The Neutrino Signal From Pair Instability Supernovae

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Pair-instability supernovae (PISNe) are the explosions of very massive stars with carbon-oxygen cores in the range of 64 $\mathrm{M}_\odot$ to 133 $\mathrm{M}_\odot$. These kind of supernovae are candidates for some observed superluminous supernovae although recent studies suggest PISNe in the local Universe may be much dimmer and hidden among other supernova classes. While observations of PISNe using electromagnetic radiation may be able to distinguish these supernovae from the other types, a much clearer and unambiguous difference is found in the neutrino emission. In this talk I present the first ever calculations of the neutrino signal from pair-instability supernovae using two hydrodynamical simulations chosen to bracket the mass range of the carbon-oxygen core. We take into account both the full time and energy dependence of the emission and the flavor oscillations through the mantle of the star, as well as investigating equation-of-state and line-of-sight differences. We then process the computed neutrino fluxes at Earth through five different neutrino detectors chosen to represent the range of current or near-future technologies. I will show how the neutrino signal from PISNe possesses unique features that distinguish it from other supernovae, how the detectors we consider are capable of observing neutrinos from PISNe at the standard distance of 10 kpc, and how the proposed HyperKamiokande detector can even reach the Large Megallanic Cloud and the several very high mass stars known to exist there.