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A field-deployable, fast, sensitive hydrogen analyzer

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We report the development of a novel laser based hydrogen sensor capable of making high speed (<5 second), high sensitivity (<5 ppb) measurements of molecular hydrogen in the atmosphere. This instrument enables a variety of hydrogen related applications including industrial emissions quantification and prospecting for naturally occurring hydrogen sources. This paper focuses on the former application but informs the latter.

Accurate quantification of leaks associated with hydrogen transport and storage infrastructure is vital to evaluate the environmental benefit associated with the transition from fossil fuels to hydrogen as an energy source. Understanding the locations and magnitudes of leaks is critical in efforts to mitigate the indirect climate impact of transitioning to a hydrogen economy. Quantification of hydrogen leaks requires a field-deployable, fast, sensitive measurement technology which, until recently, has not existed. Our approach is to catalytically convert hydrogen to water vapor which is subsequently monitored with extremely high precision using an Aerodyne tunable infrared laser direct absorption spectrometer (TILDAS). We will present laboratory-based instrument performance results and quantitative measurements of hydrogen emission rates from recent mobile measurements as shown in the figure. Additional future applications include geological hydrogen prospecting, soil emission/consumption measurements, nuclear waste monitoring and possibly airborne hydrogen surveys.