

## ***Interactive comment on “Variational modelling of extreme waves through oblique interaction of solitary waves” by F. Gidel and O. Bokhove***

### **Anonymous Referee #2**

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This paper is about the reflection of obliquely incident solitary waves on vertical walls. This is a well studied problem and it is known that at small angles a Mach stem is observed which can lead to large amplitudes (up to 4 times the incident wave). The main goal of the paper is to devise a finite element numerical scheme that can be used to solve the Benney-Luke equation - an equation which encompasses previous studies using the KP equation. The paper is well written but probably spends too many pages re-deriving BL and KP (albeit using variational methods). The name Benney-Luke was unfortunately seldom used in the literature (to my knowledge it reappears in Milewski & Keller 1996 and Pego & Quintero 1999) and, although I am not aware of any, I wonder if are any studies of Mach reflection using “three-dimensional Boussineq” (which is essentially what Benney-Luke is) models in the literature.

I would note that recently Kodama and Yeh have claimed that the KP order is insufficient

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to capture the large amplitude Mach stem and that better results are obtained using higher order corrections to KP. These would be out of the range of the present BL equation. However, given how BL performs here one may wonder whether this claim is correct.

Note that the “extreme wave” claim for such cross wave constructions in shallow water is not new (see Peterson et al).

I also believe the title is a bit too broad. It should probably mention the oblique reflection of a solitary wave with a wall. (perhaps keep the same title and add “: application to Mach reflection.”)

I am happy to recommend this paper for publication. Incidentally I do not find the way the actual waves are presented (Figures 9 & 10) particularly informative - a larger version of the top view (i.e. the bottom right panel) only would be better.

Milewski, P. A., & Keller, J. B. (1996). Three-dimensional Water Waves. *Studies in Applied Mathematics*, 97(2), 149-166.

Pego, R. L., & Quintero, J. R. (1999). Two-dimensional solitary waves for a Benney–Luke equation. *Physica D: Nonlinear Phenomena*, 132(4), 476-496.

Kodama, Y., & Yeh, H. (2016). The KP theory and Mach reflection. *Journal of Fluid Mechanics*, 800, 766-786.

Peterson, P., Soomere, T., Engelbrecht, J., & Van Groesen, E. (2003). Soliton interaction as a possible model for extreme waves in shallow water. *Nonlinear Processes in Geophysics*, 10(6), 503-510.

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