TRENDS IN GALAXY FORMATION AND EVOLUTION IN THE CONTEXT OF THE VIRIAL AND FUNDAMENTAL PLANES

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The kinetic description of gravitating systems has acquired vital importance in the context of trends in galaxy formation and evolution as evidenced by the existence of the virial and fundamental planes. The fundamental plane deviates for brighter and fainter ellipticals; until the brightest cluster members (BCMs), whose structures have been most modified by interactions, seem to occupy a fundamental plane with a different slope as compared to normal ellipticals. Extending the work of Magalinsky (1972, *AZh*, **49**, 1017; *Sov.Astron.-AJ*, **16**, 830), the Vlasov equation is applied to study small perturbations (considered as protogalaxies) of the exact solution corresponding to a spatially homogeneous medium in expansion. It is found that a perturbation attains a saturated size whose scale length, as a function of a reduced parameter of evolution (in terms of the characteristic frequency of dispersion of momenta, τ), $R(\tau) \propto K.E./P.E. \propto (K.E.)^2/\sigma \propto (\Delta V)^2/\text{Proj.density} \propto \sigma^2/I$, which has the parametric form of the virial plane. The subsequent evolution is characterized principally by the variation of the energy due to the gravitational interactions between stars (considered as mass points), given by the potential energy such that the harmonic mean separation scale (between stars) characterizes this evolution. In this stage of the evolution the harmonic scale separation has the parametric form, $\langle r^{-1} \rangle \propto (K.E.)^{1/2}$, and $\langle r^{-1} \rangle \propto (P.E.)$ such that $\langle r^{-1} \rangle \propto (K.E.)^{1/2}/(P.E.) \propto \sigma/I$. Notice that this is the parametric form of the fundamental plane of evolved ellipticals since the harmonic scale separation determines a physically significant scale.

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