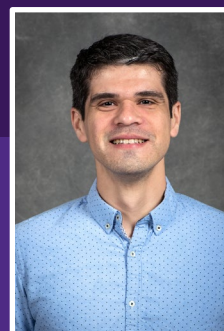


THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT COLLOQUIUM SERIES PRESENTS:

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Probing Properties of Matter at the Nanoscale by Using Scanning Electron Diffraction

The fundamental pillars of emergent physics and functionality of materials lie in the structural complexity of the atomic constituents. A complete understanding of this complex correlation requires experimental methods that are able to deliver a direct relationship between the properties and the atomic structure. However, the experimental determination of materials properties at nanoscale is often challenging and requires techniques that combine high spatial resolution, precision, and chemical sensitivity. In this colloquium, I will show examples of how to explore the information contained in the transmitted scattering of a finely focused electron beam traversing a thin foil. The resultant convergent beam electron diffraction (CBED) patterns include localized information on sample structure, composition, phonon spectra, three-dimensional defect crystallography and more. Recent advances in the fast-pixelated detector technology have enabled collection of these CBED patterns at many probe positions with millisecond dwell times, namely scanning electron diffraction. As a result, many image modalities can be achieved from a single dataset. I will demonstrate the usefulness of this technique to solve materials problems including precisely determination of octahedral rotation in electron beam sensitive halide-based perovskites using ptychography, local symmetry in ferroelectric ultra-thin films, three-dimension polarization in perovskites oxides, and more. Additionally, strategies for handling, processing and extracting useful data from such large datasets will be addressed.

Dr. Roberto dos Reis is specialized in advanced characterization of a vast range of materials using transmission electron microscopy (TEM) techniques. He has B.Sc, M.Sc and Ph.D degrees in Physics from Federal University of Rio Grande do Sul in Brazil where he worked on synthesis and characterization of semiconductor thin-films. During his PhD studies, he was a long-term visiting scholar at Lawrence Berkeley National Laboratory (LBNL)/CA working under supervision of Dr. Zuzanna Liliental-Weber on characterizing highly mismatched III-V and II-V semiconductor alloys for photovoltaic applications as member of the electronic materials group from 2010-2013. In the last 5 years, Roberto worked alongside Dr. Ulrich Dahmen and Dr. Jim Ciston as postdoctoral researcher at the National Center for Electron Microscopy (NCEM) facility of the Molecular Foundry/LBNL applying advanced electron diffraction techniques to a variety of materials as well as collaborating with several users in a multidisciplinary environment.

Tuesday, January 29 • 4 pm • Tech L211