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Small particle motions in inhomogeneous super fluid turbulence
TAKUMI MARUYAMA, SHINICHIRO WAKI, SOU SUZUKI, VOLKER SONNENSCHEIN , HIDEKI TOMITA, YOSHIYUKI TSUJI, TETSUO IGUCHI, Nagoya University — Lagrangian trajectories of small particles in a fully developed turbulent state are studied in a rectangular duct. A plate heater is attached on the bottom to generate the thermal counter flow. The bath temperature is changed from 1.9 K to 2.1 K, and is controlled within 0.1 mK. Small particles made of solid hydrogen are visualized by high-speed camera and their trajectories are recorded. Their motions indicate complex features depending not only on bath temperature and heater power, but also on particle size. Particle motions near the wall are different from those at duct center. We report the effect of flow inhomogeneity on the particle motions. Smaller particle tends to be affected by the inhomogeneity than the larger particle sizes. To characterize the particle motions, the Hurst exponent is defined by $|\vec{x}(t+\tau) - \vec{x}(t)| \propto \tau^H$, where $\vec{x}(t)$ denotes the particle position at time t. It is found that there is a characteristic time scale τ_0[1]. For small time separation, $\tau \leq \tau_0$, the exponent H is small. However, for large time separation, $\tau_0 \ll \tau$, H is nearly 1. [1] W.Kubo and Y.Tsuji, Journal of Low Temperature Physics, 2019, Volume 196, pp 170176

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