

## ASTROPHYSICS SEMINAR SERIES

### **Constraints on the Nuclear Equation of State and r-Process Nucleosynthesis from the Multi-Messenger Detection of Binary Neutron-Star Merger GW170817**

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12:30 pm - Rm 184 NSH

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The first detection of gravitational waves a binary neutron star merger GW170817 by the LIGO-Virgo Collaboration has provided fundamental new insights into the astrophysical site for the r process nucleosynthesis and on the nature of dense neutron-star matter. The detected gravitational wave signal depends upon the tidal distortion of the neutron stars as they approach merger. We examine how the detected “chirp” depends the adopted equation of state. This places new constrains on the properties of nuclear matter. The detected evidence of heavy-element nucleosynthesis also provides insight into the nature of the r-process and the fission properties of the heaviest nuclei. Parametrically, one can divide models for the r-process into three scenarios roughly characterized by the number of neutron captures per seed nucleus ( $n/s$ ). In addition to neutron-star mergers, these include magneto-hydrodynamic jets from supernovae and the neutrino heated wind above the proto neutron star in core-collapse supernovae. Insight from GW170817 allows one to better quantify the relative contributions of each astrophysical site and the fission termination of the r-process.



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