

Abstract Submitted  
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**Universality of the logarithmic velocity profile restored** PAOLO LUCHINI, Univ of Salerno — The logarithmic velocity profile of wall-bounded turbulent flow, despite its widespread adoption in research and in teaching, exhibits discrepancies with both experiments and numerical simulations that have been repeatedly observed in the literature; serious doubts ensued about its precise form and universality, leading to the formulation of alternate theories and hindering ongoing experimental efforts to measure von Kármán's constant. By comparing different geometries of pipe, plane-channel and plane-Couette flow, here we show that such discrepancies can be physically interpreted, and analytically accounted for, through an equally universal higher-order correction caused by the pressure gradient. Inclusion of this term produces a tenfold increase in the adherence of the predicted profile to existing experiments and numerical simulations in all three geometries. Universality of the logarithmic law then emerges beyond doubt and a satisfactorily simple formulation is established. Among the consequences of this formulation is a strongly increased confidence that the Reynolds number of present-day direct numerical simulations is actually high enough to uncover asymptotic behaviour, but research efforts are still needed in order to increase their accuracy.

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