Acoustic detection of high energy neutrinos in ice: Status and results from the South Pole Acoustic Test Setup

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Currently, several experiments are running or being constructed in order to detect neutrinos of the GeV to PeV energy region by Cherenkov light emission of secondary particles produced in neutrino-nucleon interactions. In order to observe the very small predicted neutrino fluxes at the higher energies of EeV with reasonable statistics, new detection methods are needed to instrument the required larger detector volumes at reasonable cost. One solution is the detection of the acoustic signature of an UHE neutrino interaction since acoustic waves are predicted to have attenuation lengths in the order of a few kilometer in ice and water [1]. Combining the optical and radio techniques with this acoustic detection method would allow for a larger sensitive volume at reasonable cost with high sensitivity and low background [2].

The feasibility and specific design of an acoustic neutrino detection array in the South Pole ice depend on the acoustic properties of the ice. For example, the speed of sound and background noise levels relate to the level of refraction of the surface noise and energy threshold respectively. The South Pole Acoustic Test Setup (SPATS) has been built to evaluate the acoustic characteristics of the ice in the 10 to 100 kHz frequency range.

The array of three vertical acoustic strings that had been deployed in the upper 400 meter of the Antarctic ice cap in January 2007, was extended in the 2007/2008 polar season by a fourth string. Each string has 7 stages with each one transmitter and one sensor module. Moreover, a retrievable transmitter was used in 6 drill holes during the last polar season to collect data at even more distances and depths. The latest SPATS results will be presented at this conference.
