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**Interferometric measurement method for  $Z_2$  invariants of time-reversal invariant topological insulators**<sup>1</sup> FABIAN GRUSDT, Department of Physics and research center OPTIMAS, University of Kaiserslautern, Germany, DMITRY ABANIN, EUGENE DEMLER, Physics Department, Harvard University, Cambridge 02138, MA, USA — Recently experiments with ultracold atoms started to explore topological phases in 1D optical lattices. While transport measurements are challenging in these systems, ways to directly measure topological quantum numbers using a combination of Bloch oscillations and Ramsey interferometry have been explored (Atala et.al., arXiv:1212.0572). In this talk I will present ways to measure the  $Z_2$  topological quantum numbers of two and three dimensional time-reversal invariant (TR) topological insulators. In this case non-Abelian Bloch oscillations can be combined with Ramsey interferometry to map out the topological properties of a given band-structure. Our method is very general and works even in the presence of accidental degeneracies. The applicability of the scheme is discussed for different theoretically proposed implementations of TR topological insulators using ultracold atoms.

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