Ice Fishing for Neutrinos
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Neutrinos are particles that only interact weakly and thus are difficult to detect, requiring large detector volumes and very efficient background suppression. Since they travel through space largely undisturbed, they are great messengers from astronomic sources invisible in electromagnetic radiation. If a high energy neutrino interacts with a nucleus, it creates a hadronic shower and in the case of a charged-current interaction, also a charged lepton. The secondary particles emit Cherenkov radiation when travelling through a medium at a speed higher than the medium’s speed of light. The IceCube Neutrino Observatory is detecting high energy neutrinos of atmospheric and astrophysical origin. Within a cubic kilometer of instrumented volume, PMTs deployed deep in the Antarctic ice collect Cherenkov radiation from secondary particles created in neutrino interactions. IceCube has found the highest-energy neutrino events to-date, with energies exceeding 1 PeV. These neutrinos are too energetic to have been produced in the Earth’s atmosphere and thus must come from yet unknown astrophysical sources. After presenting the detector setup, neutrino signatures, and select analysis procedures, I will discuss some of IceCube’s high energy results.