THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Undergraduate Research Seminar

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3:30 - 4:30 p.m.
Zoom

Resonances and transmission for waves in truncated media

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Abstract. In a lot of toy models in quantum mechanics, you can construct "states" that live only at certain "energies" by trapping things into specific regions, say using an infinite square well or harmonic potential. This can be done similarly (although with some extra complications) by having an infinitely extending repeated (or periodic) structure. These energies correspond to eigenvalues and the states correspond eigenfunctions of an operator. The spectrum of a given type of element comes from a related calculation where one asks about trapping that comes from the nucleus and the energy levels the electrons can obtain. However, in materials, we often don't want to look at exact systems, but we consider what happens if energy can leave the system because it is not perfectly trapping or that regular structure does not go on all the way to infinity (hence the systems are "truncated" as in the title). In this talk, we will first give an overview of the subject of scattering theory in one-dimension and how the exact models inform what we should see, then we will talk about some recent results on scattering resonances partly from some classical results in a new book by Dyatlov-Zworksi on a specific model, plus some extensions obtained by Jeremy with collaborators Jianfeng Lu (Duke) and Alex Watson (Minnesota). Next, Joe will talk about his project to extend both works to consider behavior near excited states, as well as prediction of transmission peaks in related models. These kinds of problems are related to the idea of "lasing" in condensed matter physics, which amounts to studying very related problems!