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Stable single molecules for quantum optics and all-optical switches

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Propositions

attached to the thesis

“Stable single molecules for Quantum Optics
and all-Optical switches”

- I. The use of fluorescent probes in condensed-matter systems has brought new insights about the heterogeneity at the nanometer scale.
- *Chapters 2, 3, 6 of this thesis* -
- II. Single molecules at low temperatures in non-perturbing media can be used as sensors to detect vibrational amplitudes and frequencies of different mechanical oscillators, down to picometer displacements.
- *Chapter 5 of this thesis* -
- III. Methyl groups in the local environment of a single fluorescent molecule affect its excitation linewidth and frequency stability.
- *Chapter 2 of this thesis* -
- IV. The spectral properties of a single molecule depend on the physico-chemical properties of the host solid in which it is embedded and therefore are a topic for the field of condensed-matter chemistry.
- *Chapters 2, 3, 6 of this thesis* -
- V. The generalization of single-molecule techniques to the life sciences has blurred the meaning of the word

“molecule”. Therefore, we need a new definition of the term “single molecule”.

- VI. Quantum technologies based on photons will likely require integrated optics architecture for improved performance, miniaturization, and scalability.
- *Jeremy L. O'Brien, Science* **2012**, 338, 363.
- VII. Future quantum communication will rely on the integration of single-photon sources, quantum memories and systems with strong single-photon nonlinearities.
- *Ilja Gerhardt, Nature* **2014**, 509, 66.
- VIII. It is surprising that in the award of the Nobel Prize in Chemistry for the year 2014 the technique of single-molecule spectroscopy is seen as a mere tool for super-resolution imaging.
- IX. Contrary to what is often stated, the future of the world is not in the hands of our kids.

Pedro Navarro,
Leiden, November 13, 2014