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Triad Resonance in Transition to Turbulence in Rotating Disk Boundary Layer ERIC MATLIS, THOMAS CORKE, University of Notre Dame — This work is a study of the resonant interaction between traveling cross-flow modes and low-mode-number stationary modes in transition to turbulence of the three-dimensional boundary layer flow over a rotating disk. A distributed array of ink dots are placed on the disk surface to enhance a narrow band of azimuthal and radial wave numbers of both stationary and traveling modes. The size of the dots is small ($d = 1.6$mm, $h = 0.06$ mm, $h(\omega/\nu)^{1/2} = 0.16$) so that the disturbances they produce is linear. Two hot-wires are used to perform spatial correlation measurements giving the wavenumber vector. The time series were sorted in terms of the separate contributions of the traveling and stationary modes. Cross-bicoherence was used to identify triad phase locking between frequencies of traveling and stationary cross-flow modes. Frequencies that satisfied this condition were then shown to satisfy wave number matching required for a triad resonance. The triad resonance was found to be the dominant mechanism for spectral broadening during transition to turbulence. This mechanism can account for large wavelength stationary modes observed in flow visualization on disks and swept wings.

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