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Charge and spin fractionalization in strongly correlated topological insulators[1] PREDRAG NIKOLIC, George Mason University, TANJA DURIC, Max Planck Institute, Dresden — The recently discovered two-dimensional topological insulators (TI) with time-reversal symmetry are closely related to integer quantum Hall states in which electron spin plays the role of charge. The appearance of protected edge states in these systems can be understood by describing the spin-orbit coupling as the source of an SU(2) (spin-dependent) magnetic flux. However, the absence of spin conservation cripples the quantum spin-Hall effect. In this talk we will explore the possibility of obtaining strongly correlated TIs with fractional quasiparticles. Such states are the SU(2) analogues of fractional quantum Hall states, but with modified topological orders due to the spin non-conservation. We will discuss two heterostructure designs featuring a "conventional" TI quantum well that could host a fractional TI state of Cooper pairs or excitons. These devices exploit a quantum critical point for electron localization to provide a fragile spectrum that can be dramatically reshaped by the strong spin-orbit coupling. Then, we will present a topological spinor-field theory of fractional TIs and explain how the spin-orbit coupling can produce a combined charge and spin fractionalization despite the spin non-conservation.

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