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Relaxation and evolution towards inverse energy equipartition in star clusters

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Recent observations with HST and Gaia deepened our understanding of the internal kinematics of star clusters. Motivated by those findings, we aim to gain theoretical insights into how various kinematic properties influence the overall dynamical development of these stellar systems. Through N-body simulations, we explore the effects of different initial velocity distributions, ranging from tangentially to radially anisotropic. We reveal accelerated relaxation processes in the tangentially anisotropic models, leading to faster mass segregation in the inner regions and a more rapid evolution towards core collapse. Additionally, we observe distinct patterns in the evolution away from the initial equipartition of velocities, especially in the outer cluster regions. The radially anisotropic models evolve towards energy equipartition while the tangentially anisotropic and isotropic models show an "inverted" energy equipartition (where the high-mass stars have higher velocity dispersion than the low-mass stars). The duration and radial range of this inversion are influenced by the initial velocity distribution - increasing with the system's tangential anisotropy and decreasing with radial anisotropy.

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