



Low Temperature Laboratory

PICO GROUP [HTTP://LTL.TKK.FI/PICO/](http://ltl.tkk.fi/pico/)

GENERAL

The staff and experimental facilities of the PICO group of Low Temperature Laboratory (LTL) are located in Micronova. The group investigates mesoscopic physics and its applications primarily at low temperatures. Main focus is on charge transport and thermal properties of nano- and microstructures. Particular research topics include quantized and coherent single charge pumping, physics and applications of small Josephson junction devices, energy relaxation and non-equilibrium in electronic nanostructures, thermometry, and electronic cooling. Samples and devices are fabricated in the clean rooms of LTL and of Micronova. Most of the experiments at low temperatures (0.01 – 4 K) are performed in Micronova.

STAFF

Our full-time staff includes one professor, one senior researcher, three post-doc researchers, and two graduate students. Besides these, we have very close relations with some of our collaborating institutes, through which the manpower adds up to an average of 12 scientists.

ACADEMIC DEGREES

In 2005, one PhD degree and one Master's degree were completed.

MAJOR FACILITIES AND EQUIPMENT

Three dilution refrigerators, one down to 10 mK and two down to 30 mK temperature, an adiabatic demagnetization refrigerator. Shared facilities with other groups from LTL include scanning electron microscope for e-beam lithography, e-gun UHV thin film deposition system, wire bonder, AFM.

CONTACT PICO group <http://ltl.tkk.fi/pico/>

Prof. Jukka Pekola (jukka.pekola@tkk.fi) +358-9-4514913
Dr. Alexander Savin (savin@boojum.hut.fi) +358-9-4514901

COLLABORATION UNITS

CNRS and University of Joseph Fourier, Grenoble, France
Scuola Normale Superiore, Pisa, Italy
Institute of Solid State Physics and Landau Institute, Chernogolovka, Russia
Chalmers University of Technology, Gothenburg, Sweden
University of Stony Brook, Department of Physics and Astronomy, New York, USA
Kinki University, Higashi-Osaka, Japan
VTT Microsensing, Espoo, Finland
VTT Information Technology, Espoo, Finland
Centre for Metrology and Accreditation, Mikes, Helsinki, Finland
Microelectronics Centre of HUT, Finland



NanoScience Centre, Jyväskylä, Finland
Nanoway Cryoelectronics, Espoo, Finland

PUBLICATIONS 2005

A. O. Niskanen, J. M. Kivioja, H. Seppä, and J. P. Pekola, Evidence of Cooper-pair pumping with combined flux and voltage control, *Phys. Rev. B* **71**, 012513 (2005).

J. M. Kivioja, T. E. Nieminen, J. Claudon, O. Buisson, F. W. J. Hekking, and J. P. Pekola, Observation of transition from escape dynamics to underdamped phase diffusion in a Josephson junction, *Phys. Rev. Lett.* **94**, 247002 (2005).

J. M. Kivioja, T. E. Nieminen, J. Claudon, O. Buisson, F. W. J. Hekking, and J. P. Pekola, Weak coupling Josephson junction as a current probe: effect of dissipation on escape dynamics, *New J. Phys.* **7**, 179 (2005).

Juha Vartiainen, *Kvanttilaskentaa suprajohteilla*, *Tietoyhteys* **3**, 16 (2005).

F. Giazotto and J. P. Pekola, Josephson tunnel junction controlled by quasiparticle injection, *J. Appl. Phys.* **97**, 023908 (2005).

Jukka Pekola, Tunnelling into the chill, *Nature* **435**, 889 (2005).

M. Prunnila, P. Kivinen, A. Savin, P. Törmä, and J. Ahopelto, Intervalley-scattering-induced electron-phonon energy relaxation in many-valley semiconductors at low temperatures, *Phys. Rev. Lett.* **95**, 206602 (2005).

J. P. Pekola, T. E. Nieminen, M. Meschke, J. M. Kivioja, A. O. Niskanen, and J. J. Vartiainen, Shot-noise-driven escape in hysteretic Josephson junctions, *Phys. Rev. Lett.* **95**, 197004 (2005).

Submitted:

Francesco Giazotto, Tero T. Heikkilä, Arttu Luukanen, Alexander M. Savin, and Jukka P. Pekola, Thermal properties in mesoscopics: physics and applications from thermometry to refrigeration, cond-mat/0508093, submitted to *Rev. Mod. Phys.*

Juha Karvanen, Juha J. Vartiainen, Andrey Timofeev, and Jukka Pekola, Experimental Designs for Binary Data in Switching Measurements on Superconducting Josephson Junctions, submitted for publication.

A. M. Savin, J. P. Pekola, D. V. Averin, and V. K. Semenov, Thermal budget of superconducting digital circuits at sub-kelvin temperatures, cond-mat/0509318, submitted for publication.

F. W. J. Hekking and J. P. Pekola, Finite frequency quantum noise in an interacting mesoscopic conductor, cond-mat/0508450, submitted for publication.