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r-process nucleosynthesis from matter ejected in binary neutron star mergers

We perform full GR simulations of binary neutron-star mergers employing three different nuclear-physics EOS, considering both equal- and unequal-mass configurations, and adopting a leakage scheme to account for neutrino radiative losses. Using a combination of techniques, we carry out an extensive and systematic study of the hydrodynamical, thermodynamical, and geometrical properties of the matter ejected dynamically, employing a nuclear-reaction network to recover the relative abundances of heavy elements produced by each configurations. Three results are particularly important. First we find that within the sample considered here, both the properties of the dynamical ejecta and the nucleosynthesis yields are robust against variations of the EOS and masses. Second, using a conservative but robust criterion for unbound matter, we find that the amount of ejected mass is less than 1e-3 solar masses, hence at least one order of magnitude smaller than the standard assumptions in modelling kilonova signals. Finally, using a simplified and gray-opacity model we assess the observability of the kilonova emission, finding that for all binaries the luminosity peaks around ~1/2 day in the H-band, reaching a maximum magnitude of -13, and decreasing rapidly after. Supported by European Research Council Grant No. 677912 EUROPIUM

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