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Tilt-induced instability of a vortex in a stratified fluid PATRICE MEUNIER, NICOLAS BOULANGER, STÉPHANE LE DIZES, IRPHE — The dynamics and stability of a vortex in a linearly stratified fluid is studied experimentally and theoretically when the axis of the vortex is slightly inclined with respect to the direction of stratification. For Froude numbers larger than one, the tilt of the axis induces strong density gradients and an intense axial flow in a rim around the vortex, at the radius where the angular velocity of the vortex is equal to the Brunt-Vaisala frequency. This critical layer can be studied theoretically in the viscous regime, which shows that the axial flow changes from a jet to a shear layer when turning around the vortex, in excellent agreement with the PIV measurements. For high Reynolds numbers, this axial flow creates a Kelvin-Helmholtz instability and a jet instability, leading to secondary vortices rolled-up around the primary vortex. The growth rates of these instabilities have been measured and compared to predictions from a linear stability analysis. These three-dimensional instabilities of the tilted vortex does not lead to the destruction of the vortex, but it decreases its core size if the Froude number is larger but close to one.

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