Core Theory

The quantum revolution gave this revelation: we've finally learned what Matter is. The necessary equations are part of the theoretical structure often called the Standard Model. That yawn-inducing name hardly does the achievement justice, and I'm going to continue my campaign, begun in *The Lightness of Being*, to replace it with something more appropriately awesome:

$$\text{Standard Model} \rightarrow \text{Core Theory}$$

This change is more than justified, because

1. "Model" connotes a disposable makeshift, awaiting replacement by the "real thing". But the Core Theory is already an accurate representation of physical reality, which any future, hypothetical "real thing" must take into account.
2. "Standard" connotes "conventional", and hints at superior wisdom. But no such superior wisdom is available. In fact, I think – and mountains of evidence attest – that while the Core Theory will be supplemented, its core will persist.

The Core Theory embodies beautiful ideas. The equations for atoms and light are, almost literally, the same equations that govern musical instruments and sound. A handful of elegant designs support Nature's exuberant construction, from simple building blocks, of the material world.

Our Core theories of the four forces of Nature – gravity, electromagnetism, and the strong and weak forces – embody, at their heart, a common principle: *local symmetry*. As you will read, this principle both fulfills, and transcends, the yearnings of Pythagoras and Plato, for harmony and conceptual purity. As you will *see*, this principle both builds upon, and transcends, the artistic geometry of Brunelleschi and the brilliant insights of Newton and Maxwell into the nature of color.

The Core Theory completes, for practical purposes, the analysis of matter. Using it, we can *deduce* what sorts of atomic nuclei, atoms, molecules – and stars – exist. And we can reliably orchestrate the behavior of larger assemblies of these elements, to make transistors, lasers, or Large Hadron Colliders. The equations of the Core Theory have been tested with far greater accuracy, and under far more extreme conditions, than are required for applications in chemistry, biology, engineering, or astrophysics. While there certainly are many things we don't understand – I'll mention some important ones momentarily! – we do understand the Matter we're made from, and that we encounter in normal life (even if we're chemists, engineers, or astrophysicists).