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TÉMA

Single photon emission in STM-induced luminescence from fullerene excitons

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Quantum systems like molecules or quantum dots cannot emit two photons at the same time which results in an antibunching of the emitted photon train and a dip in the photon-photon correlation function. Such single photon emitters are key elements for quantum cryptography and their application needs a perfect optical separation of neighboring emitters. This requires reproducible emitter distances typically above the optical diffraction limit and has imposed strong limitations on suitable structures and materials. Here we demonstrate single photon emission excited locally by a low temperature (4 K) Scanning Tunneling Microscope (STM) and characterized with sub-molecular resolution. Using a Hanbury Brown-Twiss interferometer scheme in STM-induced electroluminescence we discovered that localized trap states in fullerene multilayers form single photon emitters. The emission spectrum is a line spectrum attributable to exciton recombination and from the correlation data, exciton life times as short as 0.17 ns are determined. With increasing tunnel current a saturation of the emission and a change of the correlation function are observed. We will discuss these observations within the frame of a three state kinetic model.

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