Colloquium

Radioactive transients from the r-process ejecta of neutron star mergers

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Refreshments at 3:30 P.M. in 202 NSH

During (or immediately following) the violent merger of two neutron stars, some small fraction of mass is likely thrown off at sub-relativistic speeds. This material may assemble into heavier nuclei by rapid neutron capture (the r-process), perhaps making a major contribution to the heavy element production in the Universe. The subsequently radioactive decay of the freshly synthesized nuclei may power transient visible emission similar to, but significantly dimmer than, an ordinary supernova. New astronomical surveys may be able to detect such events, which would present an extraordinary opportunity to probe the unknown site of the r-process, allowing us to study the properties of these nuclei immediately after they were produced. Assuming that advanced LIGO/VIRGO succeed in detecting gravitational waves from neutron star mergers, these transients would also serve as informative electromagnetic counterparts. I will discuss the theory of r-process production in neutron star mergers, discuss the nature of the opacity and radiative transfer in the ejecta, and present calculations which estimate the brightness, duration, and spectral properties of the associated astronomical transients.

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