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Enhanced sensitivity to astrophysical neutrinos with a surface veto array above IceCube

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The IceCube neutrino observatory features a kilometer-cubed deep detector and a surface component, IceTop, instrumenting the square-kilometer footprint of the detector. IceTop consists of ice-filled tanks equipped with optical sensors capable of detecting charged particles produced in air showers. Besides measuring the cosmic-ray spectrum and composition, IceTop can be used as a veto for IceCube. With the discovery of an astrophysical flux at high energy, this role is becoming more important as a pathway to the design of a larger surface array. Since the earth is not transparent to very-high-energy neutrinos, searching for a signal from the southern hemisphere is a priority. This search, however, requires suppressing a large background consisting of penetrating atmospheric muons and neutrinos. A surface array, such as IceTop, can reduce the background by identifying particles which are generated in the same air shower as the muons in the deep detector. I will present the capabilities and limitations of IceTop as a veto for cosmic rays as well as the status of simulations of various designs for an upgraded surface array.

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