Spherically Symmetric Collapsing Solution in the form of Shadow Wave

Sanja Ružičić
Assistant Professor, Faculty of Sciences, University of Novi Sad, Novi Sad

Marko Nedeljkov
Faculty of Sciences, University of Novi Sad, Novi Sad

Abstract:

It has been proved that spherically symmetric solutions to compressible Euler and Navier-Stokes equations can blow up. However, dealing with singularities at the origin is still a challenging task. In this paper we deal with isothermal Euler-Poisson system which is used to model collapse of self-gravitating Newtonian star. Density dependent viscosity term is added on the right-hand side of momentum equation and it has been proved that there exists stable shadow wave solution with unbounded density at the origin. A shadow waves are used to approximate wide class of singular solutions (including the well known delta and singular shocks) by introducing small parameter which is used to create a layer around the SDW front in which the solution components could potentially blow up. This results is extended to the vanishing pressure case. It is analyzed how the density dependent viscosity term affects the solution behavior.

Keywords:

Gravitational collapse, radially symmestric solution, shadow waves.