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Theoretical Aspects of Level Crossing Scales in Turbulence
ADAM J. WACHTOR, RYAN SOKOLOWSKI, AARON P. FREEMAN, JENNIFER SHOCKRO, HARIS J. CATRAKIS, University of California - Irvine — We consider theoretical aspects of the statistics of level crossing scales in turbulence. Our focus is on two basic quantities of fundamental and practical interest. The first quantity is the probability density function of the level crossing scales. The second quantity is the correlation function of thresholded signals or fields corresponding to the level crossings. We explore a general mathematical approach aimed toward establishing relations between these two quantities. In addition to the general approach, we study specific classes of level crossings with power-law, exponential, and log-normal statistics. These three types of level crossings are believed to be appropriate for various turbulent flows, according to available observations, and thus are particularly relevant for turbulence studies. Because the correlation function is closely related to the power spectrum, this approach has the potential to illuminate the relation between the probability density function of level crossing scales and the spectrum of the corresponding thresholded signals or fields.

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