Neutrinos, Photons, and Nucleosynthesis from Newly Formed Compact Objects

Hot dense neutron stars are formed in the inner most regions of massive stars during core collapse supernovae and during the merger of two neutron stars. Copious numbers of photons, neutrinos, and newly formed nuclei are produced during these events. In particular, the heavy r-process nuclei are likely produced in one or both of these scenarios. In these environments, nuclear physics, hydrodynamics, and gravity play paramount roles in determining the evolution of the dense object itself, what nuclei are synthesized, and the properties of the emitted radiation. I will first discuss the physics of the inner most regions core-collapse supernovae. This part of the talk will focus on my work studying neutrino emission from protoneutron stars, which has constrained both the late time neutrino signal and possible modes of nucleosynthesis in these events. Second, I will discuss nucleosynthesis in material ejected during binary neutron star mergers and my work predicting optical transients powered by the decay of ejected radioactive nuclei. I will highlight some of the uncertainties that exist in both of these scenarios, and how these uncertainties can be reduced with future theoretical and computational work with input from current and next generation observational and experimental facilities.

Thanks,

Luke