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Dynamical Mechanisms of Accretion in Galactic Nuclei

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

Ukraine, Russland und Deutschland

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Projekt-Website: https://wwwstaff.ari.uni-heidelberg.de/mitarbeiter/spurzem/

The rates at which stars are delivered to the tidal disruption zone is critically dependent on a complete and comprehensive understanding of all relaxation processes, first near the SMBH (where its gravity dominates), the so-called Keplerian zone, and second in the outer zone (where self-gravity of stars dominates), the so-called harmonic region. The goal is to study accretion processes of gas and stars near the SMBH and their connection to the surrounding star cluster and galaxy with computer simulations. A second branch of SMBH growth is connected to the merger tree of galaxies in the standard cosmology. If each galaxy harbours a SMBH, then they form a SMBH binary after each galaxy merging process. The probability of these binaries to merge also and form a larger SMBH depends sensitively on the merging timescale of the SMBH binary. The bottle neck is the extraction of energy by encounters with stars in the galactic nucleus. SMBHs are characterized by their mass and their spin. The second goal of this project is to investigate the impact of the spins on the longterm evolution of the SMBH binary and on the stellar component in the galactic nucleus. The consortium is undergoing a revolution in parallel processor technologies, hardware and software, especially with regard to the fact that Graphic Processing Units, GPU's, have become widely used nowadays to accelerate many an application, including computational physics and astrophysics. Recent GPU's offer correspondingly 2496/2880/4992 processor cores within one computing node. Only by using this technology, together with the added value of the astrophysical expertise of all participating teams, the consortium will be able to reach the goals of the project, because it is a multi-scale and multi-physics project. It is not the goal to study full large scale galactic mergers; effects from outside the kpc region will only be taken into account as boundary conditions or if there is a specific effect to study.

Projektbeteiligte

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Simulation of the loss-cone instability in spherical systems - II. Dominating Keplerian potential
Merging timescale for the supermassive black hole binary in interacting galaxy NGC 6240
Cosmological Insights into the Early Accretion of r-process-enhanced Stars
Properties of loss cone stars in a cosmological galaxy merger remnant, Astronomy & Astrophysics
Preparing the next gravitational million-body simulations: Evolution of single and binary stars in Nbody6++GPU, MOCCA and McLuster