Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Long-wave instability of a multicomponent fluid layer with Soret effect[1] ILYA RYZHKOV, VALENTINA SHEVTSOVA, Microgravity Research Center, Universite Libre de Bruxelles, Belgium — The long-wave instability of a vertical layer filled with a multicomponent fluid is investigated. The basic state is the plane parallel flow, where the linear temperature profile induces linear profiles of composition due to the Soret effect. This effect is characterized by the separation ratios that can be positive or negative depending on the direction of component segregation (to the hot or cold wall). It is shown that the cross-diffusion coefficients can be eliminated by introducing new concentrations and separation ratios. This transformation preserves boundary conditions in a wide class of problems including Rayleigh-Bernard configuration. It allows us to reduce the problem to that without cross-diffusion. The long-wave instability is caused by the interplay between the main flow and the concentration waves, which have a long scale in vertical direction and produce non-uniform density stratification. In the general case of n-component mixture, several stable regions in the parameter space are identified. The complete analysis is performed for the ternary fluid case. It is shown that the onset can be monotonic or oscillatory depending on the parameters. The critical Grashof numbers are plotted and their behaviour is discussed.

[1]The work is supported by the INTAS Grant 06-1000014-6257.

Valentina Shevtsova
Microgravity Research Center, Universite Libre de Bruxeles, Belgium

Date submitted: 30 Jul 2007 Electronic form version 1.4