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Particle Substructure. A Common Theme of Discovery in this Century†

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It is not once nor twice but times
without number that the same ideas
make their appearance in the world.
Aristotle, *On the Heavens*

1. Introduction

After exposure to public accounts of scientific work the layman might conclude that new results or 'breakthroughs' in science tend to supersede results that were previously known and accepted. However, in physics this is rarely the case. Rather, the more common situation is that the range of validity of an older concept is found to be less than universal. For instance, Newtonian mechanics remains as valid for velocities small compared to the velocity of light as it did before the advent of relativity.

What is even more remarkable is that, despite the explosion of knowledge about nature on a smaller and smaller scale, some of the basic rules that describe the behaviour of matter remain equally valid today. It is to this latter phenomenon that this talk is addressed. Specifically, I will give some examples from modern developments in particle physics which demonstrate that the fundamental rules of quantum mechanics, applied to all forces in nature as they became understood, have retained their validity. The well-established laws of electricity and magnetism, reformulated in terms of quantum mechanics, have exhibited a truly remarkable numerical agreement between theory and experiment over an enormous range of observation.

As experimental techniques have grown from the top of a laboratory bench to the large accelerators of today, the basic components of experimentation have changed vastly in scale but only little in basic function. More important, the motivation of those engaged in this type of experimentation has hardly changed at all.

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