RON BROWN
EXCELLENCE IN INNOVATION AWARD

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Through groundbreaking experiments, seminal publications, and patents, the team laid the groundwork for the use of Rydberg atom technologies as exquisitely sensitive and accurate electromagnetic field sensors. The team demonstrated Rydberg sensors as world-best electromagnetic field measurements with 100x lower uncertainty than conventional sensors, traceable to the SI, in a compact form. They went on to show that their sensors could detect phase, essential for decoding communication signals, and could replace antennas and front-end electronics in conventional receiver systems. This revolutionary innovation enables the use of a new type of receiver for sensitive applications where conventional electronic receivers and antennas would cause debilitating interference and field distortion, representing a completely new way to perform absolute measurements of electromagnetic fields.

The team's achievement is the culmination of more than a decade of research, including:

- Conceived (2010) and demonstrated (2014) first SI traceable, self-calibrating Rydberg sensor with sub-wavelength spatial resolution, not constrained by the size limitations and invasiveness of traditional antennas.
- Demonstrated accurate field measurements at frequencies above 200 GHz (2016).
- Miniaturized key components to promote commercial applications for Rydberg antennas and sensors (2017).
- Landmark demonstration of Rydberg-based measurement of phase modulation on communications signals (2020).
- World best sensitivity (2021).
- Determining the angle-of-arrival of a radio-frequency source with a Rydberg atom-based sensor (2021).

As early as 2014, the team demonstrated the potential for these Rydberg atom-based sensors. It required dedication and several critical breakthroughs to demonstrate practical applications of these sensors for detecting and transmitting communication signals and other electromagnetic signals.

The team has made the U.S. a world leader in Rydberg-atom electromagnetic field sensing. They pioneered new sensors to fully characterize RF electromagnetic signals. More than 65 organizations from industry, academia, and government agencies worldwide have launched Rydberg programs because of the team's work, representing more than $100M in research investments.