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The effect of buoyancy on vortex breakdown in a swirling jet JACOB COHEN, DINA MOURTAZIN, Faculty of Aerospace Engineering, Technion - Israel Institute of Technology, Haifa, 32000, Israel — The purpose of this experimental study is to explore the effect of buoyancy on vortex breakdown (VB) in swirling jets. Three non-dimensional parameters govern the flow: the jet exit Reynolds number, the swirl ratio and the Richardson number (buoyancy). The experimental apparatus consists of a vertical swirling water jet which discharges into a large tank. Moderate values of the Reynolds number are used in the range of $150 \leq Re \leq 600$. Swirl is imparted onto the jet in a rotating chamber whereas the temperature difference between the jet and its surrounding is established by passing the jet through a heat exchanger, immersed in a circulating water bath with a controlled temperature. Vector maps of the vertical mid-plane and horizontal cross-sections are obtained by PIV measurements. It is demonstrated that VB can be effectively suppressed (enhanced) by prescribing a negative (positive) temperature difference between the jet core and its surrounding fluid. Moreover, the experimental critical swirl ratio for the appearance of VB is found to be in good agreement with a simple criterion, originally derived by Billant, Chomaz and Huerre (*J. Fluid Mech.*, 1998, **376** p. 183), for isothermal swirling jets and extended here to include buoyancy effects. The transition of VB from a closed bubble to an open cone configuration is mapped in terms of the Reynolds and Richardson numbers.

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