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Inner-outer interactions in a rough wall turbulent boundary layer over hemispherical roughness using PIV GOKUL PATHIKONDA, Georgia Institute of Technology, CAITLYN CLARK, KENNETH T CHRISTENSEN, University of Notre dame — Inner-outer interactions over rough-wall boundary layer were investigated using high frame-rate, PIV measurements in a Refractive index-matched (RIM) facility. Flows over canonical smooth-wall and hexagonally-packed hemispherical roughness under transitionally rough flow conditions (and with $Re_\tau \sim 1500$) were measured using a dual camera PIV system with different fields of view (FOVs) and operating simultaneously. The large FOV measures the large scales and boundary layer parameters, while the small FOV measures the small scales very close to the wall with high spatial ($\sim 7y^*$) and temporal ($\sim 2.5t^*$) resolutions. Conditional metrics were formulated to investigate these scale interactions in a spatio-temporal sense using the PIV data. It was found that the observations complement the interaction structure made via hotwire experiments and DNS in previous studies over both smooth and rough-wall flows, with a strong correlation between the large scales and small scale energies indicative of the amplitude modulation interactions. Additionally, frequency and scale modulations were also investigated with limited success. These experiments highlight the similarities and differences in these interactions between the smooth- and rough-wall flows.

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