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Measurements in a High Reynolds Number Wake[1] MARCUS HULTMARK, JUAN JIMENEZ, SEAN BAILEY, ALEXANDER SMITS, Princeton University — Experiments were conducted in the Princeton/ONR HRTF windtunnel with highly pressurized air. The wake of a DARPA SUBOFF submarine model was measured over a large range of Reynolds numbers at 5 different downstream locations. The model is an axisymmetric body without appendages (fins) supported by a streamlined support, mimicking a semi-infinite sail. For all Reynolds numbers studied, the mean velocity distribution becomes self-similar between 3 and 6 diameters, D, downstream for the side where the support is not located. In contrast, self-similarity in the Reynolds stresses is not reached at the furthest downstream location ($x/D = 15$). The spectra reveal two peaks in the near-wake. The lower wavenumber peak corresponds to a Strouhal number based on diameter and freestream velocity of about 0.22, suggesting that it is associated with an azimuthal or helical shedding mode in the wake. This mode is evident at all Reynolds numbers, at all cross-stream positions, indicating that it is unlikely to be due to the interference of the support wake with the model wake. The mode is seen only for $x/D < 15$, suggesting that it plays a partial role in the approach to self-similarity of the turbulent stresses.

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Marcus Hultmark
Princeton University

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