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Gravitational-wave and radio emission from black hole-neutron star mergers in the Einstein Telescope era

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Black hole-neutron star (BHNS) mergers have recently been detected through their gravitational-wave (GW) emission. Such mergers could also produce electromagnetic emission as a short gamma-ray burst (sGRB), and/or an sGRB afterglow upon interaction with the circummerger medium. In this talk, we present new simulations on the expected detection rates with the Square Kilometre Array Phase 1 (SKA1) of sGRB radio afterglows associated with BHNS mergers. We use recent population synthesis results of BHNS mergers and estimate their sGRB afterglow flux to obtain the detection rates with SKA1. We show the dependence of this rate on, for example, the the neutron star equation of state and GW detector sensitivity. We will argue that the much increased sensitivity of future GW detectors like the Einstein Telescope increases the chances of an sGRB localisation and radio detection substantially compared to the current generation of GW detectors. We also report on the benefits of a multimessenger analysis in inferring the properties of such a neutron star binary. We describe a fiducial BHNS merger, and simulate its sGRB afterglow and GW emission while taking systematic errors into account. We are able to infer both the binary source parameters as well as the parameters of the sGRB afterglow simultaneously when combining the GW and radio data. The radio data can provide useful extra information on, e.g., the neutron star mass but this is limited by the systematic errors involved.

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