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A New Convective Instability with Growth Normal to a Boundary Layer

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Lingwood's (1995) Briggs-Bers spatio-temporal instability analysis of the rotating disc boundary layer has been repeated in the inviscid limit. For long enough waves, we find that one spatial branch crosses both the real and imaginary axes of the complex wavenumber plane. Such waves have exponentially diverging eigenfunctions in the wall-normal direction. A saddle-point analysis has been developed describing the behaviour of disturbances in the wall-normal direction which predicts a new type of convective instability in which the disturbance grows as it propagates normal to, i.e. out of, the boundary layer. But surely such modes are unphysical as they don't satisfy homogeneous boundary conditions. A numerical integration of inverse Fourier transforms of an impulsive forcing has been carried out, with integration countours chosen such that all modes decay exponentially. Nonetheless, their collective behaviour produces exponential growth in the wall-normal direction.

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