FONDAZIONE BRUNO KESSLER

ECT*
EUROPEAN CENTRE
FOR THEORETICAL STUDIES
IN NUCLEAR PHYSICS AND RELATED AREAS

TIFPA
Trento Institute for
Fundamental Physics
and Applications

JOINT SEMINAR

Thursday, December 14th, 2023 at 14:30
TIFPA, Sala Fortuna, Via Sommarive 14, Povo

Numerical estimation of early-stage kilonovae ejecta opacity reproducible in laboratory plasmas

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In the Universe, elements beyond the ^{56}Fe's peak are synthesized by the slow (s-) and rapid (r-) neutron capture nucleosynthesis processes. The former takes place in AGB (Asymptotic Giant Branch) stars, while the astrophysical loci of the latter are still unclear. This has led the scientific community to investigate exotic phenomena such as the coalescence of compact binary objects. In the context of the multi-messenger astronomy, thanks to the observations of the GW170817 event, neutron star mergers have been addressed as one of the most eligible candidate for the r-process. The thermal transients generated after the coalescence are known as Kilonovae (KNe). They are powered by the radioactive decay of neutron-rich isotopes and strongly depend on the opacity. Numerical simulations have been performed in the framework of the PANDORA (Plasma for Astrophysics Nuclear Decay Observation and Radiation for Archaeometry) project that aims at measuring, for the first time, plasma opacities relevant for the the KN ejecta environment. In this context, numerical estimates of plasma opacity for selected light r-process nuclei will be presented. In addition, we will highlight how the inclusion of atomic inputs provided by relativistic codes such as GRASP and DIRECT in dedicated collisional-radiative models for laboratory plasmas could better address the opacity estimation of KNe. These results will be relevant to shed light and bridge the gap between theoretical predictions and observations.

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