Contribution ID: **55** Type: **Oral Contribution**

Spectral modelling of kilonovae in 3D NLTE

Wednesday 11 June 2025 09:30 (20 minutes)

Kilonovae are the transients powered by the radioactive decay of *r*-process elements, usually associated with neutron star mergers (NSMs). The late-time spectrum of NSMs is the most important tool to investigate the origin of the heaviest elements including the actinides, their nucleosynthesis at these sites, the environments of their production, and whether or not their abundances can be sufficiently explained by NSMs alone. Spectral modelling is an essential bridge to validate the theory of *r*-process sites, as it allows the results of hydrodynamic explosion models to be compared directly with observations.

We present the first results of our work on the spectral modelling of kilonovae in three dimensions (3D) and non-local thermodynamic equilibrium (NLTE). This approach is essential since the hydrodynamical model results of NSMs are highly asymmetric, requiring 3D treatment; additionally, the elemental signatures of the bulk material in the ejecta become visible only at late times, when NLTE is a necessity.
EXTRASS is a spectral code designed for the 3D NLTE modelling of supernovae in the late-time nebular phase. It is able to generate light curves and spectra for arbitrary viewing angles by following photon packets, using explosion models as input. We are extending this code to kilonovae, with the aim of producing the first 3D NLTE synthetic light curves and spectra of NSM models.

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