Fachbereich 4
Produktionstechnik
Maschinenbau &
Verfahrenstechnik

CENTER OF
APPLIED SPACE TECHNOLOGY
AND MICROGRAVITY
ZARM

Fluids and Space Engineering Seminar

Date: Wednesday, June 26, 2019 at 13:00
Location: ZARM, Room 1730

The Faraday Flow - a benchmark experiment for turbulent dispersion and mixing

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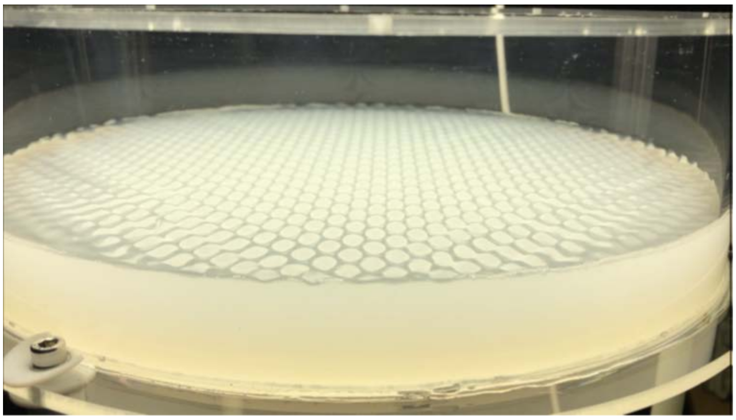

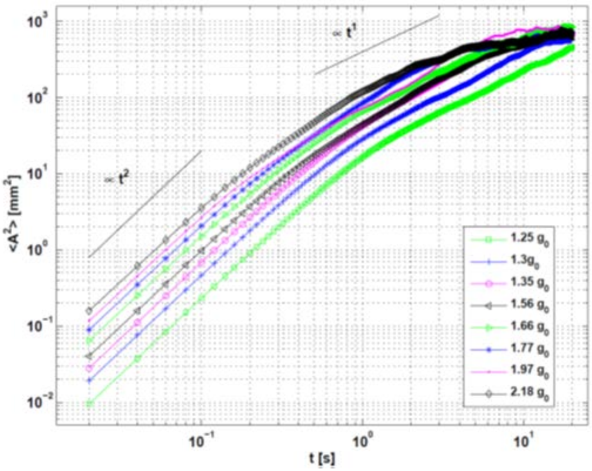

Figure 1: Faraday wavefield in a 2%-milk water solution with water height of 3 cm and driving frequency of 50 Hz (a), the energy spectra changes with the amplitude of the forcing $a_0 = cg_0$ (g_0 being the gravitational constant) therefore also the effective absolute diffusion $< A^2(t) >$ changes (b).

Faraday waves are capillary ripples that form on the surface of a fluid being subject to vertical shaking with monochromatic sinoidal excitation $a(t) = a_0 sin(wt)$. The resulting pattern of waves is known to be depending on driving frequency, Faraday (1831). Faraday waves have been studied for a large variety of applications, ranging from bio-medicine to material sciences (controlled pattern formation, walking and orbiting of droplets), Saylor and Kinard (2005); Couder et al. (2005). In capillary ripples, a complex and random transport of floating particles is generated, Ramshankar et al. (1990). However, only recent studies, von Kameke et al. (2011, 2013); Francois et al. (2013), proved the existence of a horizontal velocity field at the surface, called Faraday flow, which was shown to exhibit attributes of two-dimensional (2D) turbulence, most importantly an inverse energy cascade. Experimental results confirmed the presence of a dual energy cascade in the case of Faraday wave driven 2D-turbulence, von Kameke et al. (2011), as theoretically predicted by Kraichnan (1971). Energy is introduced at intermediate forcing scales and transferred upwards to larger scales, resulting in a net inverse energy flux. This phenomenon can lead to energy condensation, by which large and ordered flow structures emerge from the the seemingly disordered motion at small scales. The turbulence intensity and the turbulent effective diffusivity of the Faraday flow can be easily varied by adjusting the amplitude of the vertical shaking, while the length scales of the fluid flow is manipulated by changing the frequency. Therefore, and because of its two-dimensionality, the Faraday flow is proposed to serve as a benchmark experiment to study different measures of mixing and transport in the future.