THE KILONOVA CASE AT THE FRONTIERS BETWEEN NUCLEAR AND ATOMIC ASTROPHYSICS

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Gravitational waves (GWs), the ripples in the fabric of space-time, open the way to access the unrevealed Universe. Cataclysmic events like neutron star mergers (NSM) origin GWs and other “messengers”, e.g., electromagnetic (EM) signals. In the new era of multi-messenger astronomy, all information must be combined to unravel more secrets of the Universe, such as heavy elements nucleosynthesis. Among EM messengers, first observed in 2017, Kilonovae (KNe), thermal transients fed by decaying synthesized heavy nuclei in NSM plasma ejecta, could provide an answer to the long-standing question of how and where heavy elements are produced in the Universe. KNe can be direct spectroscopic observables of these events. The research, presented in the framework of the PANDORA project at INFN-LNS, is a first-of-its-kind design of experimental and computational activities. We aim 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. The research opens to new scientific horizons, entangling plasma physics, atomic, and nuclear astrophysics in the novel self-contaminating atomic astrophysics field.

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