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## Gravitational and Magnetic Instabilities of Thin Fluid Layers

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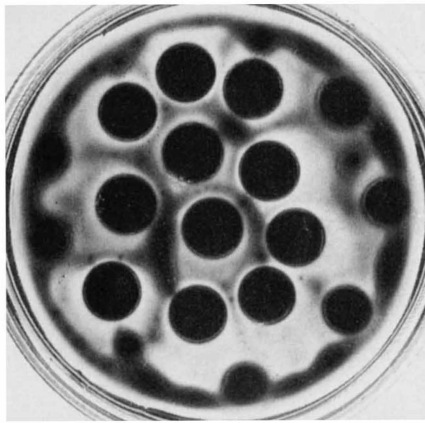


Figure 1

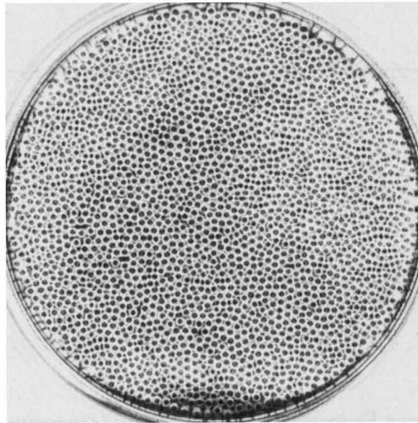


Figure 2

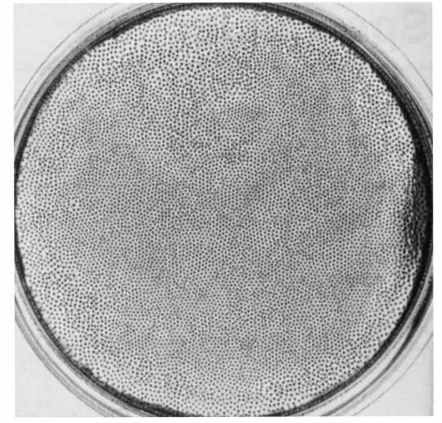


Figure 3

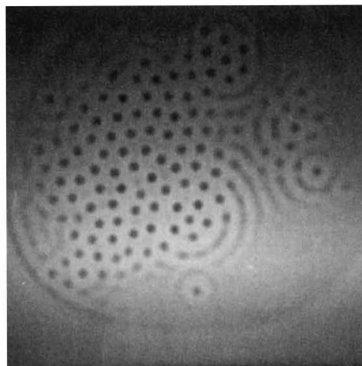
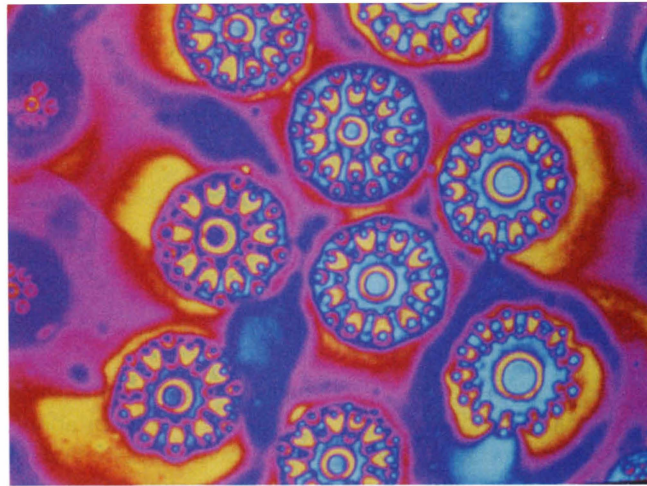


Figure 4



Figure 5

## GRAVITATIONAL AND MAGNETIC INSTABILITIES OF THIN FLUID LAYERS

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The interface of thin horizontal layers of viscous fluids may be destabilized by the application of a gravity field (heavier fluid lying on top of a lighter one: Rayleigh–Taylor instability) or a uniform magnetic field normal to the interface (Rosensweig instability of ferrofluids). In the magnetic instability, the most unstable wavelength decreases as the square of the applied magnetic field (Fig. 1: thin layer of

ferrofluid deposited on a pool of glycerine seen from above, round ferrofluid lenses caused by the gravitational instability alone; Fig. 2: same situation with 90 G magnetic field; Fig. 3: magnetic field increased to 137 G).<sup>1,2</sup> Ferrofluid flowers (color picture) were obtained by suddenly increasing the magnetic field when the fluid layer had been already broken into large “lenses.” In the Rayleigh–Taylor instability, the most unstable wavelength is proportional to the capillary length. Axisymmetric and hexagonal patterns are the most frequently observed (Fig. 4: plan view of the unstable layer, thicker regions appear as dark spots; Fig. 5: oblique view of the fluid layer showing a periodic array of hanging drops).<sup>3</sup>