DK Seminar

Mar 29, 2017, 14:15 - 15:45
University of Vienna,
Oskar-Morgenstern-Platz 1, HS 2

Ronald Quirchmayr

University of Vienna

A shallow water equation for waves of large amplitude

We introduce a model equation which we derived from the classical water wave problem for unidirectional water waves, where the divergence-free flow beneath the free water surface over a flat bed is governed by the incompressible Euler equations, with gravity acting as the only external force. This model equation describes the evolution of the horizontal velocity component of the flow field evaluated at a specific depth within a shallow water regime, allowing for waves of large amplitude. We present well-posedness results of the corresponding Cauchy problem by using Kato's semigroup approach for quasilinear hyperbolic evolution equations. Furthermore we discuss the traveling wave solutions of this highly nonlinear partial differential equation. By applying qualitative methods from the theory of dynamical systems, in particular tools from integrable planar systems, we establish a full classification of all traveling waves. Thereby we discover completely new types of traveling waves, e.g. peaked solitary waves with compact support and periodic traveling waves with peaked crests and troughs, which do not appear as solutions of shallow water equations for waves of moderate amplitude such as the well-known Camassa-Holm equation.