PhD PROPOSITION:

LOW DIMENSIONAL SYSTEMS ON SEMICONDUCTING SUBSTRATES

2009-2011

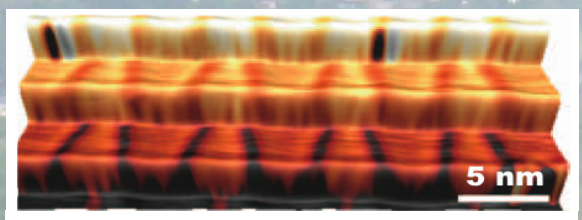

Figure 1. Scanning tunnelling microscopy image of Au(788) surface, which is a template for nanostructuring [1].

Electronic structure in solids is generally described by a free electron approach. A considerable effort is performed nowadays beyond this picture in order to describe electron interaction [2]. Interactions are enhanced in low dimensional systems due to the stronger electron localisation. We have recently observed such a behaviour leading to a metal-insulator transition induced by electron interactions on a Sn/Ge(111) surface [3]. Other exotic phenomena in low dimensional systems are the apparition of fractional quantum Hall effect [4], the enhancement of the magnetic moment [5] or the Luttinger liquid behaviour in one dimensional systems [6].

This PhD project will grow artificial nano-objects to study their electronic properties related to low dimensionnality. We have already shown how to taylor the surface state properties by exploiting self-organised nanostructures in metallic surfaces (see figure) [1]. Our objectif now is to grow nanostructures on semiconducting surfaces like silicon to decouple their electronic states from the bulk. The constituting elements of the nanostructures can be atoms, metallic clusters or molecules. Temperature, distance or coupling variation between the constituting elements can lead to electronic instabilities induced by electron-electron or electron-phonon interactions. The experimental studies of the electronic properties will be performed by photoemission at Soleil synchrotron (near Paris). Scanning tunnelling microscopy/spectroscopy (at Nancy, France) will allow to determine the atomic structure and the local electronic properties of the nanostructures.

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FUNDING : 50 % CNRS, 50 % Soleil Synchrotron (**DEA required**)
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