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Evolution of stellar binaries from supermassive black hole binaries

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The evolution of main-sequence binaries resided in the galactic centre is influenced a lot by the central supermassive black hole (SMBH). Due to this perturbation, the stars in a dense environment are likely to experience mergers or collisions through secular or non-secular interactions. In this work, we study the dynamics of the stellar binaries at galactic centre, perturbed by another distant SMBH. Geometrically, such a four-body system is supposed to be decomposed into the inner triple (SMBH–star–star) and the outer triple (SMBH stellar binary–SMBH). We survey the parameter space and determine the criteria analytically for the stellar mergers and the tidal disruption events (TDEs). For a relative distant and equal masses SMBH binary, the stars have more opportunities to merge as a result from the Lidov–Kozai (LK) oscillations in the inner triple. With a sample of tight stellar binaries, our numerical experiments reveal that a significant fraction of the binaries, ~70 per cent, experience merger eventually. Whereas the majority of the stellar TDEs are likely to occur at a close periapses to the SMBH, induced by the outer Kozai effect. The tidal disruptions are found numerically as many as ~10 per cent for a close SMBH binary that is enhanced significantly than the one without the external SMBH. These effects require the outer perturber to have an inclined orbit ($\geq 40^\circ$) relatively to the inner orbital plane and may lead to a burst of the extremely astronomical events associated with the detection of the SMBH binary.

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