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Universal Froude number in a circular hydraulic jump, implication on the jump radius selection[1] ALEXIS DUCHESNE, LUC LEBON, LAURENT LIMAT, Laboratoire Matière et Systèmes Complexes - CNRS - Université Paris Diderot — In the literature, it is known that the properties of a standard hydraulic jump depend critically on a Froude number Fr defined by the ratio between the flow speed and the gravity waves speed: Fr is larger than 1 upstream of the shock, and smaller than 1 downstream, an accumulation of gravity waves occuring at the shock with formation of a sharp liquid wall. Surprisingly, to our knowledge, this question of Froude number value has never been explored for the circular hydraulic jump formed by an impinging jet on a horizontal surface. We have investigated carefully this question, varying the flow rate, the liquid viscosity and the surface tension. We have found that, in the specific case of a circular jump with no confinement walls, there exists an universal value, equal to 0.38 on which the Froude number defined at the jump exit is locked. We examine the implications of this result on the selection of the jump radius R, after combining it with the large scale flow structure around the jump, calculated in the lubrication limit. In agreement with our data, R is very close to follow the law proposed by Bohr, but this law has to be modified by introducing non negligible logarithmic corrections.We also discuss the implications of our results in terms of Watson description of the shock.

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