Can we always neglect the bulk viscous pressure in variable density flows? MILTIADIS PAPALEXANDRIS, Universite catholique de Louvain — In linearly isotropic (Newtonian) fluids, the bulk viscous pressure is proportional to the velocity divergence, with the bulk viscosity of the fluid being the proportionality coefficient. Stokes' hypothesis states that the bulk viscosity of a Newtonian fluid can be set equal to zero. Although not valid for many fluids, it is common practice to invoke this hypothesis in the study of low-Mach-number, variable-density flows. In this talk, based on simple scaling arguments we provide a necessary condition for neglecting the bulk viscous pressure from the governing equations of low-Mach number flows. More specifically, we show that the Reynolds number defined with respect to the bulk viscosity must be very large. We further show that even when this condition is not satisfied, the bulk viscous pressure does not need to be taken explicitly into account because it can be combined with the dynamic pressure.

Miltiadis Papalexandris
Universite catholique de Louvain

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