Nonlinear Airy wave pulses on the sea surface

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The possibility of self-acceleration of the water-wave pulse with a constant envelope in the form of the nonlinear Airy function during its propagation in deep and intermediate water is experimentally and theoretically analyzed. This wave packet has amazing properties - accelerates without any external force, and preserves shape in a dispersive medium. The inverted Airy envelope wave function can propagate at a velocity that is faster than the group velocity. We experimentally study the behavior of Airy water-wave pulses in a super-tank and long scaled propagation, to investigate its main properties, nonlinear effects and stability. Theoretical modeling analysis is based on nonlinear Schrodinger equation. The following problems are investigated: - Defining the scope of applicability, feasibility and stability conditions of nonlinear Airy wave trains in a deep water conditions. - Defining regimes of self-acceleration and self-deceleration of the main pulse, immutability shape of Airy envelope. - Assessing the impact of nonlinearity on the propagation of Airy waves. We analyzed the influence of the initial pulse characteristics on self-acceleration (deceleration) of wave packet and the stability of the envelope form. The anticipated results allow extending the physical understanding of the evolution of nonlinear dispersive waves in a wide range of initial conditions and at different spatial and temporal scales, from both theoretical and experimental points of view.