Recent Progress in Particle Astrophysics and Cosmology

Pisin Chen

Department of Physics and Graduate Institute of Astrophysics, National Taiwan University, Taipei, Taiwan 10617

a Leung Center for Cosmology and Particle Astrophysics, National Taiwan University, Taipei, Taiwan 10617

b Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, Stanford, CA 94305, USA

pisinchen@phys.ntu.edu.tw

Recent years have seen the dramatic progress in our understanding of the universe. Such advancement covers the entire spectrum of subjects in particle astrophysics and cosmology, ranging from inflation, dark matter, dark energy, to ultra-high energy cosmic rays (UHECR) and neutrinos (UHECN). These are made possible due to the fact that almost every frontier subject in this field has had its most advanced detection/observation instruments completed and in operation during this time. For example with much higher precision, the Planck data has on the one hand confirmed the general notions of cosmology, but on the other hand imposed new challenges to our ultimate understanding of both early and late-time universes. Similar situation applies to UHECR physics with Pierre Auger Observatory in the southern hemisphere and Telescope Array in the north, where new revelations on its composition and spectral shape have been put forward. For UHECR detection, IceCube has provided us constraints on gamma ray bursts (GRB) as ‘cosmic accelerators’ while ANITA puts new upper bound on GZK neutrino flux. The AMS onboard the International Space Station announced their confirmation of the rise of the positron fraction above 20GeV previously seen by Pamela and Fermi, showing evidence of new physics phenomena. Then there came the exciting news from the SuperCDMS about the possible evidence of WIMP-type dark matter with mass around 8.9GeV. In this talk I will give an overview of these discoveries and their theoretical implications, and highlight several exciting projects under preparation.