Current status of the atomic gravimeter development at FSUE “VNIIFTRI”

Osipenko Georgii[1], Aleynikov Mikhail[1], Pashkova Juila[1]

[1]Time and frequency division, FSUE “VNIIFTRI”, Mendeleevo, Russian Federation

Email: osipenko@vniiftri.ru

Wide area of applications of geophysics and gravity research requires an accurate measurement of the free fall acceleration parameter g. For today, atomic gravimeters based on matter wave interference have already reached the performance level of the best classical gravimeters. Due to the absence of moving mechanical parts atomic gravimeters have an advantage[1] over classical ones in terms of faster measurement cycle time and longer lifetime.

We report the latest results of the atomic gravimeter development at VNIIFTRI[2]. The working principle is based on the Raman spectroscopy of Rb87 laser cooled atoms[3]. The design and main characteristics of the atomic gravimeter based on atomic fountain will be presented. One of the key parts of the atomic gravimeter – optical system is based on frequency doubled 1560 nm telecom fiber lasers stabilized with modulation transfer spectroscopy and commercially available OPPL systems. Measurements of the beat note frequency result in less than 600 kHz and 1.5 MHz peak to peak frequency fluctuations over 24 hours for cooling and repumper lasers respectively. The optical system allows to achieve approximately 1×10^7 atoms with the temperature of 2.1 μK. The part of the optical system responsible for the generation of Raman beams is based on the combination of frequency doubled 1560 nm laser with a wideband fiber electro-optic modulator. The active intensity stabilization based on acousto-optic modulator and modulation spectroscopy offset frequency stabilization[4] are employed in order to minimize the effects related to intensity fluctuation induced phase noise and spontaneous emission. The further steps for the development of atomic gravimeter will be discussed.

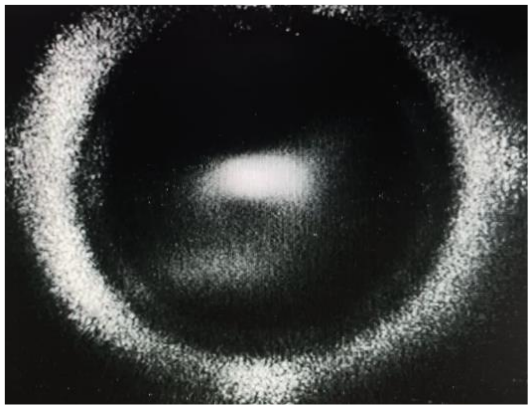

Fig. 1: The cloud of cold rubidium atoms in six beam MOT before launching with moving optical molasses

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