

# Mach reflection and KP solitons in shallow water

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(Submitted on 2 Apr 2010)

Reflection of an obliquely incident solitary wave onto a vertical wall is studied analytically and experimentally. We use the Kadomtsev-Petviashvili (KP) equation to analyze the evolution and its asymptotic state. Laboratory experiments are performed using the laser induced fluorescent (LIF) technique, and detailed features and amplifications at the wall are measured. We find that proper physical interpretation must be made for the KP solutions when the experimental results are compared with the theory under the assumptions of quasi-two dimensionality and weak nonlinearity. Due to the lack of physical interpretation of the theory, the numerical results were previously thought not in good agreement with the theory. With proper treatment, the KP theory provides an excellent model to predict the present laboratory results as well as the previous numerical results. The theory also indicates that the present laboratory apparatus must be too short to achieve the asymptotic state. The laboratory and numerical results suggest that the maximum of the predicted four-fold amplification would be difficult to be realized in the real-fluid environment. The reality of this amplification remains obscure.

Comments: 16 pages, 10 figures,

Subjects: **Pattern Formation and Solitons (nlin.PS)**; Fluid Dynamics (physics.flu-dyn)

Cite as: [arXiv:1004.0370v1](https://arxiv.org/abs/1004.0370v1) [nlin.PS]

## Submission history

From: Yuji Kodama [[view email](#)]

[v1] Fri, 2 Apr 2010 18:04:27 GMT (1886kb,D)

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