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SIMULATIONS OF HYDRODYNAMIC PROCESSES FOR ASTROPHYSICAL OBJECTS IN 3D STATEMENT ON MESHES OF HIGH RESOLUTION

Abstract

The paper presents numerical simulation results of interaction process of Supernova strong shock wave with interstellar molecular cloud. In the present problem statement gravitation, heat conductivity and radiative losses are neglected. The processes of deformation and fragmentation of molecular cloud, formation of passing through and reflected shock wave systems, contraction and ablation of the matter are investigated in detail. The post-processor treatment the results ofn calculations made it possible to distinguish the following features of the molecular cloud matter: the vortexes formation, erosion and ablation. After hitting the cloud by the Supernova shock the reflected shock appears and moves upstream, the cloud surface is getting perturbed with the time, the Richtmyer-Meshkov instability begins to develop downstream. The next stage is characterized by expansion of the cloud and formation of complicated wave structure. After the primary shock wave vortexes are formed in time. The ablation process develops at the surface of the cloud. Shock interactions of SW with abruptly accelerated superficial layers of clouds produce density perturbations. This process is accompanied by effect of the Kelvin-Helmholtz instability initiated by the momentum difference between cloud layers and outer medium. The vortexes form ringlike structure on the cloud surface. Those structures are transformed into vortex streets and initiate formation of the whirlpool studs. Counter rotating neighboring vortexes form primary and secondary systems of vortex structures. These vortex structures are stretched, bended and change their shape in time forming secondary, tertiary structures etc. Modeling results for a single and two clouds system evolution have been analyzed in supersonic gas dynamics manifestation.