

Organic molecules for quantum technologies: State of the art and future prospects

C. Toninelli^{1,2}

¹*CNR-INO, Istituto Nazionale di Ottica, Via Carrara 1, 50019 Sesto F.no, Italy*

²*LENS e Università di Firenze, Via Carrara 1, 50019 Sesto F.no, Italy*

E-mail: toninelli@lens.unifi.it

Organic molecules of polyaromatic hydrocarbons were the first system in the solid state to show single photon emission [1,2]. However they are still considered unconventional sources of non-classical light. I will try to unveil part of the mystery behind such quantum emitters and show how they could effectively contribute to integrated quantum photonic platforms.

I will report on fluorescence coupling from a single molecule to a planar optical antenna [3] and a single-mode dielectric waveguide [4], discuss the integration of single quantum emitters into hybrid dielectric-plasmonic devices [5] and the coupling with 2D materials [6]. I will present our recent results about the fabrication of single-molecule doped nanocrystals, preserving the optical properties of the bulk system, i.e. negligible blinking and spectral diffusion [7]. Eventually, I will report on ultrafast time-resolved transient spectroscopy on a single molecule [8].

References

- [1] W. E. Moerner and L. Kador, *Phys. Rev. Lett.* **62**, 2535 (1989).
- [2] M. Orrit and J. Bernard, *Phys. Rev. Lett.* **65**, 2716 (1990).
- [3] S. Checcucci et al., *Light: Science and Applications* **6**, e16245 (2017)
- [4] P. Lombardi et al., *ACS Phot.*, <https://doi.org/10.1021/acsp Photonics.7b00521>
- [5] G. Kewes et al., *Sci. Rep.* **6**, 28877 (2016).
- [6] K. Schaedler et al., in preparation
- [7] S. Pazzagli et al., arXiv:1712.05178
- [8] M. Liebel et al., *Nat. Phot.* **12**, 45-49 (2017)