Physics strings us along

By Margaret Wertheim, MARGARET WERTHEIM is the "Quark Soup" science columnist for the L.A. Weekly. She is at work on a book about the role of imagination in theoretical physics.

THERE HAS BEEN much talk of late about the scientific method, which usually takes place in the context of distinguishing science from other "less rational" practices, such as religion and magic. But in recent years science itself has been showing increasingly magical tendencies. In the field of theoretical physics, it is now common practice to talk about other dimensions of reality, entire landscapes of universes for which there is no empirical evidence whatever.

In the latest, hottest Big Science tome — the delightfully titled "Warped Passages" — Harvard physicist Lisa Randall describes the idea that the universe we see around us is but one tiny part of a vast reality that may include an infinite number of other universes. Randall is an expert on both cosmology and that arcane branch of particle physics known as string theory. By marrying the two fields, she and her colleagues have formulated a picture in which our universe may be seen as a soap-film-like membrane (a "braneworld") sitting inside a much larger space: the bulk. According to general relativity, the universe we live in has four dimensions: three of space and one of time. Randall's work extends this framework and posits the existence of a fifth dimension. The fifth dimension is the bulk, and within its immeasurably expanded space, there is no reason to assume that ours is the only cosmos.

Evidence for this new dimension is nonexistent. The reason it is being imagined is to resolve a puzzle about gravity: Why is it that when you put a magnet on your fridge door, the magnet sticks to the fridge rather than falling to the floor? How is it that the tiny magnet exerts a bigger force than our whole planet?

Randall's fifth dimension is an attempt to explain why gravitational force is so much weaker than the other forces of nature.

Competing versions of string theory talk about 10 or 11 dimensions, though usually they are tiny. Yet these microscopic dimensions have also become seedbeds for epic ecologies of coexisting universes. String cosmologists routinely write papers about the "populations" of universes that would arise from particular versions of their equations, conjuring into being with a few lines of symbols infinite arrays of other worlds.

IN MANY WAYS, string theorists' extension of the universe is just one more step in a historical chain of cosmic expansions. In the 17th century, the Newtonian revolution expanded our vision by positing that the point-like stars were other material suns with their own planetary systems. A century later, Immanuel Kant suggested that the hazy astronomical blobs known as "nebulae" were each separate galaxies, a notion of immensity so staggering it beggared belief at the time. From one material planet to many; from one star to many; from one galaxy to many; and now, according to string theory, our vision must expand from one space-time to many.

The difference here is that the prior extensions were prompted by observations of distant phenomenon. The extra dimensions of string theory and the other universes they might entail have never been observed and, in principle, they may not be observable, at least not directly. At present they are pure fictions. String theory is so fecund in its descriptive power that one physicist has estimated there may be as many as 10 to the power of 100 different versions of its equations! Each one articulates a different set of possible universes and, at present, there is no way of determining if our universe matches any of them.

Once upon a time, the sine qua non of scientific practice was supposed to be empirical verification. Experimental evidence was the core principle of Francis Bacon's much-vaunted "scientific method." In truth, the picture has always been more complex. Science is also an engine of the imagination, leading our minds beyond the mundane realm of what is to the enchanted regions of what might be.

Nowhere is the speculative dimension of science more prominent than theoretical physics, which has given us such magical possibilities as time machines made from spinning black holes, wormholes that become portals to the far ends of the universe and the "parallel worlds" of quantum mechanics, which, in theory, make every possible version of history a realized physical fact.

The stories that theoretical physicists tell us are written in the language of mathematics, but for all its formal rigor, the science has become in effect a form of speculative literature. Unchained by the fetters of verification, string theorists are free to dream, articulating through their equations vast imagined domains in which almost anything that is mathematically possible is deemed to be happening "somewhere."

As Randall writes in her opening pages: "Physics is far more creative and fun than people generally recognize."

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