W02a Gravitational wave mergers from von Zeipel-Lidov-Kozai oscillations of binary black holes in galactic nuclei

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The environment close to supermassive black holes (SMBHs) can reach stellar densities of about $\sim 10^7\,M_\odot/pc^3$. An example is the SMBH in our galaxy, which features a density cusp composed of old and young stars, and even compact remnants. Moreover, a high number of binaries is expected to be present close to SMBHs in galactic nuclei, either deposited by infalling star clusters or born in situ from tidally disrupted molecular clouds. These binaries can efficiently interact dynamically with other stars, undergoing close encounters that can trigger tidal disruptions and mergers. Previous studies only considered the effect of von Zeipel-Lidov-Kozai oscillations as a mechanism to merge compact object binaries orbiting around SMBHs. For the first time, we follow the evolution of such binaries also considering the effect of 3-body encounters with background stars, by means of hybrid Monte-Carlo/direct N-body simulations. We find that 3-body encounters can alter dramatically the evolution of binaries, interrupting the von Zeipel-Lidov-Kozai evolution. Encounters can accelerate the coalescence of the compact binaries, by exciting their eccentricity or by altering their orbital inclination and thus triggering von Zeipel-Lidov-Kozai oscillations. These kinds of events will be detected by LIGO, Virgo and KAGRA, and possibly even by LISA and DECIGO. Three-body encounters will also breakup the binaries, preventing the coalescence and quenching the merger rate in galactic nuclei.