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The Time Dependent Nebular Phase of Kilonovae

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The thermal transient following a binary neutron star merger, known as a kilonova (KNa), is expected to enter the steady state nebular phase several days to weeks after merge. In this state, the ejecta is optically thin and bolometric luminosity tracks instantaneous radioactive energy deposition. The steady-state phase is expected to last until reprocessing timescales become long, at which point the time dependent phase begins. Thermodynamic quantities such as temperature and ionisation, as well as luminosity, deviate from the steady state solutions during this transition and onwards. We study this effect on the temperature, ionisation and luminosity solutions of KNa ejecta in non-local thermodynamic equilibrium (NLTE), using the Monte Carlo spectral synthesis code SUMO. A simple single zone, spherically symmetric explosion model undergoing homologous expansion is investigated in a timespan ranging from 5 to 100 days after merge. In this talk, I will discuss the impact of time dependent effects, and their dependencies on ejecta parameters and energy deposition.

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