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The effect of atomic data in modeling kilonova from photospheric to nebular phase

Binary neutron star (BNS) mergers provide an excellent cosmic laboratory for understanding the origin of heavy ($Z > 26$) elements, which has been a long-standing mystery in astronomy. In the neutron-rich material ejected from the BNS merger, heavy elements are synthesized via rapid neutron capture (r-process). The radioactive decay of such elements produces emission in the ultraviolet-optical-infrared (UVOIR) range, called a kilonova. Such a kilonova is already detected as a follow-up observation of gravitational wave from a BNS merger (GW170817), ushering in the era of multi-messenger astronomy.

The observational properties of the kilonova (light curve and spectra) across all different (photospheric to nebular) phases depend on the microphysics, i.e., the detailed atomic data of the heavy elements. Calculation of such atomic data hinders the progress towards modeling such transients. We calculate such atomic data suitable for modeling kilonova across different phases. In my talk, I will discuss the recent progress in such atomic calculations and its effect on modeling kilonova light curves starting from early photospheric phase (t $\sim$ hour) to nebular phase (t $>$ a week).

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