# An Apparatus for Bose-Einstein Condensates in Novel Traps by Time Averaged Adiabatic Potentials

Mark Baker, Vasiliki Bolpasi, Paul Condylis, Melina Pappa,
Daniel Sahagún Sánchez, and Wolf von Klitzing
Institute of Electronic Structure and Laser,
Foundation for Research and Technology-Hellas,
P.O. Box 1527, GR-71110 Heraklion, Greece.
http://www.bec.gr
e-mail: daniel@iesl.forth.gr

## Abstract

Time Averaged Adiabatic Potentials (TAAP) offer an unprecedented potential for the manipulation of ultracold atoms and Bose-Einstein Condensates. Various trapping geometries can be formed, from multiple well structures, to ring potentials, and even pancake traps. The TAAP [1, 2] is produced by combining static and oscillating magnetic fields with RF-dressing fields. For example, we can form an atom guiding ring if we start off with a quadrupole field modulated by a homogeneous field and then, applying a modulated RF-field such that it is resonant with the atoms on a ring. This yields an extremely flexible and tightly-confining trapping geometry. The radial confinement can be in the kHz range, whereas the diameter of the ring can be tuned from about 30 micrometers to a few centimetres: ideal conditions for a guided matterwaveSagnacinterferometer.

Here, we present the Cretan BEC machine, which has been designed for the exploration of TAAP traps. In our experiment, atoms are loaded into a TOP trap [3] via a double magneto-optical trap system. A 2D-MOT produces an atomic beam, with a flux of $10^9$ atoms/s, which is directed into an ultra-high vacuum science chamber where the atoms are collected into a standard MOT. After loading, the MOT is compressed, and the atoms transferred into the TOP trap. Thus, approximately $10^9$ atoms at around 500 micro-Kelvin are trapped ready for further evaporative cooling, and manipulation by the TAAP.

We will detail some of the technical challenges, such as the RF generation, and their solution.

**Keywords:** atom interferometry, Bose-Einstein condensation, adiabatic potentials

## References

[1] Igor Lesanovsky and Wolf von Klitzing, Phys. Rev. Lett. **99** 083001 (2007)

[2] Igor Lesanovsky and Wolf von Klitzing, Phys. Rev. Lett. **98** 050401 (2007)

[3] W. Petrich, M.H. Anderson, J.R. Esher, and A. Cornell, Phys. Rev. Lett. **74** 3352 (1995)