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Fluctuations of thermodynamic variables in compressible isotropic turbulence DIEGO DONZIS, SHRIRAM JAGANNATHAN, Texas A&M Univ — A distinguishing feature of compressible turbulence is the appearance of fluctuations of thermodynamic variables. While their importance is well-known in understanding these flows, some of their basic characteristics such as the Reynolds and Mach number dependence are not well understood. We use a large database of Direct Numerical Simulation of stationary compressible isotropic turbulence on up to 2048^3 grids at Taylor Reynolds numbers up to 450 and a range of Mach numbers ($M_t \approx 0.1 - 0.6$) to examine statistical properties of thermodynamic variables. Our focus is on the PDFs and moments of pressure, density and temperature. While results at low M_t are consistent with incompressible results, qualitative changes are observed at higher M_t with a transition around $M_t \sim 0.3$. For example, the PDF of pressure changes from negatively to positively skewed as M_t increases. Similar changes are observed for temperature and density. We suggest that large fluctuations of thermodynamic variables will be log-normal at high M_t. We also find that, relative to incompressible turbulence, the correlation between enstrophy and low-pressure regions is weakened at high M_t which can be explained by the dominance of the so-called dilatational pressure.

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