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Progress toward a cold-atom based vacuum standard and pressure gauge STEPHEN ECKEL, DANIEL BARKER, JAMES FEDCHAK, NIKOLAI KLIMOV, ERIC NORRGARD, JULIA SCHERSCHLIGT, National Institute of Standards and Technology — Preparation and evaluation of ultra-high-vacuum (UHV) and extreme-high-vacuum (XHV) environments is critical for high-quality semiconductor fabrication and emerging quantum technologies. Vacuum sensors for these pressure ranges, such as ion-gauges, are not primary (i.e., they require calibration themselves) and have large, poorly-understood uncertainties. We present our progress towards a primary standard for vacuum measurement in the XHV using cold Li atoms confined in a magnetic trap. Our apparatus will allow high-accuracy measurements of atom-molecule collision cross-sections that are necessary to extract the vacuum pressure from the observed background-gas-limited lifetime of the trapped atoms. We have also developed chip-based techniques to slow and trap Li atoms with a single laser beam. This nano-fabricated atom-trapping platform forms the basis for a deployable, primary vacuum sensor with embedded traceability that can replace an ion gauge.

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