Second Swiss-Taiwanese Workshop on "Nanotechnology: towards novel materials"
Taipei, Taiwan, June 20 - 24, 2005

On the Birth of a Super Molecule

H.-J. Eisler, J.N. Farahani, P. Mühlschlegel, D.W. Pohl and B. Hecht

Nano-Optics group, National Center of Competence for Research in Nanoscale Science, Institute of Physics, University of Basel, Klingelbergstr. 82, CH-4056 Basel, Switzerland

Tailoring the light-matter interaction at the nano scale, is one of the most fascinating and active research fields of current solid state physics, chemistry and materials science. This activity is mainly driven by the vision on generating, manipulating and directing the flow of photons as the carrier of information, much like the studies on moving carriers in semiconductor materials let to the now existing information technology. Before we can explore a nano-photonics based technology as a new area in mankind, we have to face the challenge of learning how to make the most efficient and most controllable optical light source.

We present a new approach along those stimulating visions of future information technology showing for the first time that we can control the radiative and non-radiative relaxation channels of single quantum dot, that we can controllably enhance its photoluminescence rate while shortening its excited state lifetime at wish. The key element in doing so has to be rationalized by the interacting of a nano scale optical antenna – an analogue of the well-established radio antenna concept.

The interaction of a single quantum dot with a bow tie antenna is demonstrated for visible light. Due to the interaction of the metallic nano scale antenna, generated at the apex of a Si_3N_4 atomic force microscopy tip by focused ion beam milling, with a single quantum dot, we can demonstrate the birth of a new light emitting species, called *super molecule*.

E-Mail: Hans.Eisler@unibas.ch
Website : http://www.nano-optics.ch