NEUTRINO PHYSICS WITH THE ICECUBE DETECTOR

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IceCube is a cubic kilometer neutrino telescope under construction at the South Pole. The primary goal is to discover astrophysical sources of high energy neutrinos. We describe the detector and present results on atmospheric muon neutrinos from 2006 data collected with nine detector strings.

1. Introduction

The IceCube detector is a cubic kilometer neutrino telescope under construction at the South Pole[1]. The main goal of IceCube is to detect cosmic neutrinos of all flavors in a wide (100 GeV to 100 EeV) energy range[a]. IceCube will search for point sources of extra-terrestrial muon neutrinos and diffuse fluxes of extra-terrestrial neutrinos of all flavors. Possible high energy neutrino sources are active galactive nuclei (AGNs), gamma-ray bursters (GRBs) and supernova remnants (SNRs). Other IceCube physics topics include searches for WIMP anihilation in the Earth and Sun, signatures of supersymmetry in neutrino interactions, and exotica like magnetic monopoles or extra dimensions[1].

2. The IceCube detector

The IceCube detector is shown in Fig.1. When complete, the detector will cover an area of 1 km^2 at depths of 1.45 to 2.45 km below the surface. The $\sim$ 1km^3 detector volume is driven by the low extra-terrestrial neutrino flux expectations[4] and neutrino interaction cross sections. IceCube will be composed of $\sim$ 4800 in-ice Digital Optical Modules (DOMs), recording Cherenkov light from charged particles, on 80 strings spaced by 125 m.

[a]So far the only observed extra-terrestrial neutrinos are low energy neutrinos from the Sun[2] and SN1987A[3].