Diagnosing a strong topological insulator by quantum oscillations

Work done with
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...Why pose the question at all?
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• I. E. Tamm (1932). "On the possible bound states of electrons on a crystal surface".

• W. Shockley (1939). "On the Surface States Associated with a Periodic Potential".
A tunable topological insulator in the spin helical Dirac transport regime


LETTERS

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Q: Do non-degenerate spin-helical states alone prove that you are dealing with a topological insulator?
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A: Not quite.
Q: Why?

A: Because, e.g., in inversion layers, such states appear due to Rashba spin-orbit coupling, simply because of structural inversion asymmetry.
E. I. Rashba (~1960) : 
Q: Do the Landau level spectroscopy and the Berry phase analysis alone prove that you are dealing with a topological insulator?

\[ I = \cos \left[ 2\pi \frac{F}{H} + \pi + \gamma \right] \]
Q: Do the Landau level spectroscopy and the Berry phase analysis alone prove that you are dealing with a topological insulator?

\[ I = \cos \left[ 2\pi \frac{F}{H} + \pi + \gamma \right] \]

A: Not quite...
E. I. Rashba (~1960) :
Diagnosing a strong topological insulator by quantum oscillations:
Conclusion:

• An odd number of fundamental frequencies of quantum oscillations mean a strong topological insulator.

• An even number of fundamental frequencies mean a weak or a topologically trivial insulator.
...Thank you!

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