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Dark solitons on the surface of water

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The nonlinear Schrödinger equation (NLS) models the evolution dynamics in time and space of weakly nonlinear water wave trains in finite or infinite depth. In the defocusing regime (finite depth), the NLS admits a family of soliton solutions, which describe the strong depression of wave envelopes. These solitons are referred to dark solitons and have been already observed in optics and in Bose-Einstein condensates. We present experimental results on gray and black solitons, propagating in a wave flume. Furthermore, we analyze the data and discuss the discrepancies observed with respect to theoretical predictions. The results prove that in the case of weak-nonlinearity of the waves, the NLS describes well the dynamics of nonlinear wave packets in finite depth.