Title:	Properties of loss cone stars in a cosmological galaxy merger remnant
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Abstract:	Aims. We investigate the orbital and phase space properties of loss cone stars that interact strongly with a hard, high-redshift binary supermassive black hole (SMBH) system formed in a cosmological scenario. Methods. We use a novel hybrid integration approach that combines the direct N-body code φ-GRAPE with ETICS, a collisionless code that employs the self-consistent field method for force calculation. The hybrid approach shows considerable speed-up over direct summation for particle numbers > 106, while retaining accuracy of direct N-body for a subset of particles. During the SMBH binary evolution we monitor individual stellar interactions with the binary in order to identify stars that noticeably contribute to the SMBH binary hardening. Results. We successfully identify and analyze in detail the properties of stars that extract energy from the binary. We find that the summed energy changes seen in these stars match very well with the overall binary energy change, demonstrating that stellar interactions are the primary drivers of SMBH binary hardening in triaxial, gas-poor systems. We find that 76% of these stars originate from centrophilic orbits, only possible in a triaxial system. As a result, even the slight triaxiality of our system results in efficient refilling of the loss cone, avoiding the final parsec problem. We distinguish three different populations of interactions based on their apocenter. We find a clear prevalence of interactions co-rotating with the binary. Nevertheless, retrograde interactions are the most energetic, contributing only slightly less than the prograde population to the overall energy exchange. The most energetic interactions are also likely to result in a change of sign in the angular momentum of the star. We estimate the merger timescale of the binary to be ≈20 Myr, a value larger by a factor of two than the timescale reported in a previous study.
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