# Special Tutorial&Seminars concerning:
# "Plasma Physics in 2-Dimensional Electron Systems and their Applications to Terahertz Nano-Devices"

Dear all the colleagues:

This is to announce a Special Tutorial&Seminars concerning "Plasma Physics in 2-Dimensional Electron Systems and their Applications to Terahertz Nano-Devices" scheduled on February 12th, 2009. The lectures will be given by RIEC Visiting Professor Dr. Vychaslav POPOV, and JSPS Foreign Research Fellow Dr. Abdelouahad El Fatimy. From the fundamental physical basis to the cold cuts of their research and development will be presented with highest care for graduate/undergraduate students to be well understood. The organizer will cordially invite all the students, researchers and staffs who have interest on this peculiar field to participate in.

**Lecturer:**

1. RIEC Visiting Prof. Vyacheslav POPOV (Prof. Salatov Univ., Russian Academy of Science)
2. JSPS Research Fellow, Dr. Abdelouahad El Fatimy (CNRS, Univ. Boldeaux, France)

**Date/Time:** 10:00am ~ 4:30pm, Feb. 12th (THU), 2008
**Location:** RIEC Building II, Large meeting room at 4th floor

**Program:**

**Morning Session**

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**1. Tutorial by Prof. V. Popov 10:00〜11:00**

**Title:** Electrodynamics of Plasma Oscillations in Micro-Structures and Micro-Devices with Two-Dimensional Electron Channels

**Abstract:** Physical properties and potential applications of two-dimensional (2D) plasma oscillations in microstructures and microdevices will be discussed. It will be explained why the electromagnetic effects are important in such structures. Theoretical electromagnetic approach, which can be used for modeling the plasmonic phenomena in different types of microstructures and microdevices, will be outlined. Basic features of terahertz plasma oscillations in diode and transistor devices with 2D electron channels will be considered. Unusual damping mechanism of plasmons due to the intermode plasmon-plasmon scattering will be discussed. The band structure of plasmonic spectra in spatially periodic systems will be addressed. It will be shown that plasmonic effects can be considerably enhanced in periodic arrays of plasmonic-device units and in large-area grating-gate plasmonic structures. The condition for strong coupling between the plasmon and electromagnetic (terahertz) radiation will be formulated and discussed.

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COFFEE BREAK

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**2. Seminar by Prof. V. Popov 11:15〜12:15**

**Title:** Terahertz Photoconductivity in Grating-Gated and Density-Modulated Two-Dimensional Electron Channels

**Abstract:** It is known that hydrodynamic non-linear electronic effects in two-dimensional (2D) electron systems may be resonantly enhanced by exciting plasma oscillations, which can be used for detection, generation, and frequency conversion of terahertz radiation. In large-area plasmonic structures, all players in this non-linear arena involving terahertz wave, plasmons, and electrons interact in coherent way over long distances, which brings a new flavor into the non-linear phenomena. At this seminar two new plasmon-assisted mechanisms for terahertz photoconductivity will be discussed. The first mechanism is due to the electron drag by 2D plasmons excited in a large-area grating-gate structure by incoming terahertz radiation. This mechanism is active in both homogeneous and spatially modulated 2D electron plasma. The second mechanism to be considered at this seminar is caused by the electrostriction effect in spatially periodic 2D electron plasma. It is shown that the latter mechanism can produce much more sensitive detection of terahertz radiation.

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LUNCH BREAK
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**Afternoon Session**

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**3. Seminar by Dr. A. El Fatimy 15:00〜16:30**

**Title:** Field Effect Transistors for Terahertz Detection/Emission:physics and first imaging applications

**Abstract:** The physics and first imaging application of the field effect transistors working at THz range are presented. Resonant frequencies of the two-dimensional plasma in field effect transistors increase with reduction of the channel dimensions and can reach the terahertz (THz) range. They are shown to be responsible for resonant and voltage tuneable detection/emission in sub-THz and Terahertz range. Also, non-resonant/damped or over-damped plasma can be active in Terahertz range providing a new efficient mechanism of the broadband detection. This work presents main theoretical and experimental results on THz detection/emission by field effect transistors in the context of their possible application for THz imaging.

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