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WIT: from low energy to supernova neutrinos for Super-Kamiokande in the SK-Gd phase.

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The Super-Kamiokande water Cherenkov underground neutrino observatory is located in Japan. Since 2020, it has undergone two loadings with gadolinium sulfate. In the first loading during summer 2020, 13 tons of gadolinium sulfate octahydrate were dissolved, corresponding to a mass concentration of 0.02% gadolinium sulfate. In the second loading, 26 tons were diluted, resulting in a mass concentration of 0.06% gadolinium sulfate. These loadings enabled approximately 50% and 75% of neutron captures on gadolinium after the first and second loadings, respectively, leading to a new phase known as SK-Gd. In this phase, neutron captures predominantly occur on gadolinium, significantly improving the sensitivity to anti-neutrinos.

The Wide-band Intelligent Trigger (WIT) is a computing farm that receives online data from Super-Kamiokande's data acquisition system (DAQ) and triggers on events with a kinetic energy of at least 2.5 MeV. These events are then stored for later analysis. Although WIT was originally designed to improve Solar analyses, the dissolution of gadolinium has opened up new physics opportunities. One of these opportunities is the study of spallation-induced backgrounds, which are relevant for various analyses. Additionally, the online detection of supernovae has become possible, ranging from the detection of pre-core collapse supernova anti-neutrinos from massive and close stars to the detection of galactic core collapse supernovae using only their anti-neutrinos.

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