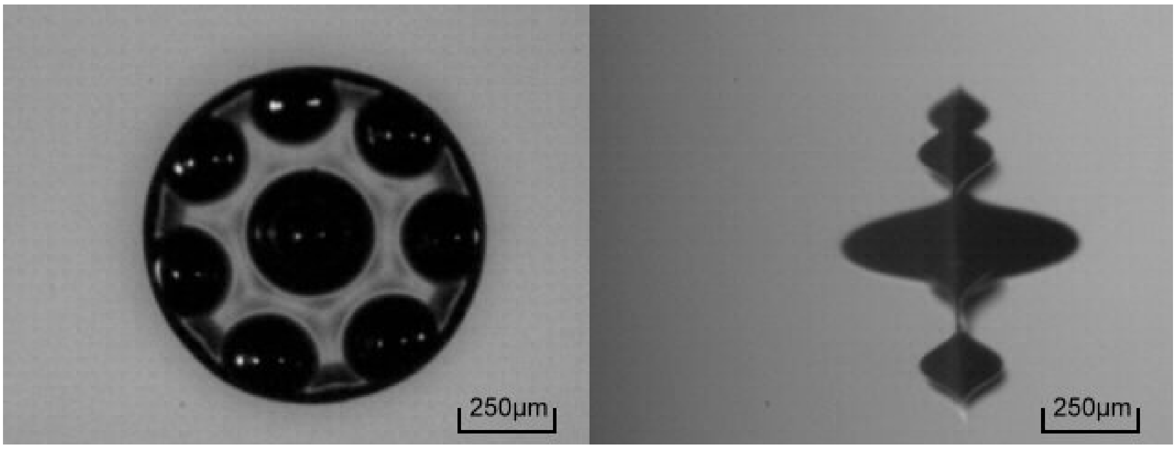

Rosensweig Instability of a Ferrofluid Droplet

Submitted by
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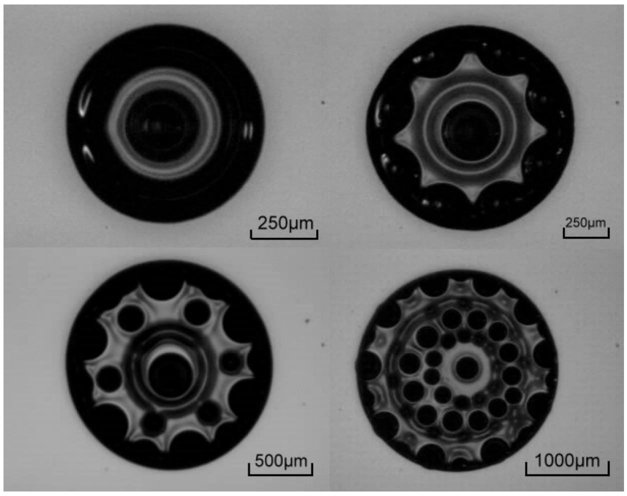
We perform experiments of the Rosensweig instability on a circular thin film of ferrofluid droplet. The experimental setup consists of a circular thin layer of ferrodroplet placed on a glass plate subjected to a perpendicular field. The ferrofluid used is a light mineral oil-based ferrofluid (EMG901) produced by the Ferrotec Corp. with a saturation magnetization Ms = 660 gauss. The field strength is generated by a pair of coils in the Helmholtz configuration powered by a programmable power source. The power source is turned on instantly to generate a uniform field strength of H=346Oe and kept constant by fixed the current intensity. We record the interfacial morphologies of ferrodroplet by a charge-coupled device (CCD) camera. The images of side views are taken via reflection of a prism.

The observation of a representative case for a ferrodroplet of initial diameter d≈900 μm (measured from the top view), as the images of top and side views at the equilibrium state shown in the above figure. The droplet is broken up into numerous “sub-scale droplets”, including a largest “central droplet” near the original droplet’s center surrounded by a circular array that consists of 7 smaller and nearly evenly distributed “subdroplets” .



These sub-scale droplets recorded from the top views are not plain two-dimensional circular films but typical three-dimensional Rosensweig crests with sharp spikes as shown by the side views. Significant dominance of the “central droplet” is clearly observed at the present condition on a dry plate.

The top views patterns of sub-scale droplets depend strongly on the initial sizes of ferrodroplets. In general, a more complex as well as a larger number of sub-scale droplets are observed for a bigger droplet because of weaker constraint of surface tension. Four major modes of pattern formation are found between 800 μm ≦ d ≦ 3,000 μm as demonstrated in the second figure.

This research is supported by the National Science Council of the Republic of China through the grant NSC-95-2221-E-224-077-MY3 .