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Development of a new UHV/XHV pressure standard (Cold Atom Vacuum Standard)

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Since the earliest days of neutral atom trapping it has been known that the background gas in the vacuum limits the lifetime of atoms in the trap. We are inverting this problem to create a quantum-based standard and sensor. Because the measured loss-rate of ultra-cold atoms from the trap depends on a fundamental atomic property (the loss-rate coefficient or thermalized cross section) such atoms can be used as an absolute sensor and primary vacuum standard. Researchers have often observed that the relationship between the trap lifetime and background gas can be an indication of the vacuum level, but a true absolute sensor of vacuum has not yet been realized. We are developing the atomic toolkit, and designing and building the apparatus to measure relevant cross sections, as well as building our first prototype vacuum sensing apparatus. In this presentation, we will discuss our progress, and present our newest measurements.

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