Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Wave-current interaction in a laboratory flume: an analogue of the Hawking effect DANIEL ROBB, EDMUND TEDFORD, GREGORY LAWRENCE, University of British Columbia — The propagation of surface water waves against an adverse current is studied both numerically and experimentally. In particular, we examine a flume experiment where a streamlined obstacle was placed in a steady open-channel flow to create a spatially-varying current (Weinfurtner et al. 2011, Phys. Rev. Lett.). Long waves were generated downstream of the obstacle and propagated upstream against the current. As they travelled over the lee side of the obstacle they were blocked and converted into a pair of outgoing short (deep-water) waves. The first of the pair had a group velocity and phase velocity both pointing downstream, whereas the second had the unusual property of a group velocity and phase velocity pointing in opposite directions. Here we present the correspondence between the Saint-Venant equations for shallow water flows and the wave equation on a general curved spacetime geometry used in general relativity. We then describe the analogy between the pair of outgoing surface water waves and the Hawking effect. Finally, based on our numerical simulations we discuss the conditions which are favorable for detecting the analogue Hawking effect in a hydraulics laboratory with the aim to support future experimental studies.

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Date submitted: 31 Jul 2019 Electronic form version 1.4