation builds into observable physics and contains no contradictions to reality it becomes a good candidate for "most Fundamental".

Such a journey from "most Fundamental" is a tall order, but perhaps not an impossible one. With so many bases to cover how can it be other than impossible? The answer is that Nature traveled a path to produce what we see around us. We don't need to create some complicated path. We only need to determine the path that Nature followed.

This alternative "bottom-up" journey starts in the discipline of philosophy or metaphysics. Over a century ago physicists and philosophers pursued ether theories. Those theories failed. As Special Relativity emerged the "bottom-up" search faded.

Is it time to invite philosophy and metaphysics back into the realm of physics? "Bottom-up" thinking may provide the path to the most Fundamental underpinnings of physics. Just as physicists cannot do it alone, neither can philosophers. A productive relationship between these disciplines could prove valuable.

**– Most Simple –**

"Most Fundamental" must lack identifying detail. Identifying detail requires something more than a single simple physical entity. Think about this for a moment. Instead of adding special attributes to an entity, we require it to be absent special attributes. Paths often spread out before they converge. We are seeking convergence to a single entity.

If we were to allow fundamental physical entities to possess identifying details, then there would be multiple fundamental physical entities with variation in those identifying details. They would not be the most Fundamental.

It seems impossible for everything in physics to be explained by complete simplicity until we think about nature itself. Nature follows a simple path to build complexity from simple beginnings. How though could it be possible to build what we know as physics from a single ultimate fundamental entity endowed with no special characteristics?

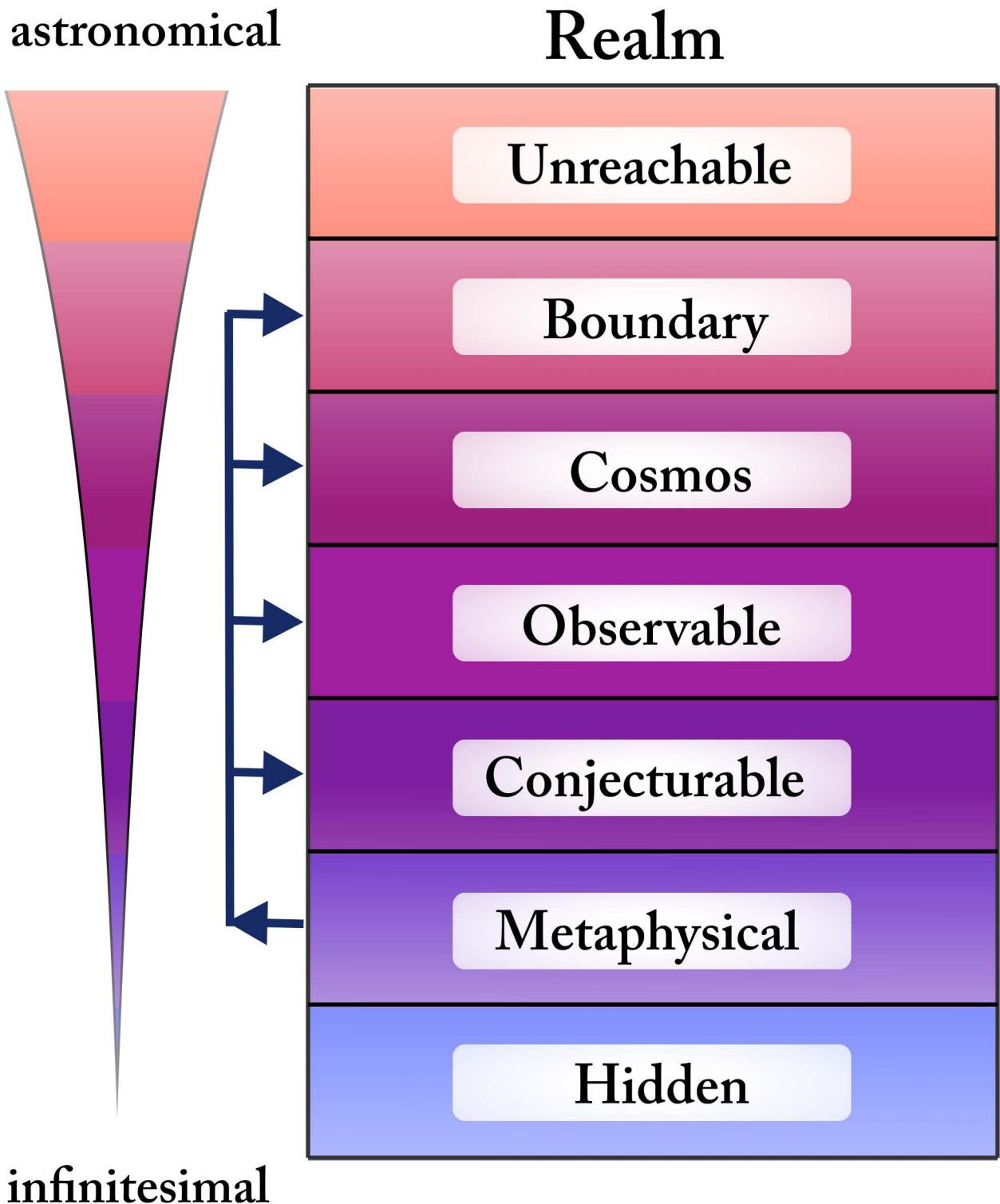
**Segmenting the Universe –**

To help describe what is most Fundamental, we will segment the universe into seven realms. The realms from astronomical and downward to infinitesimal, are:

Unreachable; Boundary of the Universe; The Cosmos; Observable Physics; Conjecturable Physics; Metaphysics; and Hidden. The Unreachable and Hidden realms are not considered in this essay.

The realms are illustrated on the next page. Arrows show the Metaphysical realm providing relationships or a basis for other realms. Similar arrows may relate other realms. There is a feedback process to resolve conflicts with reality.

# Segmenting the Universe



The "**Boundary**" realm marks the far reach of the "Cosmos" realm. This realm may not exist; or, it may relate directly to the Cosmic Microwave Background (CMB).

The "**Cosmos**" realm extends the "Observable" realm into many of the far reaches of the universe. It has similarities to the "Conjecturable" realm in that it uses Theories, such as the Big Bang, that help to reconcile our observations.

The "**Observable**" realm contains that which we consider physically real. Measurement can be straight-forward. We live in this realm and the known laws of physics apply.

The "**Conjecturable**" realm contains Theories, such as the Standard Model and Quantum Mechanics, that allow us to better predict behavior in the "Observable" realm. Theories make new predictions that can be verified in the "Observable" realm. It is important to remember that these theories may utilize analogies that we consider physically real, but they are only analogies. Theories are helpful in extending and organizing "Observable" physics. Theories often add attributes which expand complexity instead of simplifying.

The "**Metaphysical**" realm we define as the lowest level that is needed for a single entity to provide a basis for the other realms. This realm involves contemplating possible relationships, similar to the "Conjecturable" realm. However, this realm builds upward from that which is postulated to be most fundamental. Only if this upward building process merges with reality without exception do we have a most fundamental basis.

– **"Something" or "Nothing"** –

Philosophers sometimes consider the lowest level to consist simply of "Something" and "Nothing" (not even empty space). This makes sense if we strip off the complexity to achieve deeper and deeper levels of simplicity. How though could we possibly build all of Physics from a simple "Something"? The answer is we couldn't.

Magic tricks rely greatly on diverting attention. This is Nature's version of a magic trick. We naturally try to build from the generic "Something". We should instead be building from "Nothing".

Centuries ago philosophers/physicists debated whether "extension" existed in "Nothing". The answer may be that it depends on how one chooses to view it.

"Nothing" provides an infinite choice of coordinate systems, accelerated or not, all of which are equally valid. When two "Something's" chance to encounter one another they form a relative coordinate system where the alternatives are constrained. "Nothing" provides "Something's" with the ability to achieve complex relative dynamics. This complexity could provide a foundation on which to build.

– **Building the Cosmos** –

It is not obvious that one might build the Cosmos from the same simple entity that provides the building block for space and matter. However, if we know how space and matter are built, then perhaps we know the beginning of the Universe.

**– What Next? –**

If we believe a simple entity forming the basis for all of physics cannot be found then we likely will not find it. We need to search with a heartfelt belief that an answer exists.

Should we search from the top-down with the hope that "Conjecturable" physics can converge into a simple entity and eliminate the need for a metaphysical basis? Should we search from the bottom-up and hope that metaphysics can build the reality around us?

Could it be that the answer has already been found but is concealed by the volume of information that abounds?

Combining the talents of philosophers and physicists and searching both from the top-down and the bottom-up should be given greater attention.

When we are willing to learn about nothing, we will be on the pathway to discovering what is most Fundamental.