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Congratulations to New ICFO PhD Graduate

Dr. Tomas Lamich graduated with a thesis entitled "A single emitter emitting resonance fluorescence into a coherent beam"

February 26, 2026

We congratulate Dr. Tomas Lamich who defended his thesis this morning in ICFO's Auditorium.

Dr. Lamich obtained his MSc in Optics and Optoelectronics from the Palacky University Olomouc, in the Czech Republic, before joining the Atomic Quantum Optics research group led by ICREA professor Dr. Morgan Mitchell. His thesis titled "A single emitter emittin resonance fluorescence into a coherent beam" was supervised by Prof. Dr. Morgan Mitchel and Dr. Romain Veyron

ABSTRACT:

This thesis studies the statistics of light produced by a single trapped atom in free space when interfaced with two orthogonal coherent beams. The atom scatters light into the same spatial mode as a weak coherent probe beam, giving rise to controllable photon statistics. Being able to control the photon statistics of a source can be used in applications in where different photon statistics are desired.

A single emitter in free space, when left to interact with a single pumping beam can only scatter one photon at any given moment leading to anti-bunched photon statistics. However, Goncalves et al. (2021) studied the possibility of interfacing the atom with a strong pumping beam, and a weak probing beam, leading to a controllable photon statistics, where super- and sub-Poissonian statistics can be achieved by varying either the pump-probe ratio or the relative pump-probe phase. By controlling the pump-probe ratio, it is also possible to control the probe transmission through the atom.

The experimental implementation of the "GMC" scheme shows the predicted behaviour where the transmission can be suppressed to 62 %, and tuned by changing the pump-probe ratio. It also shows that the photon statistics can go from super- to sub-Poissonian by changing the relative pump-probe phase, and the photon bunching achieved is also pump-probe ratio dependent.

In addition, measurements of the atom temperature are presented in this thesis, where the interference of the pump and probe beams on the atom lead to a direct measurements of the

rms displacement of the atom within the trap, which is linked directly to the atom temperature. These measurements demonstrate a new non-destructive method of estimating the atom temperature.

Thesis Committee:

Prof. Dr. Sile Nic Chormaic, Okinawa Institute of Science and Technology Graduate University

Prof. Dr. Darrick Edward Chang, ICFO

Prof. Dr. Igor Ferrier-Barbut, Institut d'Optique