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Optical Transients and Nucleosynthesis from Neutron Star Mergers

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The production and ejection of radioactive isotopes during, or immediately following, the merger of two neutron stars (or a neutron star and a black hole) can give rise to optical/infrared emission similar to, but dimmer and briefer than that of an ordinary supernova. These transients are promising electromagnetic counterparts to gravitational wave sources, and may be diagnostic of the sites of r-process nucleosynthesis. I will describe the physics of compact object mergers and their aftermath, and present calculations that demonstrate how the nucleosynthetic yields depend on the mechanism of ejection, the degree of neutron-richness and neutrino irradiation, and the survival lifetime of a remnant hyper-massive neutron star or the spin of a remnant black hole. We find that the color and luminosity of the transients depend sensitively on the mass and composition of the outflow, and therefore can provide a direct and informative probe of r-process nucleosynthesis at the production site.