Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A new short-wave instability of stratified vortices[1] YUJI HATTORI, SHOTA SUZUKI, MANISH KHANDELWAL, MAKOTO HIROTA, Institute of Fluid Science, Tohoku University — The linear stability of stratified vortices is studied by local and modal stability analysis. Three vortical flows are considered: the two-dimensional Taylor-Green vortices, the Stuart vortices, and the Lamb-Chaplygin vortex pair. A new short-wave instability is found by local stability analysis; it occurs on the streamlines near the heteroclinic orbits of the fluid particle which connect hyperbolic stagnation points. This instability emerges as the hyperbolic instability near the hyperbolic stagnation points, which cancels each other in the absence of stratification, survives through phase twist due to internal gravity waves. As a result the unstable regions appear as multiple bands whose number increases as stratification becomes strong; a simple model successfully predicts these bands. The direction of the wavevector is in good agreement with the structure of unstable eigenmodes obtained by modal stability analysis. Possible relation with the zigzag instability will be also discussed.

[1]Supported by JSPS KAKENHI J17K05561

Yuji Hattori
IFS, Tohoku University

Date submitted: 01 Aug 2017 Electronic form version 1.4