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Overhanging solitary water waves

In this talk we consider the classical water wave problem for an incompressible inviscid fluid occupying a time-dependent domain in the plane, whose boundary consists of a fixed horizontal bed together with an unknown free boundary separating the fluid from the air outside the confining region.

We provide the first construction of overhanging gravity water waves having the approximate form of a disk joined to a strip by a thin neck. The waves are solitary with constant vorticity, and exist when an appropriate dimensionless gravitational constant is sufficiently small. Our construction involves combining three explicit solutions to related problems: a disk of fluid in rigid rotation, a linear shear flow in a strip, and a rescaled version of an exceptional domain discovered by Hauswirth, Hélein, and Pacard, the hairpin. The method developed here is related to the construction of constant mean curvature surfaces through gluing.

This result is in collaboration with J. Davila, M. Del Pino, M. Wheeler.

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