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Gwfast and the detection of high-redshift black-hole binaries at third generation GW detectors

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The science cases of third generation (3G) ground-based gravitational-wave observatories are making significant advancements, both in Europe with the Einstein Telescope, and in the US with the Cosmic Explorer. In this context, a crucial task is to deliver robust predictions for their detection rates and parameter estimation capabilities. I will present *gwfast*, a novel, open-source Fisher matrix code for third-generation gravitational-wave detectors, focussing on its technical novelties and scalability. I will then discuss one of the key targets of 3G detectors, namely the population of black holes at redshifts beyond the star formation peak, which constitutes an unexplored territory given the limited knowledge of the population of compact objects. I will point out that the *detection* of high-redshift sources (which can cover almost all stellar mass black hole binary in the universe) does not necessarily coincide with the possibility of *confidently locating* them, as the measurement error increases with distance. This can have a large impact on cosmology and population studies and it is important to start considering this effect. I will present a new figure of merit, produced with *gwfast*, to determine the confidence of a source being in a region where stellar-origin black holes are not expected.

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