Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Internal Seminar

Development of a heatable sample holder for in-situ sample cleaning and angle-resolved probe in neutral atom microscopy

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Neutral atom microscopy (NAM) is a promising, non-destructive, soft probe, technique for surface imaging, utilising low-energy (10-500 meV) atoms scattered from surfaces. Our group used a custom-built NAM apparatus to successfully image thin MoS_2 films, including monolayers, on SiO_2/Si substrates using He atoms, Kr atoms, and Kr clusters [1]. Interestingly, Kr clusters generate clear contrast but which is inverted compared to that obtained using monoatomic beams [2]. This contrast inversion possibly arises from the differences in the angular scattering distributions when employing Kr clusters. Additionally, over time, the contrast in MoS_2 images was observed to decrease, likely due to an increase in surface corrugation caused by adsorbates. To mitigate these effects, we developed an in-situ heater system to remove adsorbates and an in-plane rotatable detection probe for understanding the scattering distribution. Additionally, we built a compact hydrogen detection system using a Residual Gas analyser (RGA) and it is calibrated. This system was used to detect hydrogen release from an acid-doped spiro sample upon ultraviolet (UV) light exposure. The talk will focus on these developments, results obtained from these experiments, and planned future work.

References:

[1] G. Bhardwaj, K. R. Sahoo, R. Sharma, P. Nath, and P. R. Shirhatti, Neutral-atom-scattering-based mapping of atomically thin layers, Phys. Rev. A **105**, 022828 (2022).
[2] G. Bhardwaj and P. R. Shirhatti, Contrast inversion in neutral-atom microscopy using atomic cluster beams, Phys. Rev. A **107**, 062813 (2023).

Wednesday, Dec 8th 2025

16:00 Hrs

Seminar Hall, TIFRH