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3D numerical simulation of gravitational turbulent mixing with regard to molecular viscosity

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Turbulent mixing under Rayleigh-Taylor instability is a classic problem. There is a lot of experimental data concerning the laws of TMZ growth, however, this date give significantly different values of the zone growth coefficient in the area which is assumed to be self-similar ($0.04 < \alpha < 0.35$).

We earlier showed in our previous papers that there was initial non-self-similar phase of turbulent mixing, both in 3D computations by TREK parallel code without consideration of molecular viscosity and in experiments. The corresponding area width depends both on the difference scheme in use and the number of computational cells and indicates that the scheme viscosity essentially affects the resultant solution.

The paper presents the results of 3D computations with regard to molecular viscosity for which simulation a code for solving Navier-Stokes equations has been developed within TREK code complex. A series of computations by the code has been carried out with $N=2\cdot10^6$ computational cells.

The computation results are compared to similar results without viscosity that allows us to estimate both its influence on the solution and the scheme effects. Computations show the increased duration of the initial non-self-similar area under large enough values of the molecular viscosity coefficients.