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Progress on opacity measurements in laboratory plasma trap relevant for Kilonovae signals

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Kilonovae (KNe) are promising electromagnetic signals arising from compact binary mergers, which offer to nuclear astrophysicists a unique window to study the heavy-element nucleosynthesis driven by the rapid neutron capture (r-process) nucleosynthesis predicted to occur in this astrophysical environment. Deeply heterogeneous post-merging ejecta composition of both light and heavy-r process nuclei, however, implies strong effects on the KNe light-curve due to the varying opacity of the system, yet hard to be fully addressed by theoretical models. In the framework of the PANDORA project at INFN-LNS, we present a first-of-its-kind design of experimental and computational activities, aiming at measuring the opacity of magneto-plasma under laboratory-controlled conditions resembling the astrophysical scenario for KNe propagation in ejecta, as being an unsolved key variable of the problem. In this view, the results of recently performed experiments at the INFN-LNS to reproduce stable early-stage ejecta thermodynamical conditions of under-dense and low-temperature plasmas are here reported, along with preliminary results on gaseous plasma opacity.

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