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Computer simulation of the process of defragmentation and ablation of mass during the interaction of shock waves with molecular clouds

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Abstract content
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In this work the results of numerical simulation of interaction process between strong shock wave generated after supernova explosion and molecular cloud (MC) have been presented in three-dimension gas-dynamical settings. Developed computational code is based on numerical solution of the Euler equations for compressible flow. Gas flow equations were represented conservatively for velocities components and energy. The parallel code using OpenMP for PC hybrid system was developed for modeling. The Intel Vtune Amplifier XE was used to profile the code using GPU. More than a two billion cells mesh (2048x1024x1024) with effective resolution for cloud radius in 128 nodes was implemented. Peculiarities of molecular cloud forming and density fragmentation in time were analyzed during time-consuming simulation. Shock wave strikes the cloud, triggering weak reflected shock waves and transmitted shock that advances in to the cloud. Inner-cloud SW compresses and defragment MC media. Post-processing used allow to find out the circumstances of vortex transfer in MC, ablation and erosion phenomena.

The shock wave interaction with several boundaries of substances with different density complicates the interaction and gives rise of vortex rings. Developing perturbations lead to the formation of vorticity over the surface of the cloud and ablation its matter. Appearing vortexes transfer to the vortex streets and initialize whirlpool studs. The neighboring counter rotating vortexes form the system of primary and secondary vortex structures. These vortex structures are stretched, bended and changing their shape with the time forming secondary, tertiary etc. systems.

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