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Experimental Investigation of Absolute Instability of a Rotating-Disk Boundary Layer HESHAM OTHMAN, THOMAS CORKE, University of Notre Dame — A series of experiments were performed to study the absolute instability of Type I travelling cross-flow modes in the boundary layer on a smooth disk rotating at constant speed. Controlled temporal disturbances were introduced by a short-duration air pulse from a hypodermic tube located above the disk and outside the boundary layer. The air pulse was positioned just outboard of the critical radius for Type I cross-flow modes. A hot-wire sensor was positioned at different spatial locations on the disk to document the growth of disturbances produced by the air pulses. Ensemble averages conditioned on the air pulses revealed wave packets that evolved in time and space. Two amplitudes of air pulses were used. The lower amplitude produced wave packets with linear amplitude characteristics that agreed with linear-theory wall-normal eigenfunction distributions and spatial growth rates. The higher amplitude pulse produced wave packets that had nonlinear amplitude characteristics. The space-time evolution of the leading and trailing edges of the wave packets were followed well past the critical radius for the absolute instability based on Lingwood (1995). With the linear amplitudes, the absolute instability was dominated by the convective modes, agreeing with the linear DNS simulations of Davies and Carpenter (2003). With the nonlinear amplitudes, the wave packet development resembled those of Lingwood (1996) suggesting the amplitudes in that case were finite.

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