Nuclear Energy Generation in the r-Process

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The recent observation of an optical afterglow ("kilo- or macronova") in the aftermath of the gravitational wave event GW170817 has confirmed that neutron star mergers are an operating site of the r-process. In such an event, energy that is released in nuclear reactions during the r-process can thermalize with the ejecta and act as a heating source. This feedback of energy influences the dynamics of the ejecta and the ejecta mass and thus needs to be accounted for in hydrodynamical simulations of neutron star mergers.
Furthermore, the late-time decays of radioactive nuclei that have been produced by the r-process power the kilonova light curve. The direct connection between nuclear decays and the evolution of the observed light curve allows for new insights into the mechanism of the r-process.
We will present the dependency of nuclear energy generation in the r-process on electron fraction, entropy, dynamical timescale, and for different theoretical mass models. Moreover, we give a new formula for heating in hydrodynamical models. We are also exploring the behaviour of late-time decays to stability relevant for the kilonova light curve and discuss interesting cases that result in a unique heating rate.