

**Wataru Mizutani, Dr.**  
**Nanotechnology Research Institute, AIST**

**1. Main Research Results**

- 1) AIST invited Dr. Marco Ravaro in Institut des NanoSciences de Paris from Jun. 7th to Aug. 1st, 2009, and conducted a collaborated research on luminescence from semiconductor quantum dots (QDs). We developed a new system based on InAs semiconductor QDs, whose strong electronic confinement results in a long exciton coherence time. Two sets of emission peaks were observed corresponding to InAs quantum wells and InAs QDs.
- 2) We invited Dr. Andrey S. Vasenko from Universite Joseph Fourier and CNRS from Jan. 29th to Mar. 16th, 2010, and studied superconductor / insulator / ferromagnet/ superconductor (SIFS) junction with arbitrary length of ferromagnetic interlayer. We had calculated the critical current numerically and analytically, and studied DOS (the density of states) in the ferromagnetic interlayer. We also calculated the macroscopic quantum tunneling rate for such systems and found that SIFS junctions will be a good candidate for quantum information devices.
- 3) We restored a multi-element evaporation machine as a main equipment for the international research base on organic multilayer devices, and prepared necessary apparatus for fabricating organic light emitting diodes (OLEDs). We accepted a Korean student from Jan. 8th to Feb. 17th, 2010, and conducted a research on a new fabrication method of OLEDs and an improvement of their efficiency.

**2. List of publication**

- 1) A. Enderlin, M. Ravaro, V. Voliotis, R. Grousson, and X.-L. Wang, "Coherent Control of a Semiconductor Qubit in the Strong Coupling Regime: Impact of Energy and Phase Relaxation Mechanism", *Phys. Rev. B* 80, 085301 (2009).
- 2) X.-L. Wang, S. Furue, M. Ogura, V. Voliotis, M. Ravaro, A. Enderlin, and R. Grousson, "Ultrahigh Spontaneous Emission Extraction Efficiency Induced by Evanescent Wave Coupling", *Appl. Phys. Lett.* 94, 091102 (2009).
- 3) X.-L. Wang, A. Enderlin, and M. Ravaro, "Nearly 80% Light-Extraction Efficiency Induced by Evanescent Wave Coupling in a Sub-Wavelength-Sized GaAs/AlGaAs Ridge Structure", submitted to *Appl. Phys. Express*.
- 4) A. Enderlin, M. Ravaro, C. Tonin, V. Voliotis, R. Grousson, A. Lemaitre, A. Martinez, and X.-L. Wang, "Radiatively Limited Dephasing in a Single Quantum Dot Strongly Coupled to a One-Dimensional Waveguide", submitted to the 30th International Conference on the Physics of Semiconductors.
- 5) A.S. Vasenko, S. Kawabata, A.A. Golubov, M. Y. Kupriyanov, and F.W.J. Hekking, "Dissipative current in SIFS Josephson junctions", *Physica C* (2010) in press.

**3. Others**

Solid state engineering group seminar , Nagoya University  
4th, March, 2010

Title "Electron cooling by diffusive normal metal- superconductor tunnel junctions"

Speaker:Andrey S. Vasenko