# Towards Transferring optical clock technology to space

Liang Hu

Supervisor: Prof. Guglielmo Maria Tino

Space optical clocks(SOCs) hold the promise of boosting the significance of tests of fundamental physics such as Einstein's theory of relativity, as well as benefiting applications such as positioning, time and frequency dissemination, and the accurate determination and monitoring of the geoid. However, space-based clocks will experience extremely different conditions from Earth-based clocks especially in laboratory, so to transport an earth-based optical clock to space, many key issues need to be evaluated and Earth-based clocks need to modify- and re-design according to space requirements.

In my PhD period, I am involved in two projects. For one, Marie-Curie Project-Future Atomic Clock Technology (FACT) [1], which mainly investigate the technical boundary conditions posed by transferring the technology to space. This in particular includes detailed assessments of the electronics with the related power and thermal management, the spatial and weight constraints and robust geometries. i) Investigation and analysis of the requirement on power and electronics for a space clock. ii) Power distribution, data acquisition & control system. iii) Input to advanced clock system design optimized with respect to compactness, optimized geometry, optical access and required interfaces compatible with the requirements derived. Second, Italian Space Agency-SAORA (Sottosistema Atomico per Orologi Atomici Ottici) project [2] focuses on designing and manufacturing an oven and a MOT chamber for space application based on the existed strontium optical clock [3].

References

[1] http://www2.hhu.de/itn-fact

[2] http://www.asi.it/sites/default/files/attach/notizia/saora.pdf

[3] N. Poli, et al. "A transportable strontium optical lattice clock." Applied Physics B 117.4 (2014): 1107-1116.