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Late time behaviour of the kilonova light curves

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Among the different signals in multimessenger astrophysics, the kilonovae are of particular interest to nuclear physicists. These electromagnetic signals can emerge from the ejecta of neutron star (NS) - NS mergers [1]. They are expected to be powered by nuclear decays since such mergers are considered dominant sites for r-process nucleosynthesis of heavy (unstable) nuclei. Even though there exist several works based on r-process network calculations, there remain loopholes in our understanding of the energy production in kilonovae. It is not easy to pin down the interplay between nuclear physics and astrophysics and new findings still emerge [2].

In this talk, we shall revisit one of the earliest kilonova models by Li and Paczynski [3] with some improvements and present a detailed analysis using all available data on the different nuclear decay modes. We shall point out some interesting features of the competition between the different decay modes at different time scales and present some hitherto unnoticed features of their role in the luminosity curves at late times.

[1] M. R. Drout et al. Science 358, 1570 (2017).
[2] Yu-Han Yang et al., Nature 626, 742 (2024).
[3] Li-Xin Li and B. Paczynski, The Astrophys. J. 507, L59 (1998).

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