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Building a Portable, Cold-Atom Pressure Standard[1] PERRIN WALDOCK, PINRUI SHEN, UBC, JAMES BOOTH, BCIT, KIRK MADISON, UBC — Both science and industry require vacuum pressure measurement, with applications including residual gas analysis, semiconductor device manufacturing, and atmospheric modeling. Remarkably, no primary pressure standard existed for the high and ultra-high vacuum regimes (below 107 Pa) until recently, when a UBC-BCIT collaboration succeeded in producing the first primary vacuum pressure standard. Based on collision-induced loss rates of trapped 87Rb atoms, this new technique uses only fundamental constants and immutable atomic properties to measure pressure. It takes advantage of quantum diffractive universality (QDU) associated with trap loss, rendering it self-defining and able to measure the pressure of any gas. This is a significant advance over the existing orifice flow standard, which only works with inert gases, and is a based on a mechanically-fabricated orifice. We are building a portable Rb-based pressure standard to compare against other devices. Following our lead, the National Institute of Standards and Technology (NIST) is building a Li-based pressure standard, which we will compare our device against. This will allow us to test the limits of QDU, refine the atom-based definition of pressure, and investigate the short-range collision interaction to atom loss rates.

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