Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Resolving Fast Ejecta from Binary Neutron Star Mergers using the Grid-Based Code FLASH[1] COLEMAN DEAN, RODRIGO FERNNDEZ, Univ of Alberta — We simulate relativistic ejecta from the contact interface of a Binary Neutron Star (BNS) merger at the highest resolution to date. The fastest component of this ejecta is predicted to freeze out the r-process and power an ultraviolet (UV) precursor to the kilonova through the radioactive decay of free neutrons. The amount of this fast ejecta produced in particle-based and grid-based hydrodynamic merger simulations is not consistent between methods, with grid codes producing orders of magnitude less fast outflows than particle codes. Here we investigate whether this deficit of fast ejecta in grid codes is due to insufficient spatial resolution, by simulating BNS mergers in a two dimensional co-rotating cylindrical coordinate system. We use self-gravitating Newtonian hydrodynamics, a gravitational wave emission based inspiral rate, and a piecewise polytropic equation of state with approximate thermal effects. This allows us to achieve a minimum grid spacing of 4 m, which resolves the pressure scale height of the stellar surface regions, where the fastest ejecta is produced upon contact. We discuss the implications of our results for the existence of prompt UV counterparts of kilonovae.

[1]We acknowledge support from NSERC of Canada, the University of Alberta, as well as the Alberta government through the Queen Elizabeth II Graduate Scholarship (2018/2019), and the Alberta Graduate Excellence Scholarship (2019/2020).

Coleman Dean
Univ of Alberta

Date submitted: 06 Jan 2021 Electronic form version 1.4