Speaker: Rudro Biswas, Purdue University

Title: "Uncovering the geometry of quantum Hall states"

Abstract: Exotic topological states of matter, of which quantum Hall (QH) states are a prominent example, have attracted considerable theoretical and experimental efforts in recent years, both due to their potential for enabling transformative technologies, and since foundational questions about the internal geometry of these states have remained open. The signature property of QH states, namely, the quantization of Hall conductance, is well-appreciated, and independent of sample-specific details, to the extent that it is used for precise measurements of fundamental constants. Less well understood, and at the frontier of current research, is how the geometry of these states responds to gravitational perturbations, i.e., deformations to the real space manifold they are embedded in, and what if any universal signatures characterize this response. In this talk I shall first review the history of the quantum Hall effect, and then focus on this frontier question. I will show that remarkable new universal behaviors emerge from probing the gravitational response of QH states. Further, I will show that these responses can be characterized not only by considering QH states in curved spaces, but equivalently, by placing them in non-uniform electric fields, thus facilitating experimental tests of these results. Finally, I will discuss technological implications of these results, and the prescription that they suggest for constructing qubits for quantum computation.