Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

A pressure standard for Ultra-High-Vacuum based on laser-cooled atoms EITE TIESINGA, National Institute of Standards and Technology, CONSTANTINOS MAKRIDES, Joint Quantum Institute — At the National Institute of Standards and Technology we are building a Cold Atom Vacuum Standard (CAVS) device that will operate as a primary standard for the Ultra-High-Vacuum and Extreme-High-Vacuum regimes. Current pressure sensors do not operate reliably at these pressures. The CAVS device operates by relating loss of microkelvin lithium atoms from a shallow conservative trap by collisions with ambient, room-temperature atoms and molecules to the background density and thus pressure through the ideal gas law. The predominant background constituent at ultra low pressures is molecular hydrogen. After giving an introduction into pressure sensing technologies, I will describe our theoretical characterization of the lithium with hydrogen-dimer collision processes as well as that with atom helium, often injected to detect leaks in vacuum systems. Specifically, we computed the relevant Born-Oppenheimer potential energy surfaces, paying special attention to their uncertainty. Coupled-channels calculations were then used to obtain total rate coefficients, which include momentum-changing elastic and inelastic processes, with a 2% relative uncertainty. We also showed that inelastic rotational quenching of the hydrogen dimer is negligible near room temperature.

Eite Tiesinga
National Institute of Standards and Technology

Date submitted: 24 Jan 2020 Electronic form version 1.4