dissertation of Zang (1976), but unfortunately it is applicable to power-law discs only.

The integral equation for determining unstable modes in 2D stellar disc also has a form of the linear eigen-value problem. This allows comparatively simple general analysis in terms of the unperturbed distribution function and the rotation curve to predict possible unstable modes in the stellar disc. The derived matrix equation is applicable for any stellar disk (with arbitrary degree of elongation of star orbits) and any rotation curve. Numerical calculations of unstable modes for several models of galactic stellar discs is performed to demonstrate the capabilities of the approach.

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From Newton to Einstein - Dynamics of N-body systems

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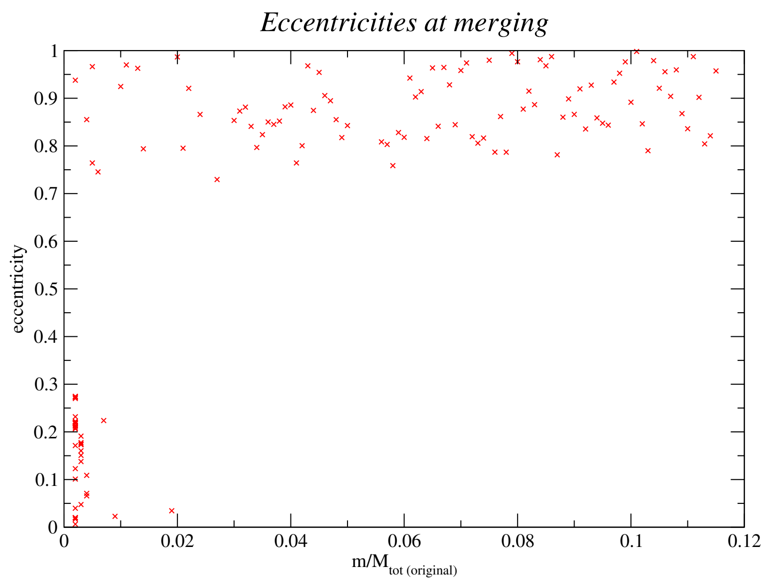
High precision direct N-Body Simulations explore the long-term dynamical evolution of gravothermal systems - dense star clusters and galactic nuclei. Stellar mass loss, compact remnants (white dwarfs, neutron stars, black holes), tight binaries provide a complex nonlinear dynamical evolution in the cluster. Software and hardware developments (parallel codes, GRAPE, reconfigurable hardware) have been driven by these simulations. Compact objects (black holes and neutron stars) typically occur in close binaries. Supermassive black hole binaries in our models exhibit phases of very high eccentricity (e > 0.9). Similarly, close binaries containing compact objects in star clusters cover typically all eccentricities, even at high binding energy. Such objects are promising sources of gravitational waves, ranging from Nanohertz frequencies to the VIRGO and LISA wavebands, depending on their evolutionary stage. Extending our direct N-body models from the Newtonian regime to high order Post-Newtonian approximations allows us to predict quantitatively gravitational wave emission. Preliminary results in this recently started f



Experimental simulation starting with 1000 massive black holes, one million solar mass each (this large mass to accelerate the evolution and study the relativistic effects clearly). Plotted are the eccentricities of orbits shortly before merger as a fucntion of the total precursor mass; note that runaway merger leads to particles having 100 times the original mass and that massive merging bodies merge at high eccentricities, which enhances gravitational radiation effects.

On the relation between the maximum stellar mass and the star cluster mass

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It has been suggested for some time from observations (Larson 1982, 2003) and theory (Elmegreen 1983, 2000) that the mass of a star cluster probably limits the mass of the most massive star in the cluster. In this contribution we further investigate this relation with the use of three different sets of Monte-Carlo simulations. In the first set a number N of stars is randomly sampled from the IMF and than added to give the cluster mass. These cluster masses are then binned and the mean maximum mass for each bin is calculated. For the second set the cluster mass is given as a condition value and stars are drawn from the IMF until the cluster mass is reached. This is done 10000 times for a set of 10 different cluster masses and the mean maximum mass is calculated for each. Finally in the third set, again the cluster mass is a condition value but the number of stars in the cluster is calculated by dividing the cluster mass through the mean mass of the IMF. This number of stars is then drawn from the IMF but sorted by mass before being added. If the cluster mass is not reached, additional stars, determined by the cluster mass minus the sum of the stars divided by the mean mass, are drawn from the IMF. Then the stars are sorted and added again. This is again done 10000 times for a set of 10 different cluster masses and the mean maximum mass is calculated for each. We show that the observations of massive stars in young clusters favour the sorted sampling procedure, indicating that stars in star clusters starting with the lowest masses until the feedback stops the star-formation. Further, we discuss the implications of this for the stellar IMF in cluster systems. For example, 10^4 clusters of mass $10^2\,M_\odot$ will not produce the same IMF as one cluster with a mass of $10^6\,M_\odot$ (Weidner & Kroupa 2005).

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