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**Near-field flow characterization of isothermal coaxial swirling jet** SANTHOSH R, ANKUR MIGLANI, Indian Institute of Science, BHASWATI CHOUDHURY, National Institute of Technology, Karnataka, SAPTARSHI BASU, Indian Institute of Science — The present experimental investigation concerns study of hydrodynamic instability resulting from vortex breakdown in a coaxial type atmospheric swirl burner. Transition from the first occurrence of pre-vortex breakdown (Pre-VB) flow reversal to a fully-developed central toroidal recirculation zone (CTRZ) is studied for a range of swirl number $S$ =0.592 to 0.801.The swirl number was varied progressively by decreasing the mass flow of center jet stream. The physics of the transition is detailed based on modified Rossby number ($Ro_m$) effect. The decrease in $Ro_m$ across the transition (from an initial 3.15 to 0.02) facilitated the penetration of swirl towards center jet, widening the zone of swirl influence. 2D PIV technique employed in meridional and horizontal planes provided rich insight into the existent dynamics. Transverse plane flow field examination at various axial stations revealed the rigid body rotation characteristic of recirculation flow patterns. Although Rayleigh's criteria for centrifugally unstable flow was satisfied by these coherent structures, the transformation was accompanied by a transition in streamwise vorticity from that dominated by centrifugal forces to the solid body core supporting inertial waves.

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