Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

On the Dynamics of air bubbles in Rayleigh-Benard Convection at various aspects ratios[1] SOOHYEON KANG, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, USA, JIN-TAE KIM, Querrey Simpson Institute for Bioelectronics, Northwestern, USA, SHIKUN SHEN, LEONARDO CHAMORRO, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, USA — A laboratory investigation was carried out to uncover the distinct dynamics of air bubbles in Rayleigh-Benard (RB) convection in a rectangular cell at aspect ratios of 1.25, 1.5, 2.0, and 2.5. The experiments were performed at Rayleigh numbers on the order of Ra$\sim 10^{10}$. Streams of 1-mm bubbles were released from the bottom of the RB tank along the path of the roll structure at a fixed location of s/D=1/2, where s is the distance along the diagonal with respect to the center of the tank and D is the half diagonal distance. Three-dimensional particle tracking velocimetry was used to track simultaneously a relatively large number of bubbles, and to quantify the associated pair dispersion for various initial separations in the range of $20 \leq \eta \leq 200$, where η is the local Kolmogorov length scale. We will discuss distinct effects of the aspect-ratio dependency on the dynamics of the bubbles, path instability, pair dispersion, and the relation with the large-scale roll structures.

[1]This research was funded by the National Science Foundation, grant no. CBET-1912824.

Soohyeon Kang
Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, USA

Date submitted: 03 Aug 2020 Electronic form version 1.4