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Entrainment Across a Sheared Density Interface in High Richardson Number Cavity Flow NICHOLAS WILLIAMSON, MICHAEL KIRKPARTICK, STEVE ARMFIELD, The University of Sydney — The turbulent entrainment of fluid across a sharp density interface has been examined experimentally in a purging cavity flow. In the experiments, a long straight cavity with sloped entry and exit boundaries is located in the base of a straight open channel. Saline fluid is entrained from the cavity into the overflow. The cavity geometry has been designed to ensure there is no separation of the overflow in the cavity region with the goal of obtaining a single mode of entrainment, related only to the interface properties rather than to cavity specific mechanisms. The bulk entrainment rate has been measured and correlated with bulk Richardson number over $Ri = 1.0 - 20$ at Reynolds number $Re = 7100 - 15100$. The entrainment rate is shown to scale with the local bulk Richardson number $E \simeq CRi^{-1.38}$, very close to the established result for entrainment across a sharp two layer density interface in a recirculating water channel (Strang and Fernando, J Fluid Mech., 428, 2001) but with an order of magnitude lower coefficient C. Experiments instrumented with PIV/LIF were used to relate the bulk Ri to the local gradient Richardson number of the interface. In the cavity setting the interface appears to remain sharper, resulting in larger Ri_g and reduced entrainment.

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