# Faraday Instability on Solid-liquid Interface of $^4$He

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When liquid is oscillated at a frequency $2\omega$ in the vertical direction, the oscillations of the surface occur at half the frequency $\omega$ above the threshold oscillation amplitude. This is called Faraday instability and is regarded as a model system for the physics of pattern formation and nonlinear dynamics[1]. It is known the Faraday wave has generated on the free surface of the ordinary liquids, but it has never been observed for the superfluid. We succeeded in visually observing that the Faraday waves were parametrically generated on a free surface of superfluid $^4$He for the first time(FIG.1). Furthermore, it is expected that the Faraday instability also occurs on the crystal-superfluid interface of $^4$He because the crystallization waves at low temperature plays an similar role in the standing waves at the free surface[2]. We also report the observation of the Faraday instability for crystal superfluid interface.

[1] M. Faraday, Philos. Trans. R. Soc. London **52**, 319 (1831).
[2] W. van Saarloos and J. D. Weeks, Phys. Rev. Lett. **74**, 290 (1995)

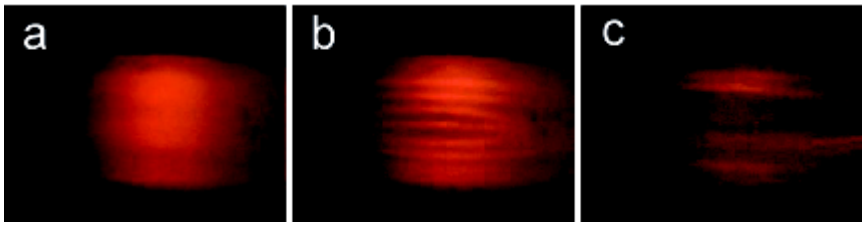


FIG.1: Superfluid free surface of $^4$He at 700 mK. It was flat when the sample cell was at rest (a). Once the sample cell started to be oscillated at t = 0 at frequency $f$ = 24.0 Hz, standing waves developed on the surface as (b) at $t$ = 5 sec and (c) at $t$ = 47 sec.