

Supernova Early Warning in the Daya Bay Reactor Neutrino Experiment

Sunday 16 June 2019 13:50 (15 minutes)

A prompt warning of supernova burst neutrino signals is quite attractive. The Daya Bay Reactor Neutrino Experiment, with liquid scintillator, is sensitive to the inverse-beta-decay (IBD) process of electron-antineutrinos, and it can give a real-time measurement of the full supernova burst neutrino energy spectrum. The Daya Bay experiment has 8 isolated neutrino detectors, so that the experiment has a better rejection to muon spallation background than single-detector experiments. A fast supernova online trigger system embedded in the data acquisition system has been implemented to enable a prompt detection of a group of IBD coincidence signals for every sliding 10-second window. This trigger has gone through both offline data analysis and the online test. The single detector background rate, including the reactor neutrino background and the fast neutron background, has been understood. A simulation of supernova neutrino signals with mean energy around 15 MeV shows that about 70% detection efficiency can be achieved for one individual supernova neutrino IBD event in each detector. A golden trigger threshold, i.e. with a false alarm rate $< 1/\text{year}$, can be set for as low as 6 candidates among the 8 detectors, leading to a 100% detection efficiency to all the 1987a type supernova burst at the distance of the Milky Way center and 95% detection efficiency to the edge of the Milky Way. As a SNEWS group member experiment, a prompt, 10s latency, trigger signal can be sent to the SNEWS server, and the experiment starts stable data-taking from 2011 and plan to continue till 2020.

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Session Classification: Contributed talks VI