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中国科学院数学与系统科学研究院
Academy of Mathematics and Systems Science
Chinese Academy of Sciences

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Academy of Mathematics and Systems Science, CAS
Colloquia & Seminars

Speaker: 李硕副研究员, 国家天文台

Inviter: 刘润球研究员

Title: Tracing the Evolution of SMBHs and Stellar Objects in Galaxy Mergers: A Multi-mass Direct N-body Model

Language: Chinese

Time & Venue: 2023.10.29 15:00-16:00 晨兴数学中心 310教室

Abstract: By using direct N-body numerical simulations, we model the dynamical coevolution of two supermassive black holes (SMBHs) and the surrounding stars in merging galaxies. In order to investigate how different stellar components evolve during the merger, we generate evolved stellar distributions with an initial mass function. Special schemes have also been developed to deal with some rare but interesting events, such as the tidal disruption of main-sequence stars, plunging low-mass stars, white dwarfs, neutron stars and stellar-mass black holes, and the partial tidal disruption of red giants or asymptotic giant branch stars. Our results indicate that the formation of a bound SMBH binary will enhance the capture rates of stellar objects by SMBHs. Compared to the equal stellar mass model, the multi-mass model tends to result in a higher average mass of disrupted stars. Instead of being tidally disrupted by the SMBH, roughly half of the captured main-sequence stars will directly plunge into the SMBH because of their small stellar radii. Giant stars, on the other hand, can be stripped of their envelopes if they are close enough to the SMBH. Though most remnants of the giant stars can survive after the disruption, a small fraction still could plunge into the SMBH quickly or after many orbital periods. Our results also indicate significant mass segregation of compact stars at the beginning of the merger, and then this effect is destroyed as the two SMBHs form a bound binary.

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