Center for Soft Matter and Biological Physics

Discussion Meeting

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"Nanoscale characterization of periodic surfaces based on dynamical scattering theory"

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4:00pm - 5:00pm

Virtual Zoom Link: https://virginiatech.zoom.us/j/98206647899

Precise metrology of nano patterns is of paramount importance in many applications across different fields, Including chemical engineering, optics, electronics, and biology. Although direct characterization approaches such as AFM and SEM are extremely informative, they suffer several limitations including inaccessibility to beneath-surface structures or the necessity for sample dissection to obtain in-depth information. On the other hand, indirect detection, primarily using neutron/x-ray scattering, offers an attractive non-destructive approach for probing in-depth structures. The caveat is that scattering methods require non-trivial data modeling based on complex scattering theories. To this end, models based on approximation methods have facilitated and advanced the use of scattering approaches. However, they are not adequate for modeling signals resulting from strong coherent wave interaction, as is in the case of periodic nanostructures. Alternatively, an exact framework for scattering from periodic structures is given by the dynamical theory (DT) model. Here, we improved an existing DT fitting protocol by advancing the fitting package,"Pywls," using a python-based package of "Cma-Es". We have applied our methodology in reconstructing the profile of different periodic nanostructures using available neutron scattering data. Our approach yields high precision and efficiency in computational time. Currently, we are optimizing our model to predict shape variations and thin-slicing protocols of complex sample profiles. In this talk, we will discuss the theoretical basis of the model, current computational developments, and possible applications of this method in relevant research areas.