



US007359059B2

(12) **United States Patent**  
**Lust et al.**

(10) **Patent No.:** **US 7,359,059 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **CHIP SCALE ATOMIC GYROSCOPE**

OTHER PUBLICATIONS

- (75) Inventors: **Lisa M. Lust**, Plymouth, MN (US);  
**Dan W. Youngner**, Maple Grove, MN (US)
- (73) Assignee: **Honeywell International Inc.**,  
Morristown, NJ (US)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 134 days.

Arinmondo et al., "Nonabsorbing Atomic Coherences by Coherent Two-Photon Transitions in a Three-Level Optical Pumping," *Lettere Al Nuovo Cimento Della Societa Italiana Di Fisica*, vol. 17, No. 10, 8 pages, Nov. 6, 1976.

(Continued)

*Primary Examiner*—Michael A. Lyons

(74) *Attorney, Agent, or Firm*—Black Lowe & Graham PLLC

- (21) Appl. No.: **11/419,052**
- (22) Filed: **May 18, 2006**

(57) **ABSTRACT**

- (65) **Prior Publication Data**  
US 2007/0266784 A1 Nov. 22, 2007

A chip-scale atomic gyroscope and methods for sensing and measuring mechanical rotation of an object are disclosed. The chip-scale atomic gyroscope can include a vapor cell including a vapor cavity adapted to contain a vaporized source of alkali-metal atoms and noble gas atoms, a pump laser source adapted to produce a first laser beam along an optical pumping axis for optically pumping the alkali-metal atoms within the vapor cavity to an excited state, and a sense laser source adapted to produce a second laser beam along a sense axis transverse to the optical pumping axis for probing the polarization angle of the noble gas atoms within the vapor cavity. The pump and sense laser sources can each be connected to a servo mechanism, which can be configured to maintain the laser beams at a wavelength corresponding to the carrier wavelength of the alkali-metal atoms and a wavelength detuned from the carrier wavelength.

- (51) **Int. Cl.**  
**G01C 19/64** (2006.01)
- (52) **U.S. Cl.** ..... **356/459**
- (58) **Field of Classification Search** ..... 356/459,  
356/369; 250/231.12  
See application file for complete search history.

- (56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
4,104,577 A 8/1978 Greenwood  
4,147,974 A 4/1979 Greenwood  
4,157,495 A 6/1979 Grover et al.  
4,403,190 A 9/1983 Greenwood  
(Continued)

- FOREIGN PATENT DOCUMENTS**  
GB 2137357 A 10/1984  
(Continued)

**19 Claims, 5 Drawing Sheets**

