LINEAR DENSITY WAVES IN GLOBULAR CLUSTERS

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ABSTRACT. It is often maintained that Antonov's equation, a linearization of the collisionless Liouville-Boltzmann equation, governs small perturbations of a stellar system. The variational integrals resulting from Antonov's equation are in six dimensional phase space. However, expanding the perturbations in the velocity coordinates and carrying out the integrals over the velocity components gives integrals in the three dimensional configuration space. Solutions in successive approximations lead to standing density waves. The first order equations involve a vector field $\xi(x)$ related to but not identical with the Lagrangian displacements of a volume element of the system. In this respect the problem is analogous to the linear oscillations of a fluid star. The analogy is exploited to provide a classification for the modes of oscillation and to obtain suitable data for variational calculations. The normal modes appear to be trispectral, in the sense that the associated vector field $\xi(x)$ is derived predominantly either from a scalar potential, a toroidal vector potential, or a poloidal vector potential. The eigenfrequencies of the radial ($\iota = 0$) and non-radial ($\iota = 1$) modes are calculated. The associated density waves are analyzed.

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