BLACK HOLES IN DENSE STAR CLUSTERS
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TITLE: The Observability of Recoiling Black Holes as Offset Quasars

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The merger of two supermassive black holes (SMBHs) imparts a gravitational-wave (GW) recoil kick to the remnant SMBH, and in extreme cases SMBHs may be ejected from their host galaxies. An accreting, recoiling SMBH may be observable as a spatially or kinematically offset quasar. Prior to the advent of a space-based GW observatory, offset quasars may offer the best evidence of recent SMBH mergers. Indeed, promising candidates have already been identified. However, systematic searches for recoils are hampered by large uncertainties, including how often and in which host galaxies offset quasars should be observable, and whether BH spin alignment prior to merger is efficient at suppressing large recoils. Motivated by this, we have developed a model for recoiling quasars in a cosmological framework, utilizing information about the progenitor galaxies from cosmological hydrodynamic simulations. Varying degrees of BH spin alignment are considered. We find that the observability of offset quasars, and their preferred host galaxies, depend strongly on the efficiency of pre-merger spin alignment, with promising indications that observations of recoils could distinguish between at least the extreme limits of spin alignment models. Our results also suggest that observable offset quasars should inhabit preferred types of host galaxies, where again these populations depend on the degree of pre-merger spin alignment. These findings will be valuable for planned and future dedicated searches for recoiling quasars, and they indicate that such objects might be used to place indirect constraints on SMBH spins.