

## Perspectives for kilonovae multimessenger detection

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The detection of the gravitational wave (GW) signal GW170817 and the electromagnetic (EM) signal AT2017gfo confirmed the association between binary neutron star (BNS) mergers and kilonovae (KNe) and showed the potential of joint detection to unveil the nature of neutron stars and the nucleosynthesis of heavy elements in the Universe. The next-generation GW interferometers, such as the Einstein Telescope, are unprecedented resources to enhance the chances of detecting EM counterparts significantly enlarging the horizon of detectable BNS mergers, and dramatically improving the source parameter estimation. In this context, providing reliable predictions about GWs and KNe joint detections is pivotal to developing detection strategies and evaluating the multi-messenger science potential. Starting from BNS merger populations based on population synthesis codes, we compute the number of detected mergers and estimate the source parameters within a Fisher-matrix approach for different configurations of ET. We evaluate the KNe emission both assuming AT2017gfo-like signals or modelling the KN parameters via numerical-relativity-informed fits for two different EOSs. We evaluate the perspectives for ET observing in synergy with the Vera Rubin Observatory (VRO) looking at the impact of GWs and KNe joint detections on constraining the EOS and for cosmology studies.

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