Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

What happens on the vortex structures when the rising bubble transits from zigzag to spiral?[1] ZHANG JIE, State Key Laboratory for Strength and Vibration of Mechanical Structures, School of Aerospace, Xian Jiaotong University, Xian, Shaanxi 710049, China, NI MINGJIU, School of Engineering Science, University of Chinese Academy of Sciences, Beijing 101408, China, THE LABORATORY OF THE MULTIFLUID MAGNETOHYDRODYNAMIC FLOWS TEAM — It has been demonstrated by many experiments that in certain liquids, a single millimeter-sized bubble will rise within an unstable path, which transits from zigzag to spiral sometimes.After performing several groups of direct numerical simulations,the present work gives a theoretical explanation to reveal the mechanism causing the transition,and the results are presented in two parts.In the first part,where a freely rising bubble is simulated, equal-strength vortex pairs are observed to shed twice during a period of the ziazag motion, which is triggered by the amounts of streamwise vorticities accumulated on the bubble interface. However,when the balance between the counter-rotating vortices is broken, an angular velocity is induced between the asymmetric vortex pairs,driving the bubble rising in an opposite spiral path.Therefore,although there is no preference of the spiral direction as observed in experiments,it is actually determined by the sign of the stronger vortex thread.In the second part, external vertical magnetic fields are imposed onto the spirally rising bubble,in order to weak the imbalance between the vortex pairs. As a consequence,as the vortex pairs become more symmetric,the rotating radius of the spirally rising bubble decreases.

[1]This work has been supported by NSFC(51636009, 11502193), CAS(XDB22040201) and MOST(2013GB114000)

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Date submitted: 15 Aug 2017 Electronic form version 1.4