

APR10-2009-020065

Abstract for an Invited Paper
for the APR10 Meeting of
the American Physical Society

Anticipating Discoveries in the LHC Era

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The LHC is taking its first steps, and the Tevatron continues running smoothly. In this talk I will review and reconsider what discoveries might occur at these machines in the next few years. First and foremost, the final piece in the puzzle of electroweak symmetry breaking lies within reach, and finding it is the aim of both machines. But the question of whether this piece is the single Higgs boson of the “minimal” standard model, or whether it consists of a whole new world of particles and forces, remains surprisingly open. Much theoretical work on models beyond the minimal standard model is driven by the “Hierarchy Problem” (why is it possible for the electroweak energy scale to be so far below the Planck energy scale?) The number of known solutions to this problem is strikingly small. However, because slightly different variants of a solution can lead to dramatically different experimental signatures (as in biology, where genotype does not map smoothly to phenotype), the range of search strategies that are needed to look for new physics is vast. I will discuss standard approaches to experimental searches and what they are designed to find. Then, illustrating the threat that theoretical bias always poses to these experiments, I will give examples of how recently relaxed biases have led theorists to propose entirely new classes of possible signatures. This has led to a wave of interesting new searches and studies by experimentalists, and offers new opportunities for discoveries in the near term.