

## ARTICLE

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# Extreme-mass-ratio inspirals produced by tidal capture of binary black holes

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Extreme-mass-ratio inspirals (EMRIs) are important gravitational-wave (GW) sources for future space-based detectors. The standard model consists of one stellar-mass black hole spiraling into a supermassive one, and such a process emits low-frequency ( $\sim 10^{-3}$  Hz) GWs, which contain rich information about the space-time geometry around the central massive body. Here we show that the small bodies in EMRIs, in fact, could be binary black holes, which are captured by the massive black holes during earlier close encounters. About 30% of the captured binaries coalesce due to the perturbation by the massive bodies, resulting in a merger rate of  $0.03 \text{ Gpc}^3 \text{ yr}^{-1}$  in the most optimistic scenario. The coalescence generates also high-frequency ( $\sim 10^2$  Hz) GWs detectable by ground-based observatories, making these binary-EMRIs ideal targets for future multi-band GW observations.

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