Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Redescribing of Busse balloon on Rayleigh-Bénard convection imposed by horizontal magnetic field YUJI TASAKA, Hokkaido University, TAKATOSHI YANAGISAWA, JAMSTEEC, TAKEHIRO MIYAGOSHI, JAMSTEC, TOBIAS VOGT, SVEN ECKERT, HZDR — Laboratory experiment of RBC was performed using GaInSn eutectic as a typical low Pr fluid with quasi-uniform horizontal magnetic field to elucidate how the Busse balloon describing stability of 2D rolls is modified by Lorenz force effect. Development of the flow from steady rolls to unsteady state were investigated with decreasing Chandrasekhar number Q in a range, $2.5 \times 10^4 \leq Q \leq 1.9 \times 10^5$ at fixed Ra numbers, $7.9 \times 10^4 \leq Ra \leq 1.8 \times 10^5$, by ultrasonic velocity profiling. The velocity profile measurements showed the dynamic morphology of the oscillatory convection, 2D oscillation observed at the onset of oscillations, oscillations of recirculation vortex pairs between the main rolls, and synchronous motion of the main rolls. The measurements also suggested that the oscillation occurs at similar Reynolds numbers $Re \approx 900$ and may be caused by instabilities on the recirculation vortex pair.This finding suggests that the oscillations are essentially different from generally observed traveling waves described as the oscillatory instability considered in the Busse balloon. Power law found on the variation of Re with Q suggested the 2D oscillation is dominated by by relation between side wall Hartmann braking and buoyancy.

Yuji Tasaka
Hokkaido University

Date submitted: 01 Aug 2019 Electronic form version 1.4