

Marie Curie ITN cQOM

Summary of the Scientific Achievements

Name of Fellow: Alexander Kocsis

Principal Investigator: Prof. Roman Schnabel

Academic / Industrial Institution: Hannover University / Hamburg University

Start Date of ITN Fellowship: 04.04.2014

End Date of ITN Fellowship: 30.04.2015

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As part of the Marie Curie ITN cQOM project, I joined Prof. Roman Schnabel's research group as a post-doctoral fellow focusing on beginning a new cryogenic membrane-in-the-middle experiment. The experimental goal is to place a Si_3N_4 membrane in the middle of a one-sided Fabry-Perot cavity, and measure the motion of the membrane with precision at the standard quantum limit. This would involve measuring the noise power spectral density of the outgoing light from the optomechanical cavity over a frequency band that is close to the fundamental mode of the membrane. The frequency band is chosen such that we can observe the transition from quantum radiation pressure noise to shot noise, while all classical noise levels are much below these levels of quantum noises. By varying the power of the probe beam we can observe the scaling of the noises and confirm thereby that these noises are quantum mechanical in nature. In this way, we can convincingly show that the membrane is probed at the standard quantum limit.

Goals achieved

In the time that I was an ITN fellow, my colleagues and I identified an appropriate research goal and the experimental techniques that we would use to achieve it. We began installing a new dilution refrigerator in the laboratory with a unique vibration damping system that had been designed to isolate an experiment from external vibrations. We set up a new fibre laser system operating at 1550 nm, and began characterizing the amplitude noise of the laser's output in order to understand if it would be a critical source of noise in our planned experiment. We began testing designs for the optomechanical Fabry-Perot cavity, as well as trying out membrane clamping techniques and procedures to align the optical cavity with the membrane inside, at room temperature. All of this work was done in close collaboration with four other ITN fellows in Prof. Aspelmeyer's group (Vienna) and Prof. Schnabel's group: Ramon Moghadas Nia, Jason Hoelscher-Obermaier, Paolo Piergentili and Mikhail Korobko.

Conferences attended

- 1) Finite Element Modeling Workshop by Prof. T. Kippenberg, 21 – 23 July 2014
- 2) Diavolezza Annual Workshop, 01 – 05 Feb 2015