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Numerical Integration of Propagation of 2D Nonlinear Density Waves in Gravitating Discs

Propagation of 2D nonlinear density waves in an infinitely thin gravitating gaseous disc is considered and an integration method is suggested. It constructs “equations of motion” of discretization mesh nodes and incorporates the evolution of the spatial domain into the physical problem. Such approach leads to reflection of irregularities in solutions in the mesh structure. Ways to regularize the latter are discussed.
The method is explored in hydrodynamic simulations of the global spiral structure in galactic discs. In addition, interpretation of the radially expanding local features in the central disc of the Galaxy in terms of the nonlinear density wave theory is evaluated.