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Higher-Order Statistics in Compressive Solar Wind Plasma Turbulence: High-Resolution Density Observations From the Magnetospheric MultiScale Mission

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Turbulent density fluctuations are investigated in the solar wind at sub-ion scales using calibrated spacecraft potential. The measurement technique using the spacecraft potential allows for a much higher time resolution and sensitivity when compared to direct measurements using plasma instruments. Using this novel method, density fluctuations can be measured with unprecedentedly high time resolutions for in situ measurements of solar wind plasma at 1 a.u. By investigating 1 h of high-time resolution data, the scale dependant kurtosis is calculated by varying the time lag τ to calculate increments between observations. The scale-dependent kurtosis is found to increase towards ion scales but then plateaus and remains fairly constant through the sub-ion range in a similar fashion to magnetic field measurements. The sub-ion range is also found to exhibit self-similar monofractal behavior contrasting sharply with the multi-fractal behavior at large scales. The scale-dependent kurtosis is also calculated using increments between two different spacecraft. When the time lags are converted using the ion bulk velocity to a comparable spatial lag, a discrepancy is observed between the two measurement techniques. Several different possibilities are discussed including a breakdown of Taylor's hypothesis, high-frequency plasma waves, or intrinsic differences between sampling directions.