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An iterative method for constructing stellar systems models: how far does it work?

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Abstract. We present a new method for constructing equilibrium phase models for stellar systems. Applications of the iterative method include both modelling of observational data and the construction of initial condition for N-body simulations.

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The aim of the iterative method (IM) is to construct an equilibrium N-body model with prescribed parameters, or constraints. Setting a given mass distribution and almost arbitrary velocities of particles, we start the iterative procedure, by letting the system go through a sequence of self-consistent evolutionary steps of short duration (iterations). At the end of each step, and before the new step is started, we transfer the new velocity distribution from a bit evolved system to a system with the initial density distribution. At this stage we need to correct individual particle velocities in accordance with imposed kinematic constraints (see details in Rodionov *et al.* 2009). We stop iterations when the velocity distribution ceases to change, which implies that the system has reached equilibrium.

We managed to construct equilibrium systems of various types – from spherical to triaxial, from one-component to multi-component, from isotropic to anisotropic (Rodionov & Sotnikova (2006); Sotnikova & Rodionov (2008); Rodionov *et al.* (2009)). Successful reconstruction of the distribution function of a model disc galaxy from its line-of-sight kinematics encouraged us to use the IM to derive the 3D kinematics of edge-on galaxies from observational data. Now we have all IR photometric parameters (for a bulge and a disc) of an edge-on galaxy NGC 4111 and obtained stellar LSVD of this galaxy at the 6-m telescope. Preliminary interpretation of kinematic and photometric observations of this galaxy in terms of its 3D structure and 3D velocity distribution showed that the IM may be very powerful method to reconstruct phase-space models of real galaxies (Sotnikova *et al.*, 2010, in preparation).

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