Contribution ID: **1106** Type: **Poster**

An End-to-End Test of the Sensitivity of IceCube to the Neutrino Burst from a Core-Collapse Supernova

Friday 16 July 2021 19:18 (12 minutes)

The next Galactic supernova presents a once-in-a lifetime opportunity to obtain detailed information about the explosion of a star and the extreme conditions found within its core. A core-collapse supernova will produce a neutrino burst visible up to half a day before electromagnetic radiation from the explosion, so the burst will provide an early warning for optical follow-up. Since local supernovae are exceedingly rare, it is critical that neutrino detectors provide prompt alerts after the arrival of a burst. The IceCube Neutrino Observatory operates with >99% uptime and is sensitive to a variety of supernova models at levels >10σ within the Milky way. Also, the IceCube Supernova Data Acquisition (SNDAQ) online triggering system is capable of issuing alerts within 7 minutes of a triggering event. IceCube's high sensitivity, near perfect uptime, and ability to issue prompt alerts makes it a critical component of the worldwide network of detectors known as the SuperNova Early Warning System (SNEWS 2.0). A "fire drill" system was designed to inject false supernova signals into the IceCube online systems, upstream in the data pipeline from SNDAQ. We will discuss IceCube's sensitivity to supernova near the Milky Way, and describe the data challenges used to ensure the readiness of SNDAQ, the IceCube Neutrino detector and its operators. We will also discuss coordination of IceCube alerts and data challenges with SNEWS 2.0.

Keywords

Collaboration

IceCube

other Collaboration

Subcategory

Experimental Methods & Instrumentation

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Session Classification: Discussion

Track Classification: Scientific Field: NU | Neutrinos & Muons