Searching for Exotic New Physics at the LHC

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Abstract: The Standard Model of particle physics provides an excellent description of particle interactions at high energies and small distance scales. With the recent discovery of the Higgs boson, the predicted particle content of the Standard Model is now complete. However, the Standard Model cannot explain certain phenomena, such as the origin of non-zero neutrino masses, the nature of dark matter, and why the Higgs mass appears to be very finely tuned. This suggests that there exist particles and forces beyond the Standard Model, possibly at an energy scale that we can reach with modern technology. The Large Hadron Collider (LHC) and the ATLAS experiment were built to test the Standard Model in an unexplored region of the high-energy particle interactions, and to search for qualitatively new particles and forces not predicted by the Standard Model.

After a description of the LHC and the ATLAS experiment, and a review of our important achievements from the first run of the LHC, I will describe our efforts to look for exotic new physics in high-energy collisions. I will focus on searches for large extra dimensions, new heavy bosons, and on model-independent searches that can be used to constrain broad classes of new physics models. I will conclude with prospects for discovery in the upcoming high-energy run at the LHC, which will begin this Spring.