Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Students' Annual Seminar

Secondary Kelvin-Helmholtz instability and Anti-bubbles

Rashmi Ramaadugu

In this talk, I will discuss two problems: 1. Secondary Kelvin Helmholtz instabilities and 2. Anti-bubbles.

Kelvin Helmholtz and Rayleigh Taylor instabilities are two important primary instabilities seen in variable-density flows. Surface tension has a stabilizing effect on these instabilities [1]. Earlier studies [2, 3] have shown the presence of secondary instabilities at high-density contrasts. Using linear stability analysis we show that the surface tension stabilizes secondary Kelvin-Helmholtz instabilities. We compare our linear stability results against high-resolution direct numerical simulations.

Anti-bubbles, which have a shell of low-density fluid surrounding high-density fluids rise due to buoyancy. These anti-bubbles when punctured at the bottom form a rim of low-density fluid which retracts. Using high resolution direct numerical simulations we show the effect of the Bond number on the retraction velocity of the rim, which is in agreement with the theory [4].

References:

[1] Chandrasekhar. S, Hydrodynamic and hydro magnetic stability, Courier Corporation, (2013)
[2] Reinaud. J, Joly. L and Chassaing, P, The baroclinic secondary instability of the two-dimensional shear layer, Phys of Fluids, 12(10), 2489-2505, (2000).
[3] Dixit. H.N and Govindarajan. R, Vortex-induced instabilities and accelerated collapse due to inertial effects of density stratification, J. Fluid Mech, 646, 415-439, (2010).
[4] Sob'yanin, D. N. Theory of the anti-bubble collapse. Phys. Rev. Lett, 114(10), 104501. (2015).

Friday, Apr 12th 2019

10:00 AM (Tea/Coffee at 9:30 AM)

Seminar Hall, TIFR-H