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Acoustic properties of glacial ice for neutrino detection and the Enceladus Explorer

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Ultra high energy neutrinos may be observed in ice by the emission of acoustic signals. The SPATS detector has successfully shown that GZK-neutrinos can be observed in the clear ice at the South Pole at the IceCube detector site. To explore other potential detection sites glacial ice in the Alps and in Antarctica has been surveyed for its acoustical properties. The purpose of the Enceladus Explorer (EnEx) on the other hand is the search for extraterrestrial life on the Saturn moon Enceladus. Here acoustics is used to maneuver subsurface inside the ice by trilateration of signals. A system of acoustic pingers has been developed to study both applications.
In the south polar region of the moon Enceladus secluded crevasses are situated, filled with liquid water probably heated by tidal forces due to the short distance to Saturn. We intend to take a sample from these crevasses by using a combination of a melt down and steering probe called IceMole (IM). Maneuvering IM requires a good understanding of ice properties like the speed of sound, the attenuation of acoustic signals in ice, their directional dependencies and their dependence on different frequencies. Information about this can not only be used for a positioning system but could also contribute to the design of a future large scale acoustic neutrino detector.
We present our analysis methods and the findings on attenuation, sound speed and frequency response obtained at several sites in the Alps and Antarctica.

Collaboration

– not specified –

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