

# Marie Curie ITN cQOM

## Summary of the Scientific Achievements

**Name of Fellow:** Dr. Sheon S. Y. Chua

**Principal Investigator:** Prof. Pierre-Francois Cohadon

**Academic / Industrial Institution:** Laboratoire Kastler Brossel (LKB) – Universite Pierre et Marie Curie (UPMC)

**Start Date of ITN Fellowship:** 13 March 2014

**End Date of ITN Fellowship:** 12 September 2014

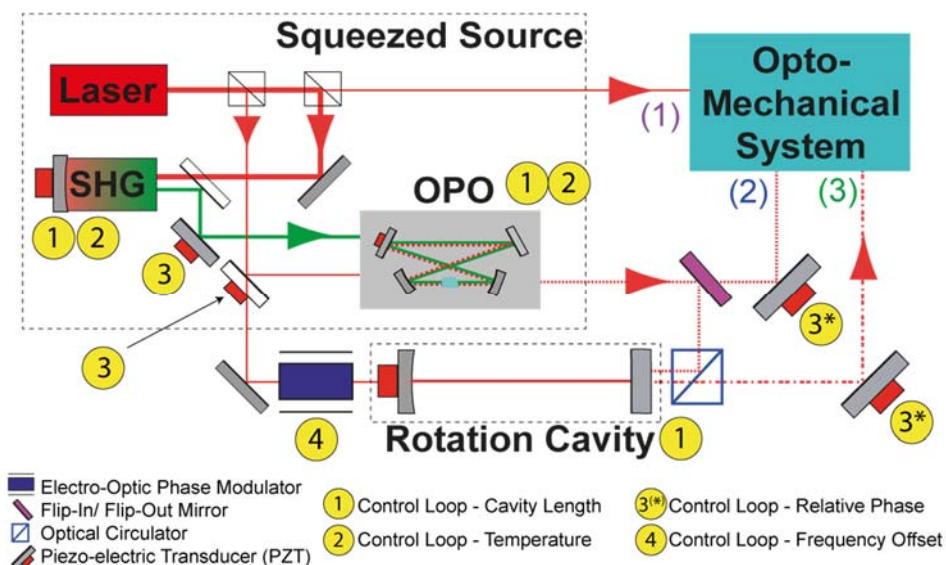
**Date of Report:** 26 November 2015

### 1. Description of research work

Frequency-dependent squeezed states, that reduce both Quantum Radiation Pressure Noise and Quantum Shot Noise, offer the capability of broadband sensitivity enhancement and the capability to surpass the Standard Quantum Limit (SQL) of a given quantum system. The objective was to design a frequency-dependent squeezed light source compatible with the macroscopic monocrystalline quartz micropillar optomechanical system at LKB, so as to surpass its SQL in displacement measurement.

### 2. Goals achieved and/or progress towards them

The design of the squeezed light source was completed. A simplified drawing is shown below. It is the combination of a doubly resonant, bow-tie Optical Parametric Oscillator that produces frequency-independent squeezing, and an optical Rotation Cavity with a Lorentzian linewidth that matches the mechanical frequency of the target quantum system. The squeezed light source will have three operating configurations, each producing a different optical quantum state that will allow the ability to verify and explore sub-SQL measurement. This frequency-dependent squeezed light source for surpassing the SQL is being constructed.



### 3. Training received (complementary/soft skills, workshops attended)

- Skills – Optomechanics
- Skills – Cryogenic systems
- Workshop attended – ITN CQOM WORKSHOP 'Laser Stabilization and high-sensitivity displacement sensing'

### 4. Dissemination and outreach activities, and your role

- Presented an Invited talk about Squeezed state enhancement of large scale optomechanical systems (LIGO)
- Outreach: Presenter at the “Fete de la Science” 2014 – simple demonstrations of physics to the general public.

### 5. List of conferences attended

- Advanced Virgo Week May 2014 – Pisa, Italy 19-21 May 2014
  - Invited Presentation: Squeezed states and LIGO