Nucleosynthesis of "light" heavy nuclei in neutrino-drive winds. Role of (α,n) reaction rates.

J. Pereira,[1,2] A. Arcones,[3,4] J. Bliss,[3,4] and F. Montes[1,2]

[1]*National Superconducting Cyclotron Laboratory, MSU, East Lansing, MI 48824, USA*

[2]*Joint Institute for Nuclear Astrophysics, http://www.jinaweb.org*

[3]*Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, D-64291, Germany*

[4]*GSI Helmholtzzentrum für Schwerionenforschung, GmbH, Plankstr. 1, Darmstadt, D-64291, Germany*

The observation of a kilonova (AT 2017gfo) associated with the gravitational-wave source GW170817 in the summer of 2017 provided direct evidence that heavy nuclei are synthetized in binary neutron-star mergers. Whereas this site is likely the host for the main r process, responsible for the robustness of the abundance pattern in the region past Z=56, other astrophysical sources might contribute to the production of lighter heavy elements around the so-called 1st peak (e.g. Sr, Y, Zr).

Neutrino-driven winds following core-collapse supernovae explosions have been proposed as a possible scenario where the synthesis of the so-called light heavy nuclei (between Fe and Ag) might occur. Steady-state model calculations, combined with nucleosynthesis reaction networks indicate a substantial sensitivity of the element abundances to (α,n) reaction rates and the astrophysical conditions (e.g. alpha-to-seed and neutron-to-seed ratios). In this presentation, I will summarize the most relevant aspects of our study, emphasizing the (α,n) nuclear reactions that have the most impact in the resulting abundances. Preliminary experimental results on some of these reactions will be briefly discussed.