# Seminar

# Institute for Plasma Research

**Title :** Growth Dynamics and Plasmonic response of Silver nanoparticles deposited on nanodots/nanorippled templates

**Speaker :** Mr. Mukul Bhatnagar
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**Date :** 13th January 2017 (Friday)

**Time :** 03.30 PM

**Venue :** Committee Room 4, (New Building), IPR

## Abstract :

Light induced resonant oscillations of conduction electrons in noble metal nanoparticles, popularly known as Localised Surface Plasmon Resonance (**LSPR**), has been a highly researched topic in recent years. Pattern formation on semiconductor surfaces through low energy ion bombardment is one technique that is rapidly moving towards a commercial and large scale platform. A combination of metallic nanoparticles with an underlying patterned template opens up different avenues for research as well as integration in plasmonic enabled devices. Few research groups have focused on the optical properties and the growth of silver nanoclusters on rippled templates produced by low energy ions using Kinetic Monte Carlo simulations while not much research work reported has been performed to understand the thermal behaviour of silver nanoclusters deposited on the rippled surfaces. In the present work, we have performed Molecular Dynamics simulations to understand the growth and thermal dynamics of silver on the rippled patterned template. It has been found from our study that the calculated sticking coefficient for a binding energy of 0.2 eV is consistent with the experimental results on the surface coverage of sub-monolayer silver on silica from in-situ RBS [1]. The results from simulations on the heat treatment of silver nanoclusters deposited on the rippled templates correlate well with the experimentally observed contour ordered and isotropic coalescence on rippled surface with different periodicities [2]. We have also performed optical characterization through Spectroscopic Ellipsometry to understand the anisotropic nature of dielectric constants of silver nanoparticles deposited on rippled patterned Silicon templates and GaSb nanodots, respectively [3, 4]. The optical response of the former shows that there is shift in plasmon resonance on account of ripple periodicity and inter-particle gap whereas for the later, the topping of silver nanoparticles not only leads to the enhancement in the absorption but also enable the developed nanoarchitectures to act as a surface enhanced Raman spectroscopy based sensor.

**References**

[1] **Mukul Bhatnagar** et al**,** *Applied Physics Letters* 108, 223101, (**2016**).
[2] **Mukul Bhatnagar** et al, *Nucl. Inst. and Meth. in Phys. Res. Sec. B: Beam Interactions with Materials and Atoms*, (**2016, In press,** DOI: 10.1016/j.nimb.2016.10.005)
[3] **Mukul Bhatnagar** et al, *Journal of Nanoparticle Research*, 17:100, (**2015**)
[4] M. Ranjan, **Mukul Bhatnagar** and S. Mukherjee, *Journal of Applied Physics,* 117,103106 (**2015**).