Project: Deployable Doppler Broadening Thermometry

Description: We are developing the next-generation deployable, calibration-free Doppler thermometers. The Doppler broadening of spectral lines relates gas temperature to SI-defining physical constants and immutable gas properties, allowing primary thermometry. Achieving the size, accuracy, and measurement speed sufficient for thermometry in industrial applications requires new approaches to absorption spectroscopy. First, to reduce the size, we are using microfabricated atomic vapor cells. Second, we are incorporating narrow linewidth lasers from optical frequency metrology to refine knowledge of atomic properties, allowing atomic Doppler thermometry with unprecedented accuracy. Third, we incorporate tunable electro-optic frequency combs to boost measurement speed. Integrated together, these three advances will yield a portable Doppler thermometer with a sensor size comparable to a standard thermometer, but with the advantage that it never has to be calibrated.

Contact: Daniel Barker, daniel.barker@nist.gov