

Chip-Scale Atomic Beam System (#8896)

Simplified production and better stability in a smaller package for precision timekeeping and navigation

This chip-scale technology produces an atomic beam with high collimation in a more easily manufactured and compact package. Developed by Georgia Tech, this atomic beam system offers greater long-term stability than vapor cell chip-scale systems and is produced in a smaller package than conventional Cesium (Cs) beam systems. It uses lithographically defined or machined planar wafers with internal cavities and channels to produce an evacuated vacuum package that houses a collimated atomic beam. Also incorporated are components to source atomic vapor as well as passive pumps to maintain vacuum conditions.

Benefits/Advantages

- **Improved stability:** Enables longer term stability than in traditional vapor cell chip-scale systems
- **Smaller package:** Utilizes a chip-scale system that is more compact than conventional Cs beam systems
- **Easily manufactured:** Uses lithographic fabrication to produce atomic beams with high collimation

Potential Commercial Applications

- Precision timekeeping (e.g., chip-scale atomic clocks primarily used in cell phone base stations)
- Navigation (e.g., interferometers used in underwater oil and gas exploration)
- Robotics

Background/Context for This Invention

Current atomic beam systems (such as Cs beam tubes for atomic clocks) exist either in lab-scale vacuum systems or in custom vacuum tubes. Georgia Tech's chip-scale system for producing atomic beams is composed of etched silicon and glass wafers that are anodically bonded under vacuum to form a hermetically sealed, evacuated device. The device consists of several chambers connected by high aspect-ratio channels to produce a collimated atomic beam. One chamber produces an atomic vapor, and another chamber provides a propagation volume for the atomic beam. Non-evaporable getter pumps and graphite are included to pump residual gases.

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Patent/IP Information

U.S. Application Filed

Publications

For more information about this technology, please visit:

<https://licensing.research.gatech.edu/technology/chip-scale-atomic-beam-system>