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**Binary black hole merger rates in rapid population-synthesis codes and the impact of improved modeling of binary physics**[1] MONICA GALLEGOS-GARCIA, Northwestern University, KALIRO PAPPAS, Massachusetts Institute of Technology, PABLO MARCHANT, Katholieke Universiteit Leuven, CHRISTOPHER BERRY, VICKY KALOGERA, Northwestern University — Rapid binary population synthesis codes have been used for decades to investigate the complex evolution of compact binaries. Although these codes are widely used, they typically lack thorough calculations and prescriptions of physical processes (e.g., common-envelope, roche lobe overflow, post main-sequence evolution). These are crucial to accurately predict the fate of binary systems. Many of these processes, however, have been more carefully implemented in stellar evolution codes such as MESA (Modules for Experiments in Stellar Astrophysics). Motivated by this, we perform binary evolution simulations to compare results between a fast binary population synthesis code, COSMIC, and MESA. We find that COSMIC produces more merging binary black holes compared to MESA, indicating that current predictions from binary population synthesis codes may be overestimates for the number of binary black holes formed via isolated field evolution. Understanding the origin of compact object binaries, and having robust predictions for binary merger rates, is critical for interpreting the growing catalog of gravitational-wave observations.

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