Integrated Cascaded Atomic Beam

An accurate cascaded atomic beam to aid in gyroscope applications and atomic clocks.

Georgia Tech inventors produced a new method of generating atomic beams with a significantly enhanced Signal-to-Background Ratio (SBR) and a path to mass manufacture and miniaturization through mature semiconductor fabrication technology. The operating principle is a cascaded atomic beam collimator consisting of a sequence of narrow tubes separated by pumping regions that significantly reduce the background flux while maintaining beam collimation. In addition, a planar atomic beam device fabricated in silicon wafer will allow for a natural incorporation of the above idea with mask-defined lithography ensuring good tube alignment, as well as proper thermal management.

Summary Bullets

- **Reduced cost** – due to fabrication techniques that enable mass manufacture and spread of technology
- **Increased generation of collimated atomic beam**s – due to the miniaturizing of clocks
- **Maximized accuracy of the clock** – by improving signal-to-noise ratio (SNR)

Solution Advantages

- **Reduced cost** – due to fabrication techniques that enable mass manufacture and spread of technology
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Potential Commercial Applications

- Gyroscopes
  - GPS-denied Navigation
  - Autonomous Vehicles
- Atomic Clocks
- Space Communication

Background and More Information

Atomic beam technologies have profoundly influenced both fundamental atomic science as well as practical applications, such as enabling GPS and navigation systems. By counting time increments via the hyperfine interval in atomic cesium, they form a cornerstone of the Global Positioning System (GPS) for

telecommunication, space communication, and navigation. Due to their commercial and practical relevance, a great deal of engineering effort has been expended in improving the performance of such clocks. Much as atomic clocks form an independent time standard, atomic inertial devices can form “inertial standards” for acceleration and rotation that can allow vehicles to navigate freely without the aid of GPS. Inertial navigation is potentially a multi-billion dollar industry with both military and commercial sectors, the latter including autonomous vehicle guidance (self-driving cars).

Inventors

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IP Status

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Publications

Atomic Beams Shoot Straighter via Cascading Silicon Peashooters, Georgia Tech Research Horizons - April 23, 2019

Images

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