

Spectral analysis and plasma ejecta opacity of the early-stage kilonova

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In the context of the multi-messenger astronomy, the observation of an electromagnetic counterpart of the GW170817 event, known as kilonova (KN), provided evidence that the coalescence of binary neutron stars systems is a favourable stellar site hosting the rapid neutron capture process (r-process). Critical information related to the KN plasma composition can be derived through the analysis of spectra. In this framework, we present numerical results of selected light r-process nuclei at different ionisation states of interest for the early-stage KN ejecta, which have been performed using the relativistic atomic code package *grasp2018* to estimate plasma opacity values. Moreover, these opacity results were used as input to the radiative transfer code *POSSIS* (Bulla M., *MNRAS*, 2019) to recreate and study spectral features and bolometric KN light curves, in order to provide useful constraints with the observed data and to improve our understanding of nuclear processes involved. Finally, we highlight the importance of having more and accurate atomic inputs to better address the opacity estimation and KN light curves modelling.

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