Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Effect of liquid surface tension on circular and linear hydraulic jumps; theory and experiments[1] RAJESH KUMAR BHAGAT, CEB, University of Cambridge , NARSING KUMAR JHA, PAUL F. LINDEN, DAMTP, University of Cambridge, DAVID IAN WILSON, CEB, University of Cambridge — The hydraulic jump has attracted considerable attention since Rayleigh published his account in 1914. Watson (1964) proposed the first satisfactory explanation of the circular hydraulic jump by balancing the momentum and hydrostatic pressure across the jump, but this solution did not explain what actually causes the jump to form. Bohr et al. (1992) showed that the hydraulic jump happens close to the point where the local Froude number equals to one, suggesting a balance between inertial and hydrostatic contributions. Bush & Aristoff (2003) subsequently incorporated the effect of surface tension and showed that this is important when the jump radius is small. In this study, we propose a new account to explain the formation and evolution of hydraulic jumps under conditions where the jump radius is strongly influenced by the liquid surface tension. The theory is compared with experiments employing liquids of different surface tension and different viscosity, in circular and linear configurations. The model predictions and the experimental results show excellent agreement.

[1]Commonwealth Scholarship Commission, St. John's college, University of Cambridge

Rajesh Kumar Bhagat
CEB, University of Cambridge

Date submitted: 01 Aug 2017 Electronic form version 1.4