



Seminario di Analisi Matematica

giovedì 23 aprile 2026, ore 16:00
Dipartimento di Matematica e Fisica
Aula M3, Lungotevere Dante 376

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Extreme waves and large deviations for 2D pure gravity deep water waves

Abstract

We study the formation of extreme waves from a statistical viewpoint in the context of the pure gravity water wave equations in deep water. We quantify their probability under random Gaussian sea initial data up to the optimal timescales allowed by deterministic well-posedness theory. The proof shows that rogue waves most likely arise through "dispersive focusing", where phase synchronization produces constructive amplification of the water crest. The main difficulty in justifying this mechanism is propagating statistical information over such long timescales, which we overcome by combining normal forms and probabilistic methods. Unlike previous results, this new approach does not require approximate solutions to be Gaussian. Joint work with M. Berti, A. Maspero and G. Staffilani.