# Seminar Announcement

Date： Sept. 12 (Thu.)

Room：Seminar room in prefab building

I. 15:30 - 16:45

Prof. A. Oguri (Osaka City University)

## " Low and high voltage properties of the Anderson model out of equilibrium"

We will describe some properties of the Anderson impurity model for quantum dots at low and high bias voltages. At low voltages, we have calculated the low-energy asymptotic form of the nonequilibrium self-energy using the microscopic Fermi-liquid theory of Yamada and Yosida in the Keldysh diagrammatic formalism. From this result, it has been deduced that the nonlinear I-V characteristics has a universal form up to the third-order term in V, which can be written in terms of the Kondo temperature and the Wilson ratio. In the opposite limit, the impurity Green's function in the high-voltage limit becomes identical to the equilibrium one in the high-temperature limit. This correspondence holds when the couplings of the dot and two leads, at left and right, are equal. These results obtained in the two limits suggest that the Coulomb interaction can be treated adiabatically both at low and high bias voltages.

Coffee Break (16:45 - 17:00)

## II. 17:00 -

### Prof. J. Mathon (City University of London)

### " Current and bias-induced switching of the magnetization in magnetic multilayers "

Slonczewski showed that a bias-induced current of electrons owing between two magnetic layers separated by a nonmagnetic spacer can result in switching of the magnetization of the second magnetic layer relative to that of the rst layer.In his model the switching is due to the components of the nonequilibrium spin current transverse to the charge cur- rent.In this talk a general formulation of the current-induced switching is given.It treats both the transverse and longitudinal components of the spin current on the same footing. The present approach is based on the nonequilibrium Keldysh formalism and can be im- plemented for a fully realistic band structure.It will be shown that the nonequilibrium current-induced contribution to the longitudinal spin current (ignored by Slonczewski) leads to an additional torque exerted by one magnetic layer on the other.The nonequilib- rium torque is proportional to the applied bias and has a component which remains nite for an arbitrarily thick nonmagnetic spacer layer (in the ballistic limit).Hence this term can also result in current-induced switching.Using a single-orbital tight-binding model,it will be shown that,for experimentally reasonable values of the bias,the current-induced torque is as strong as the equilibrium oscillatory exchange coupling.However,the current- induced torque is nonzero only for a junction in which the left-right symmetry with respect to the center of the junction is broken.Various mechanisms of the symmetry breaking will be discussed within the framework of the single-orbital tight-binding model.The latest results on current-induced switching in a Co/Cu/Co trilayer,based on a fully real- istic band structure,will also be presented.When a strong bias is applied to a magnetic tunneling junction,an additional switching e ect due to the modi cation of the potential pro le of the insulating barrier can occur.Such a bias-induced switching will also be discussed within the framework of the general non-equilibrium Keldysh formalism.

連絡先：
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前川　禎通（内2005）