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Hierarchical Triples as Early Sources of r-process Elements

Abstract

Neutron star mergers have been proposed as the main source of heavy r-process nucleosynthesis in the Universe. However, the mergers' significant expected delay after binary formation is in tension with observed very early r-process enrichment, e.g., in the dwarf galaxy Reticulum II. The LIGO and Virgo gravitational-wave observatories discovered two binary mergers with lighter companion masses ($\sim 2.6 M_{\odot}$) similar to the total mass of many binary neutron star systems in the Galaxy. The progenitor of such mergers could be a neutron star binary orbiting a black hole. We discuss the possibility, and observational support and consequences, that neutron star binaries form in hierarchical triples, which in turn merge rapidly and could explain the observed very early r-process enrichment.