The Department of Physics at the University of Cyprus is organizing a seminar on

**Wednesday, 12 September 2018, time 14:30 p.m.**

Room B228, Building 13, New Campus

**Speaker:**

**Dr. Carlos Antón**
CNRS, Univ. Paris-Sud,

“Towards ideal single photon sources and deterministic photon gates in the solid-state”

The development of scalable quantum photonic networks relies on the technological means to implement: (i) bright and deterministic sources of single and indistinguishable photons [1] and (ii) deterministic photon gates capable to manipulate and process efficiently the photonic information [2,3]. We present our advances on these two milestones: (i) the fabrication of near-optimal single photon sources of deterministically coupled quantum dots (QDs) in electrically-controlled pillar microcavities [1,4] [scheme in Fig. (a)] and (ii) first steps towards the implementation of photon gates using these devices as routers in path- [2] and polarisation-encoding [3].

Under resonant excitation we retrieve near-unity indistinguishability between single photons, and we measure a single photon purity of \(g^{(2)}(0) = 0.0028 \pm 0.0012\). Most remarkably, the deterministic emission of our single photon sources is evidenced by the brightness (defined as the probability to obtain a single photon per pulse before the first collection lens), with a value of 0.154\(\pm\)0.015. This makes our sources more than one order of magnitude brighter than parametric down conversion sources with the same photon purity [1].

Going towards the implementation of photon gates in path-encoding, we demonstrate the single-photon Fock state filtering by a QD-cavity device [scheme in Fig. (b)] [2]. The device is probed with a pulsed laser and we collect the total reflected signal in the same polarization. The system presents a nonlinearity threshold for an average incident photon number as low as ~0.3. The \(g^{(2)}(0)\) measure of the reflected light evidences that it is mostly constituted by single-photons (80% single-photons of the total output intensity) and that the multi-photons components of the field are efficiently suppressed.

Finally, going towards the implementation of photon gates in polarisation-encoding, we have also investigated the polarization rotation of coherent light interacting with a QD-cavity device by analysing the reflected photonic polarization state in the Poincaré sphere [3]. The superposition of emitted single photons (H-polarized) with reflected photons (V-polarized, Fig. (c)) leads to a large rotation of the output polarization by 20º both in latitude and longitude [3]. This result sets a proof-of-concept experiment to engineer photon routers in polarisation-encoding with charged excitons [5].