Helium Ion Microscopy studies of biological/biomedical samples, atomic size defects and elemental identification

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a. Using Helium Ion Microscope, we are pursuing collaborative projects in the biological and biomedical fields. We have imaged "aged" rat kidney glomeruli, the biological structure responsible for blood filtration. Our images clearly show structural and morphological changes associated with the aging process. We have also investigated the effect of ocean acidification on coral survivability. We have imaged calcification centers in corals and observed significant morphological changes as calcium is absorbed.

b. Our lab has a substantial experience working with ion beam techniques like RBS and MEIS where elemental identification is done routinely with great accuracy. We are developing a Time-of-Flight system capable of energy discrimination in the Helium Ion Microscope. This detector will bring elemental identification to the subnanometer regime. A proof-of-principle experiment will be presented.

c. The new Rutgers UltraSTEM microscope allows the formation of an angstrom-size monochromatic electron beam. With this capability, spatially-resolved spectroscopy studies over a wide energy range (from vibrational excitations to core-shell transitions) can be conducted in nano-sized systems. We will present results on He beam induced single atom defects in MoS_2 and their effects on the host lattice.

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