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Topological insulators and fractional quantum Hall effect on the ruby lattice[1] XIANG HU, MEHDI KARGARIAN, GREGORY A. FIETE, The University of Texas at Austin — We study a tight-binding model on the two-dimensional ruby lattice. This lattice supports several types of first and second neighbor spin-dependent hopping parameters in an s-band model that preserves time-reversal symmetry. We discuss the phase diagram of this model for various values of the hopping parameters and filling fractions, and note an interesting competition between spin-orbit terms that individually would drive the system to a Z_2 topological insulating phase. We also discuss a closely related spin-polarized model with only first and second neighbor hoppings and show that extremely flat bands with finite Chern numbers result, with a ratio of the band gap to the band width approximately 70. Such flat bands are an ideal platform to realize a fractional quantum Hall effect at appropriate filling fractions. The ruby lattice can be possibly engineered in optical lattices, and may open the door to studies of transitions between quantum spin liquids, topological insulators, and integer and fractional quantum Hall states.

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