Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Variational approach to stability boundary for the Taylor-Goldstein equation[1] MAKOTO HIROTA, Tohoku University, PHILIP J. MORRISON, University of Texas at Austin — Linear stability of inviscid stratified shear flow is studied by developing an efficient method for finding neutral (i.e., marginally stable) solutions of the Taylor-Goldstein equation. The classical Miles-Howard criterion states that stratified shear flow is stable if the local Richardson number J_R is greater than 1/4 everywhere. In this work, the case of $J_R > 0$ everywhere is considered by assuming strictly monotonic and smooth profiles of the ambient shear flow and density. It is shown that singular neutral modes that are embedded in the continuous spectrum can be found by solving one-parameter families of self-adjoint eigenvalue problems. The unstable ranges of wavenumber are searched for accurately and efficiently by adopting this method in a numerical algorithm. Because the problems are self-adjoint, the variational method can be applied to ascertain the existence of singular neutral modes. For certain shear flow and density profiles, linear stability can be proven by showing the non-existence of a singular neutral mode. New sufficient conditions, extensions of the Rayleigh-Fjortoft stability criterion for unstratified shear flows, are derived in this manner.

[1]This work was supported by JSPS Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation # 55053270

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Date submitted: 31 Jul 2015 Electronic form version 1.4