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Rogue waves in a water tank: Experiments and modeling

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Recently many rogue waves have been reported as the main cause of ship incidents on the sea. One of the main characteristics of rogue waves is its elusiveness: they present unexpectedly and disappear in the same wave. Some authors (Zakharov and al.2010) are attempting to find the probability of their appearances apart from studyingthe mechanism of the formation. As an effort on this topic we tried the generation of rogue waves in a water wave tank using a symmetric spectrum(Akhmediev et al. 2011) as input on the wave maker. The produced waves were clearly rogue waves with a rate (maximum wave
height/ Significant wave height) of 2.33 and a kurtosis of 4.77 (Janssen 2003, Onorato 2006). These results were already presented (Lechuga 2012). Similar waves (in pattern aspect, but without being extreme waves) were described as crossing waves in a water tank(Shemer and Lichter1988).
To go on further the next step has been to apply a theoretical model to the envelope of these waves. After some considerations the best model has been an analogue of the Ginzburg-Landau equation. This apparently amazing result is easily explained: We know that the Ginzburg-Landau model is related to some regular structures on the surface of a liquid and also in plasmas, electric and magnetic fields and other media. Another important characteristic of the model is that their solutions are invariants with respectto the translation group.

The main aim of this presentation is to extract conclusions of the model and the comparison with the measured waves in the water tank.The nonlinear structure of waves and their regularity make suitable the use of the Ginzburg-Landau model to the envelope of generated waves in the tank,so giving us a powerful tool to cope with the results of our experiment.