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Probing r-process nucleosynthesis in neutron star mergers

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One possible site of r-process nucleosynthesis is the violent merger of two neutron stars, in which a small fraction of neutron rich material may be ejected at sub-relativistic speeds. The subsequently radioactive decay of the heavy nuclei should power transient optical emission similar to, but significantly dimmer than, an ordinary supernova. New astronomical surveys will be able to detect such transients, which would provide a remarkable opportunity to directly probe the properties of r-process nuclei soon after they were produced. We discuss the theory of r-process production in mergers, and present numerical simulations which estimate the brightness, duration, and spectroscopic properties of the associated transients.