

Newsletter

May 2019

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What is PhotOQuant?

PhotoQuant is a European Research project within the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.

Why PhotOQuant?

For a wide range of processes, from consumer electronics to space instrumentation, there is a growing need to make temperature measurements at smaller scales. The range of currently available thermometers, however, cannot meet the challenge. Nanotechnology now offers the possibility of innovative 'optomechanical' sensors capable of measuring temperature on micrometre length scales. Not only could these new temperature sensors replace the standard high-accuracy platinum resistance thermometers but, embedded into production processes,

many industrial users could benefit from the technology.

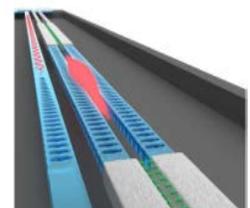
Our objective

This project will design, fabricate, and characterise different optomechanical systems for temperature measurement. Calibration methods will also be developed to make the sensors traceable to the International Temperature Scale of 1990 (ITS-90). Beyond sensing capability on the micro- and nano-scale, other advantages include reduced cost, better portability and robustness, and increased resistance to mechanical shock and electrical interference. Additionally, optomechanical sensors could be developed as a future quantum-based primary standard for temperature measurement.



PhotOQuant first interim meeting

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Highlights

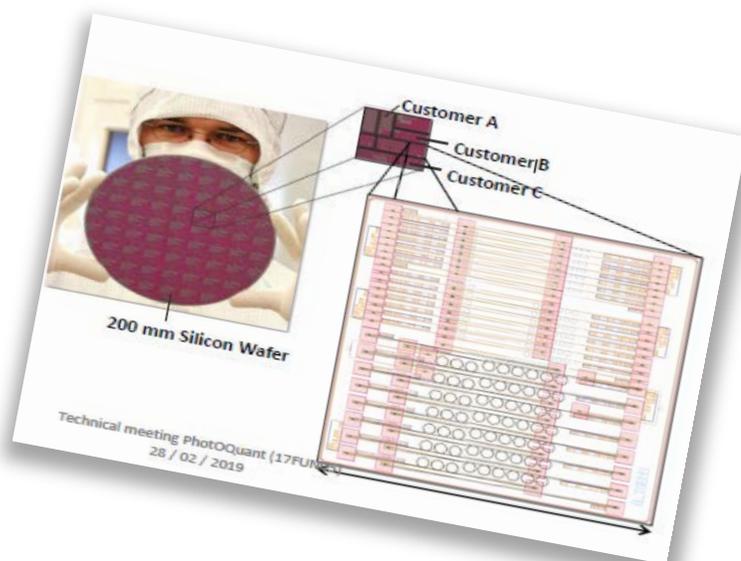
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Highlights

The different research groups that are working in the project are choosing different materials and structures to develop the innovative devices.

IHP GmbH, TUBS and PTB have designed a test structure with over 120 individual micro ring resonators. These structures have a systematic variation of the ring diameter and the coupling efficiency and will be used for the device optimisation.

CSIC is exploring the use of diamond for micro and nanophotonic optomechanical resonators. Different designs based on microring resonators have been simulated using COMSOL® and compared to same devices using traditional materials like Si and SiO₂. The goal is to obtain valid simulations that will allow to compare the performance of different optical resonators, like microrings and photonic



crystal cavities made of silicon and diamond.

CNRS with SU, have chosen SiN material due to the experimental resources currently available. Optomechanical design have been simulated giving an optical wavelength around 800 nm with an optical Q-factor of 2.106.

TU Delft have been able to fabricate, and measure optomechanical resonators with ultra-high mechanical factors $> 10^7$

and integrated optical readout using photonic structure combined with phononic shielding. TU Delft has demonstrated integrated optomechanical structures with $f Q > 10^{12}$ Hz. For these devices highly-stressed silicon nitride with a high-yield fabrication has been used. Their high on-chip optical efficiency ($> 90\%$) allow to dramatically lower the imprecision noise in the measurements.

Events



The first PhotoQuant interim meeting was hosted by CEM in Tres Cantos (Spain) the 28th February 2019 attended by representatives from all the consortium partners.

Meteorology and Climate. The project coordinator Stéphan Briaudeau, from LNE-CNAM, will give an oral presentation in which he will present an outline of the project to a wide thermometry audience.



The project has been already presented in several international conferences like the Conference on Precision Electronic Measurements (CPEM 2018) or the European Quantum Technology Conference (EQTC19).

The project partners also expect to present the project in other important conferences like CLEO Europe or the MRS-ID meeting during the summer.



The project is going to be also presented next June, in Chengdu (China) in the International Symposium on Temperature and Thermal Measurements in Industry and Science, TEMPMEKO'19. On this occasion it will be a joint event with the conferences TEMPBEIJING and Metrology for

The Consortium

PhotOQuant is coordinated by:

le **cnam**

Project partners:

CEM CENTRO ESPAÑOL
DE METROLOGÍA

 **LNE**

 **PTB**

 **VSL**

 **VTT**
MIKES METROLOGY

 Centre
de Nanosciences
et de Nanotechnologies

 **ihp**
innovations
for high
performance
microelectronics

 **IMN**
micro nano

 Laboratoire Kastler Brossel
Physique quantique et applications

 Technische
Universität
Braunschweig

 **TU Delft**

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SORBONNE UNIVERSITÉS

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EMPIR  

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