Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Experiments of Interfacial Instability on a Ferrofluid Droplet[1]
CHING-YAO CHEN, Y.-Z. CHENG, W.-K. TSAI, National Chiao Tung University, Taiwan, Republic of China, JOSE A. MIRANDA, Universidade Federal de Pernambuco, Brazil — The interfacial morphologies of an extremely thin layer of ferrofluid droplet under a constant perpendicular magnetic field are investigated. Striking patterns consisting of numerous sub-scale droplets that develop from Rosensweig instability are observed. For a dry plate the breaking pattern of sub-scale droplets can be characterized by a dimensionless magnetic Bond number, Bo_m. In general, a more pronounced instability, which is evident by a greater number of breaking sub-scale droplets N, arises with a higher Bo_m. For a magnetic Bond number that is larger than a critical value, the central droplet is torn apart. For a prewetted plate, a nearly flat fluid surface is achieved due to a smaller contact angle, which then leads to virtually evenly distributed sub-scale droplets. A global size for all breaking sub-scale droplets is observed regardless of their initial diameters. On the other hand, when a ferrofluid droplet is immersed in a thin layer of a nonmagnetic fluid, a formation of intriguing interfacial structures is observed, and the development of a hybrid-type ferrohydrodynamic instability is verified, where peak and labyrinthine ferrofluid patterns coexist and share a coupled dynamic evolution.

[1]Supported by the National Science Council of the Republic of China.

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Date submitted: 03 Jul 2008 Electronic form version 1.4