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# Abstract:creation and quantum optical characterization of colour centres in artificial diamond

In quantum technologies perspective, the long term-goal is a quantum web where quantum computers, simulators and sensors are interconnected via quantum network distributing information and quantum resources. For what concerns quantum cryptography in quantum communication, a withstanding issue is represented by the need of efficient single photon sources characterized by high stability, long durability in time and being on demand. Single photon sources are not currently completed developed and different physical system act as a single photon emitter. Diamond is one of the preferred choices for its crystalline structure, which can host different impurities, its wide energy range, which cover the visible spectrum, and the low phonons density at room temperature. Moreover, ions irradiation was developed in these years as an efficient technique to defects of different species in the material and thus optimizing their quantum optical properties.
In collaboration with the ion-micro beam facility of the INFN National Laboratories of Legnaro, different implantation campaign would be planned at different energies species and fluencies to explore the ideal condition for the creation of colour centres characterized by desirable emission properties. Subsequently, the colours centres will be characterized by confocal microscopy, by means of which it is possible to study the photoluminescent emission at the single photon level. In this configuration, the centres will be assessed in their quantum optical properties via Hanbury-Brown and Twiss interferometry.
Different colour centres are taken under analyses, starting from the easiest nitrogen-centres vacancies to more complex tin and nanodiamonds. In order to characterize single photon sources, different measurements are taken of g^((2)) and spectra to recognise the particular element that is being studied. Moreover, an analysis of data is performed to extrapolate the time life and bunching time of the metastable state. Eventually an analysis in power are carried out in order to study how the parameters of the colour centre would change according to different power with which it is excited.

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