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Binary-single scattering with unequal masses: implications for gravitational waves

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Binary black hole inspirals in globular clusters occur when the binary's eccentricity surpasses a critical value, denoted as $e_{\rm GW}$. This $e_{\rm GW}$ depends mainly on the binary's masses and semi-major axis. We perform 10^7 binary-single scattering experiments with unequal masses to identify the different channels that produce high eccentricity binaries. We determine how the cross section for resonant encounters and gravitational wave inspiral depend on mass. Applying the results to globular cluster conditions, we find that half of the inspirals are due to resonant interactions. The other half comes from flybys that excite the eccentricity of binaries that initially were just below the eccentricity threshold. This mechanism is not included in fast models for dynamical production of binary black hole inspiral. Including it roughly doubles the number of in-cluster inspirals, increasing the agreement between fast models and more accurate N-body simulations.

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