Fluid Mechanics and Some Novel Surface Waves

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We start from some wave phenomena in fluids, and discuss the construction of some novel surface waves that are considered or similar to those in the context of two-dimensional electron systems. In the first example, we first introduce the phenomenon of water waves going through a hydrodynamic vortex, whose similarity to the quantum Aharonov–Bohm effect was revealed by Berry in 1980s. We then construct an acoustic phase that is analogous to a quantum Hall system. In the second example, we will discuss the ship waves that were firstly analyzed by Kelvin, and construct plasmonic Kelvin ship waves on graphene. In the third example, we will establish the linkage between hydrodynamic Rayleigh jet (or called Worthington jet) and the process of two-dimensional plasmon launching in electron-energy loss spectroscopy.