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Electromagnetic counterpart of supermassive black hole binary mergers

When a circumprimary gaseous disc is pushed into the primary supermassive black hole (SMBH) by the tidal force of the decaying secondary black hole, it can produce an increase in luminosity. In the case of a disc that lies in the same plane of the SMBHs binary, that luminosity exceeds the Eddington limit. However, in this work we show that misaligned binary-disc systems can present the mass accretion rates also exceeding the Eddington limit. We concentrate in geometrically thin disc models with inclination angles varying from 1 to 180 degrees and binary SMBHs with mass ratio q = 10^{-3}. We find that discs with small inclination angles (< 10 degrees) produce primary SMBH accretion rates reaching up to 6.58 M_{Edd} (L_{prim} ~ 8.56 x 10^{46} erg s^{-1}). On the other hand, we also find that discs with inclinations between 20 and 30 degrees have a rise in the accretion rate less than Eddington rate, while discs inclined at 180 degrees showed no peak in the SMBHs accretion rate. These results show that the effectiveness of the tidal torques drops rapidly with increasing inclination angle. We compare our numerical results with previously obtained analytical results in the literature. Discs misaligned to small angles surrounding a primary SMBH can lead to an electromagnetic counterpart of the gravitational waves signal emitted from final stages of the SMBHs binary orbital decay.

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