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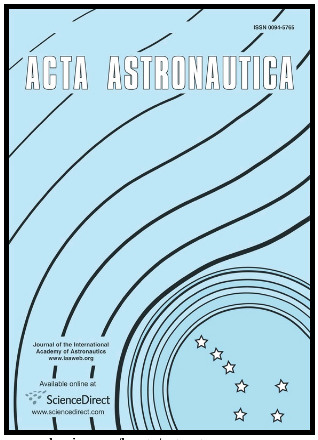

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Propagation of a strong spherical shock wave in a gravitating or non-gravitating dusty gas with exponentially varying density

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Abstract

The propagation of a strong spherical shock wave in a dusty gas with or without self-gravitational effects is investigated in the case of isothermal and adiabatic flows. The dusty gas is assumed to be a mixture of small solid particles and perfect gas. The equilibrium flow conditions are assumed to be maintained, and the density of the mixture is assumed to be varying and obeying an exponential law. Non-similarity solutions are obtained and the effects of variations of the mass concentration of solid particles in the mixture and the ratio of the density of solid particles to the initial density of the gas, and the presence of self-gravitational field on the flow variables are investigated at given times. Our analysis reveals that after inclusion of gravitational field effects surprisingly the shock strength increases and remarkable differences are found in the distribution of flow variables. An increase in time also, increases the shock strength. Further, it is investigated that the consideration of isothermal flow increases the shock strength, and removes the singularity in the density distribution. Also, the presence of gravitational field increases the compressibility of the medium, due to which it is compressed and therefore the distance between the inner contact surface and the shock surface is reduced. The shock waves in self-gravitating dusty gas can be important for description of shocks in supernova explosions, in the study of central part of star burst galaxies, star formation and shocks in stellar explosion, nuclear explosion,