Long-term evolution of massive black hole binaries. IV. Mergers of galaxies with collisionally relaxed nuclei

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We simulate mergers between galaxies containing collisionally-relaxed nuclei around massive black holes (MBHs). Our galaxies contain four mass groups, representative of old stellar populations; a primary goal is to understand the distribution of stellar-mass black holes (BHs) after the merger. Mergers are followed using direct-summation N-body simulations, assuming a mass ratio of 1:3 and two different orbits. Evolution of the binary MBH is followed until its separation has shrunk by a factor of 20 below the hard-binary separation. During the galaxy merger, large cores are carved out in the stellar distribution, with radii several times the influence radius of the massive binary. Much of the pre-existing mass segregation is erased during this phase. We follow the evolution of the merged galaxies for approximately three, central relaxation times after coalescence of the massive binary; both standard, and top-heavy, mass functions are considered. The cores that were formed in the stellar distribution persist, and the distribution of the stellar-mass black holes evolves against this essentially fixed background. Even after one central relaxation time, these models look very different from the relaxed, multi-mass models that are often assumed to describe the distribution of stars and stellar remnants near a massive BH. While the stellar BHs do form a cusp on roughly a relaxation time-scale, the BH density can be much smaller than in those models. We discuss the implications of our results for the EMRI problem and for the existence of Bahcall-Wolf cusps.

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