



Iranian Journal of Physics Research, Vol. 22, No. 3, 2022
DOI: 10.47176/ijpr.22.3.11360

The study of non-axisymmetric structure of a protoplanetary disc

M Gholipour

Research Institute for Astronomy and Astrophysics of Maragha (RIAAM), University of Maragheh, Maragheh, Iran

E-mail: gholipour@riaam.ac.ir

(Received 25 November 2021 ; in final form 27 June 2022)

Abstract

This study aims to determine the non-axisymmetric structure of a protoplanetary disc caused by the gravitational potential of a massive planet. The disc becomes non-axisymmetric by considering this gravitational effect, so that the azimuthal changes will be important. Using the spectral method, the partial differential equations (PDEs) can be converted to the ordinary differential equations (ODEs), where the problem is solvable via the proper boundary conditions. Two important parameters, i.e. " σ " (mass ratio of the second object to the central object) and " x " (ratio the radius to the distance between two objects) play very important roles in this problem. The obtained results show that the disc structure at a fixed radius is very sensitive to the azimuthal changes. This issue addresses some approaches on the disc structure, which have not received much attention. Also, we found that there is a high potential to transport the angular momentum of the disc material near the second object even in the low viscosity regime. Furthermore, if the mass of the second object is greater than a certain value, the second object may be participating in the construction of the planets. It can be concluded that the presence of the second object may be helpful in the planet formation.

Keywords: accretion, accretion discs, hydrodynamics, protoplanetary discs

For full article, refer to the Persian section