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IceCube Supernova Detection and Contributions to SNEWS 2.0

Saturday 15 June 2019 17:00 (15 minutes)

The IceCube Neutrino Observatory is an anchor of the SuperNova Early Warning System (SNEWS). IceCube is comprised of 5160 digital optical modules (DOMs) instrumenting 1 km^3 of ice deep below the surface of the geographic South Pole. This large volume makes it sensitive to neutrinos generated by core-collapse supernovae (CCSNe) in the Milky Way at >10σ for all progenitor models, and sensitive to neutrinos from CCSNe in the Magellanic Clouds at the 5σ level. Additionally, IceCube has good resolution on short timescales, making it sensitive to physics during the onset of the neutrino burst, and useful for triangulation with other neutrino experiments. IceCube's supernova trigger continuously searches for a collective rise in hit rates across the DOMs in a sliding window of several seconds. This trigger suffers from a substantial background of cosmic muon hits but has a high uptime (>99.5%), so the detector provides continuous coverage of the Milky Way. We will summarize the IceCube data currently sent to SNEWS, and discuss additional information that we may wish to implement in SNEWS 2.0 to improve source triangulation and studies of the burst onset. We will also discuss how IceCube's low-significance alerts could be used for testing the SNEWS pipeline. Finally, we describe potential IceCube-Gen2 hardware upgrades that will improve IceCube's CCSN detection horizon and neutrino energy resolution.

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