

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Gravity and Fundamental Physics (1)

Author: Dr. Stephan Seidel
Leibniz Universität Hannover, Germany, s.seidel@iqo.uni-hannover.de

Dr. Ernst Maria Rasel
Leibniz Universität Hannover, Germany, rasel@iqo.uni-hannover.de

MAIUS - A ROCKET BORNE ATOM-OPTICAL EXPERIMENT

Abstract

MAIUS is an atom-optical Experiment that will show the viability of the techniques used in the precursor projects QUANTUS-I [1] and QUANTUS-II in the environment of a sounding rocket. These previous experiments demonstrated the feasibility of performing quantum gases experiments in microgravity in the drop tower facility in Bremen, Germany. The setup is an enhancement of the design of its predecessors and will be able to produce a sample of ultra-cold atoms on-board of a sounding rocket of the type VSB-30 launched at Esrange, Sweden. It is designed to create a Bose-Einstein-Condensate of 10^5 ^{87}Rb atoms in less than 5 s and observe its evolution over periods of the order of few seconds. Additionally it will be possible to probe the properties of the sample using atom interferometric techniques.

In order to produce the samples a pre-cooled beam of atoms is created in a first ultra-high vacuum chamber and then sent into a second chamber where it is loaded into a magneto-optical trap. Afterwards it is subsequently cooled in a magnetic trap to temperatures in the range of few nK necessary for the creation of a Bose-Einstein Condensate. The laser and magnetic fields used for trapping and manipulating the atoms will be monitored by special hardware meeting the strict requirements of a rocket mission in robustness, miniaturization and power usage.

[1] Bose-Einstein Condensation in Microgravity, T. van Zoest *et al.*, Science 18 June 2010: **328** (5985), 1540-1543.