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Extreme events in compressible turbulence NAOKI MANZANO-MIURA, GREGORY P BEWLEY, Cornell University — Compressible turbulence appears in many engineered and natural settings, such as in scramjet engines and astrophysical jets. Even at subsonic speeds, however, turbulent fluctuations can be fast enough relative to the speed of sound that regions of local strong compression and expansion appear in the flow. Experiments are needed to further develop models that quantify the influence of compressibility on turbulence. In our laboratory, we used in-house hot-wire probes and state-of-the-art nanofabricated hot-wire anemometers [Vallikivi et al., Exp. Fluids (2011)] which resolve inertial range statistics, and measured turbulence in a specialized pressure vessel filled with sulfur hexafluoride (SF6). The flow was driven by a fan which produced a turbulent jet. Since SF6 gas has a low speed of sound compared to air we attained jet Mach numbers up to 0.7 at speeds low enough to enable high resolution measurements. The Taylor Reynolds number was modulated independently between 200 and 3700 with pressure adjustments. We report on the scaling of extreme events in probability distributions of velocity increments consistent with the appearance of shocklets with increasing Mach numbers, and we compare our data with DNS as well as with previous experiments.

Naoki Manzano-Miura
Cornell University

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