R08b　N 体的計算法による無衝突恒星系の位相空間での進化の再現

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A particle method for reproducing the phase space of collisionless stellar systems is described. The key idea originates in Liouville's theorem which states that the distribution function (DF) at time t can be derived from tracing necessary orbits back to $t = 0$. To make this procedure feasible, a self-consistent field (SCF) method for solving Poisson's equation is adopted to compute the orbits of arbitrary stars. On the assumption of spherical symmetry, we carry out collapse simulations of a uniform-density sphere, and compare the phase-space evolution which the current method generates to that obtained with a phase-space method for integrating the collisionless Boltzmann equation. Then, we have found excellent agreement in phase-space evolution between the two methods if an optimal basis set for the SCF technique is chosen. Since this reproduction method requires only the functional form of initial DFs but needs no assumptions about symmetry of the system, the success in reproducing the phase-space evolution implies that there would be no need of directly solving the collisionless Boltzmann equation in order to access phase space even for systems without symmetry. In addition, it also means that the orbits are computed with sufficient accuracy. Consequently, this method may be useful for the classification of orbit families to investigate the kinematic nature of stellar systems. The effects of basis sets used in SCF simulations on the reproduced phase space are also discussed.