University of Notre Dame
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COLLOQUIUM

Observable Signatures of Neutron Star Mergers

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(Refreshments at 3:30 p.m. NSH 202)

A fraction of neutron star (NS) and black hole binaries are formed sufficiently compact that they will inspiral and merge due to the emission of gravitational waves within the lifetime of the Universe. Such compact object mergers, in addition to representing some of the most extreme known astrophysical events, are among the most promising sources for the direct detection of gravitational waves with ground-based interferometers such as LIGO and Virgo. Maximizing the science of such a detection will, however, require identifying a coincident electromagnetic (EM) counterpart. One possible source of EM emission is a gamma-ray burst (GRB), powered by the accretion of material that remains in a rotationally-supported torus around the central black hole. I will overview the observational and theoretical status of the connection between NS mergers and the "short duration" subclass of GRBs. Although new observations from NASA's Swift observatory have provided stunning evidence in favor of the merger model, the puzzling discovery has also been made that many short GRBs are followed by late-time X-ray flaring activity, which does not fit current theory and may require modifying or considering alternative progenitor models. Another source of EM emission from NS mergers is a supernova-like optical transient, powered by the radioactive decay of heavy elements synthesized in neutron-rich ejecta from the merger. I will present the first calculations of the radioactively-powered transients from mergers that include both realistic nuclear physics and radiative transport, and I will discuss the prospects for detecting and identifying such events with present and future telescopes. NS mergers are an exciting area of research because ultimately comprehending their full range of observable signatures requires addressing the fascinating interplay between the physics of relativistic fluid dynamics, ultra-strong gravity, strong electromagnetic fields, nuclear/weak interactions, and plasma processes such as collisionless shock formation and non-thermal particle acceleration.

Host: Mark Caprio

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