The SIQUST Project: diamond-based single-photon sources as new quantum standards

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Optically-active point defects in diamond are systems with appealing photo-physical properties for the development of quantum technologies. The ever-growing interest in these systems is motivated by their operation at room temperature, together with an ease of access and manipulation in a solid state system characterized by high transparency and structural stability, with applications as bright and stable single-photon sources or individual spin systems with optical readout. Despite literally hundreds of emission lines in diamond have been reported in the past decades, only a handful of them can be consistently achieved through the controlled fabrication of lattice defects by means of a reproducible process such as ion implantation.

Therefore, concurrently with the remarkable results achieved at the state of the art on the exploitation of the unique properties of the negatively-charged nitrogen-vacancy center (NV^-), the quest for single-photon emitters with desirable properties still leads to the continuous discovery and characterization of new classes of optically-active defects.

In the present contribution, I will report on the joint research activities carried at the Italian National Institute for Nuclear Physics (INFN), the University of Torino and the Italian National Institute of Metrologic Research (INRiM) within the Euramet H2020 EMPIR "SIQUST" Research Project on the engineering by means of ion implantation of novel classes of quantum emitters in single crystal diamond for applications as single-photon sources. I will also introduce our recent results on the utilization of the unique spin properites of the NV^- center as quantum sensors for electric fields and temperature sensing at the micro- and nano-scale.