

Time Resolved Angle Resolved Photoemission Spectroscopy on Magnetic Topological Insulators

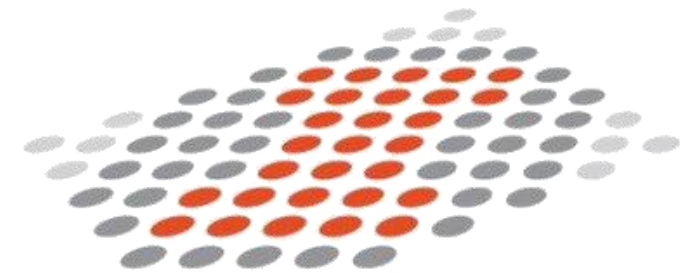
Presented by Nina Bielinski

Acknowledgments: Soyeun Kim, Fahad Mahmood,
Claudia Felser, Daniel Shoemaker, Mebatsion Gebre



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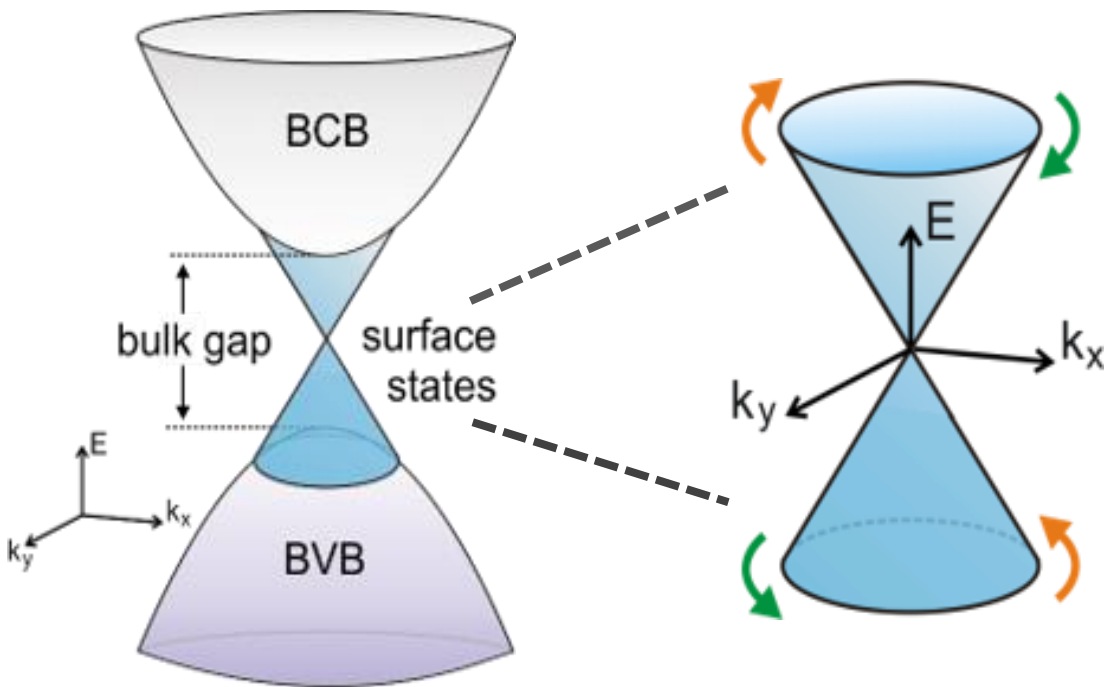
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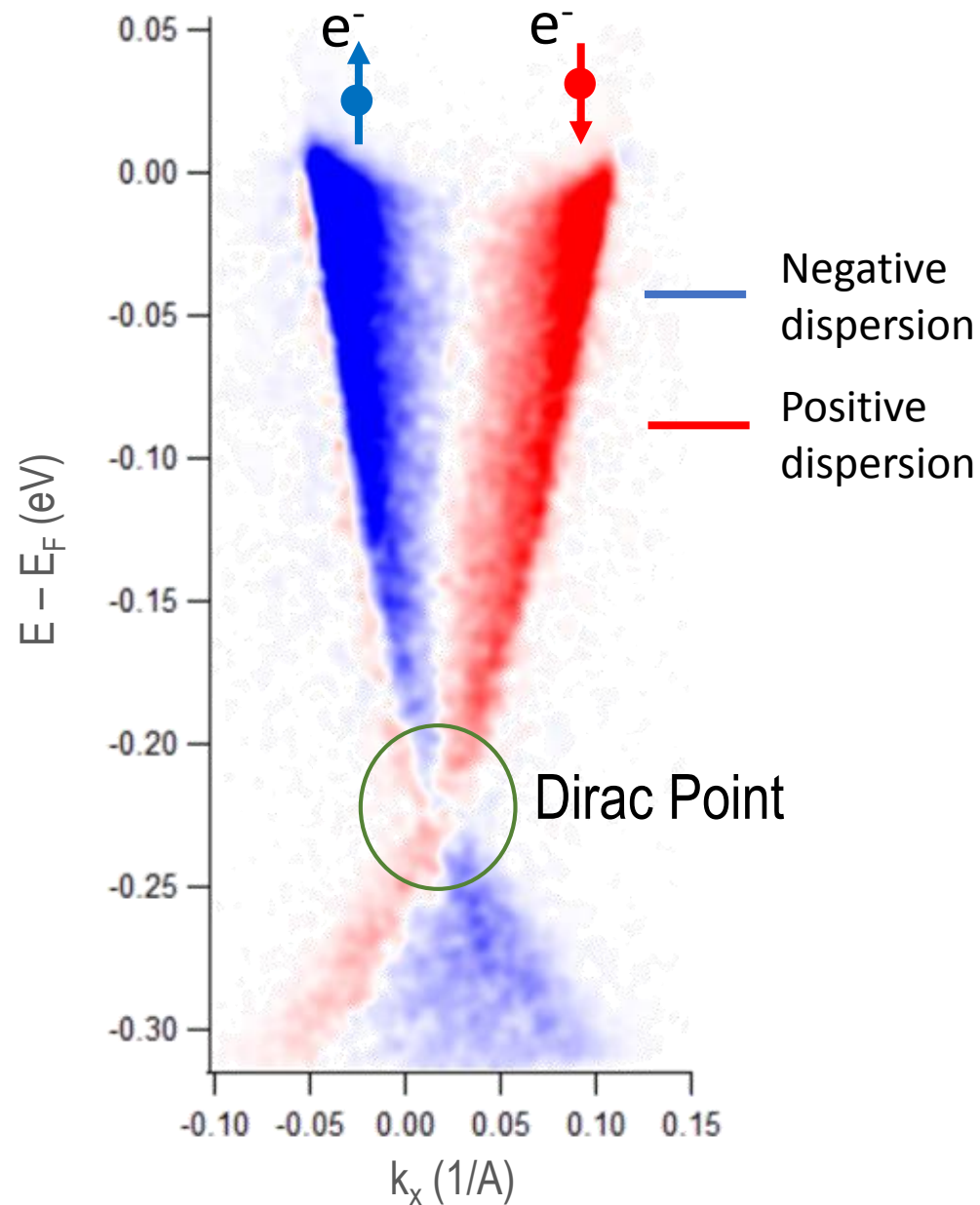
I-MRSEC

What is a Topological Insulator?

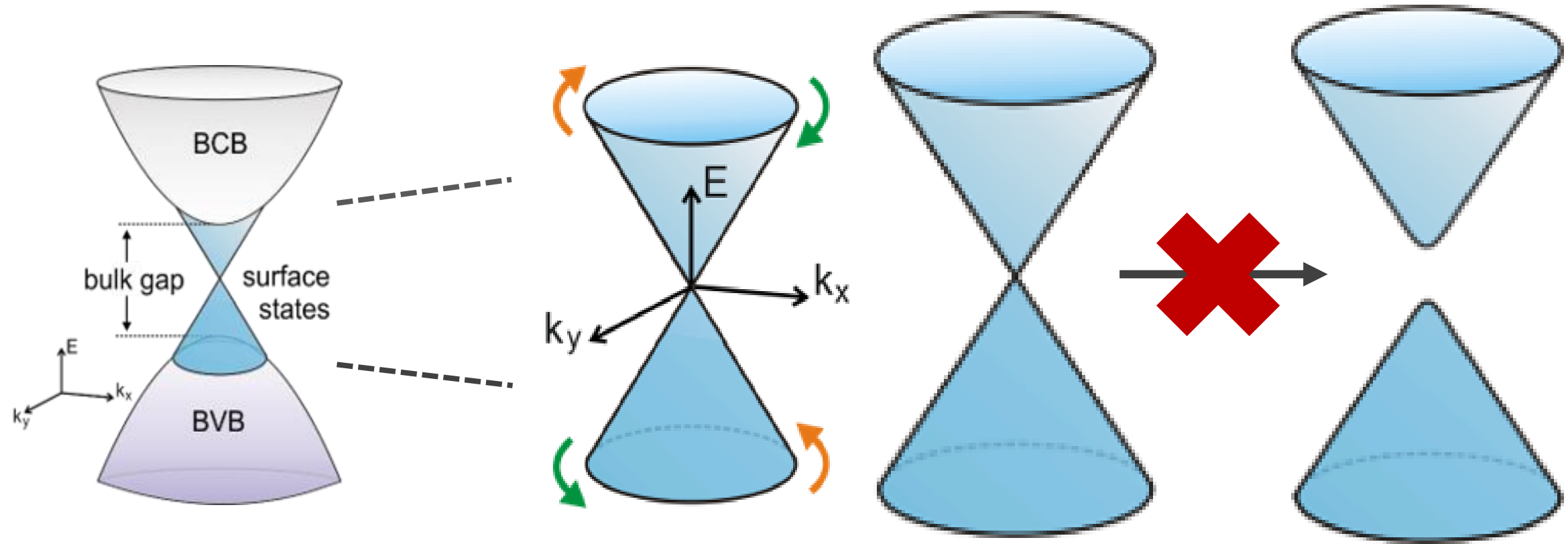
Bulk valence and conduction band structure resembling a semiconductor



Surface states meeting at the Dirac Point in the bulk band gap

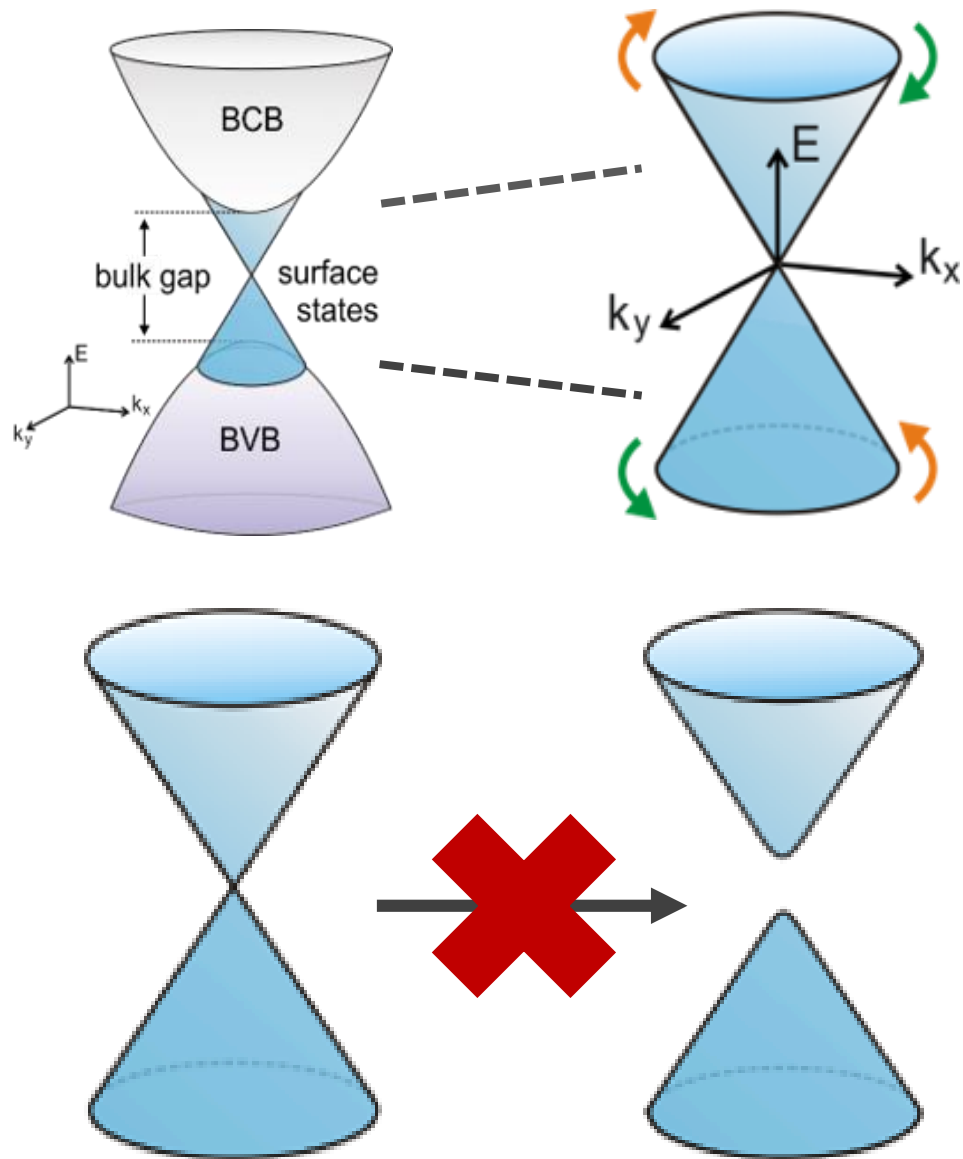


When is there gapping of the Dirac Point?

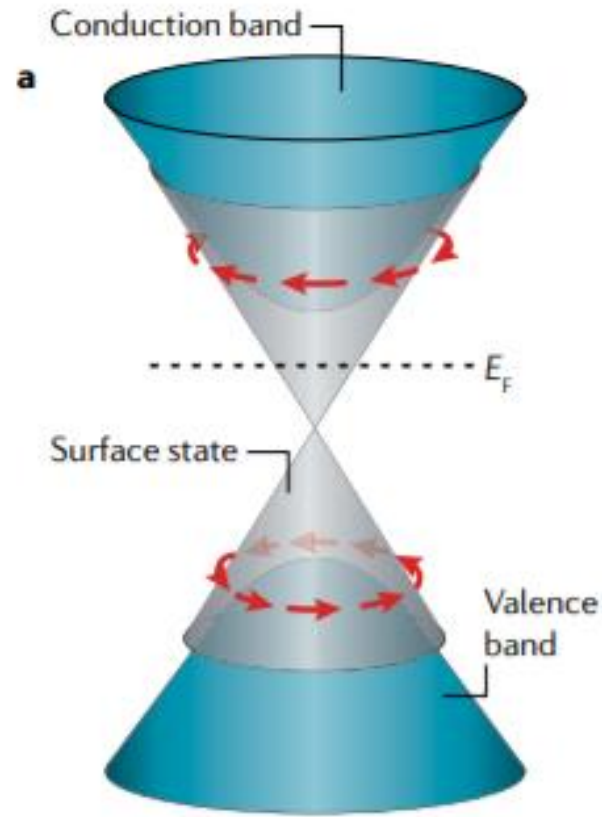


Surface states cannot gap out unless time reversal symmetry (TRS) is broken

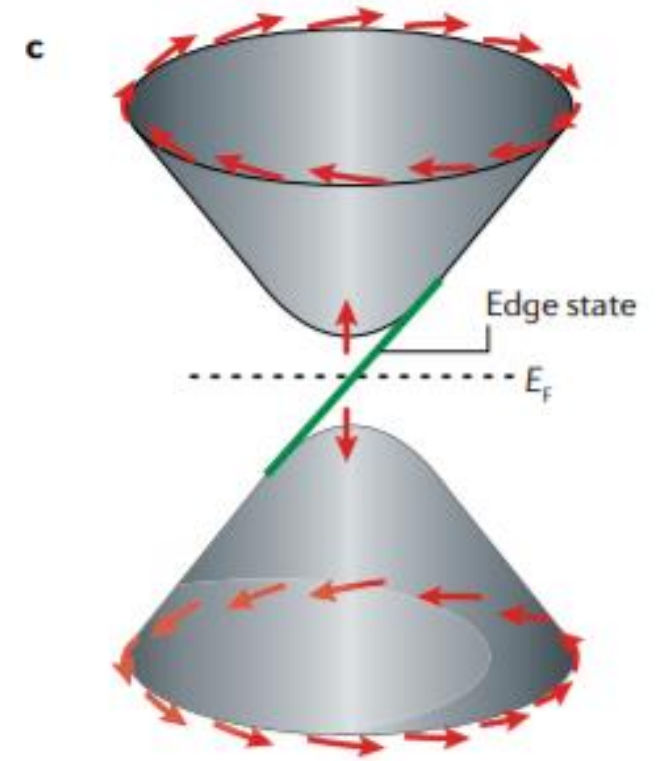
Characteristics of a Magnetic Topological Insulator



Topological Insulator



Magnetic Topological Insulator



Nature Reviews Physics **1**, 126–143 (2019)

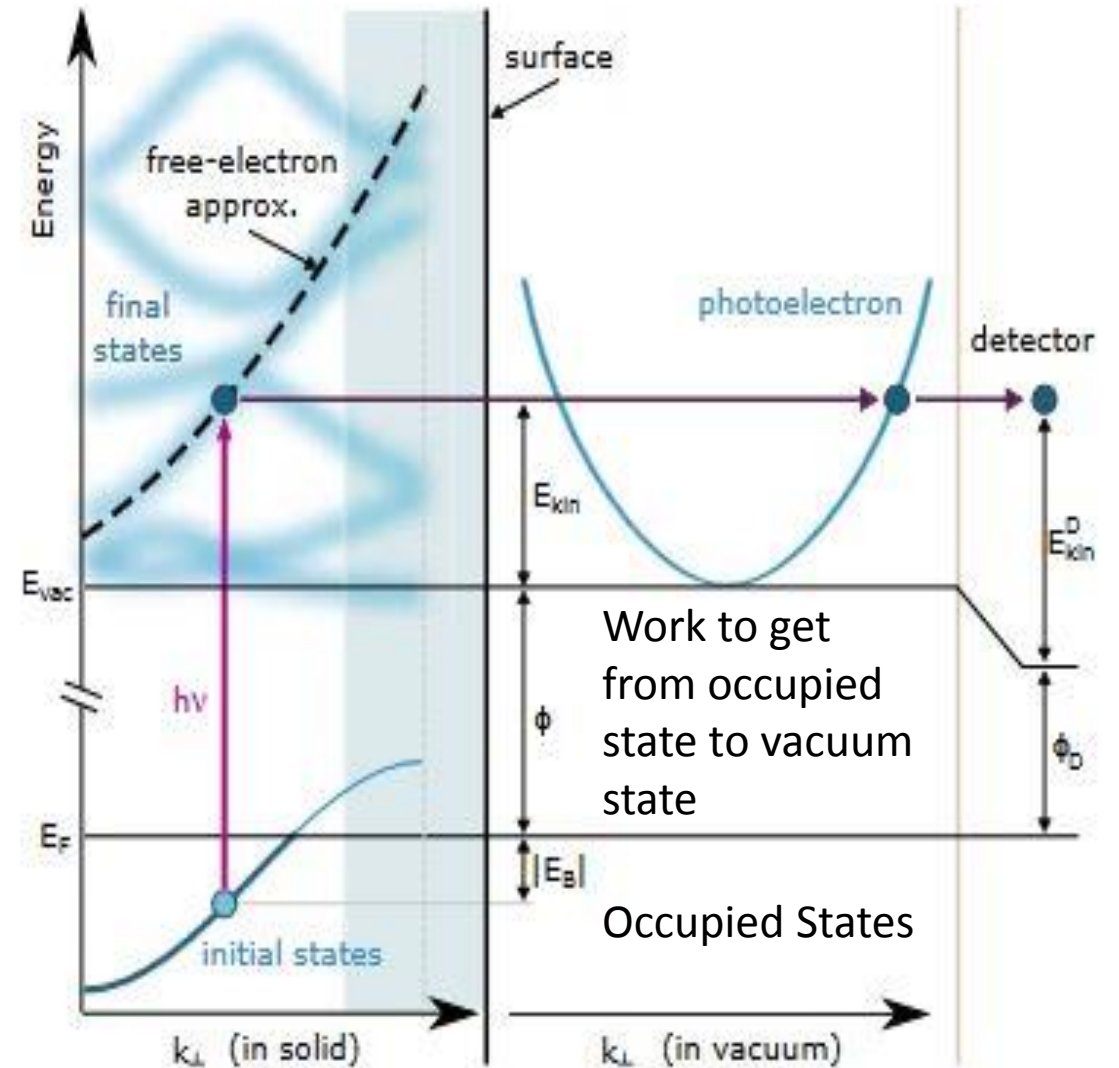
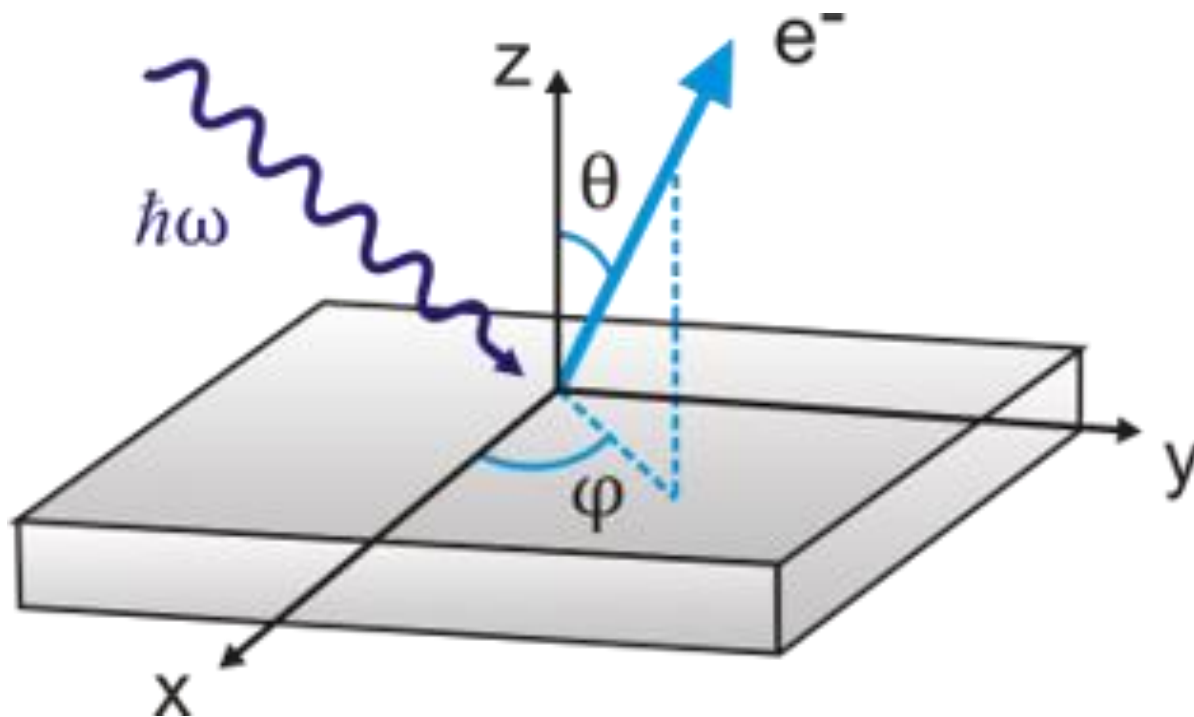
Angle Resolved Photoemission Spectroscopy (ARPES)

$$E_{kin} = h\nu - \Phi - |E_B|$$

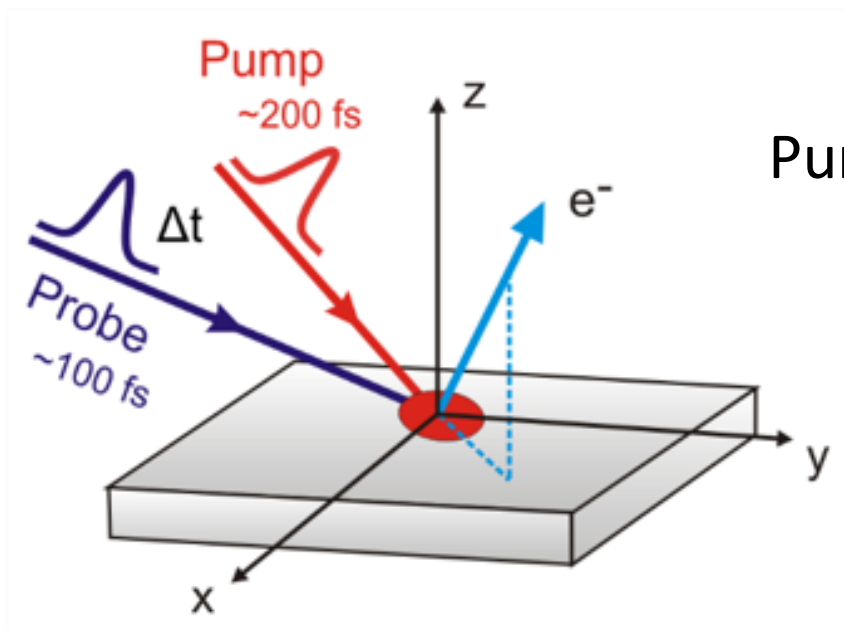
Φ : Work Function

E_B : Binding Energy

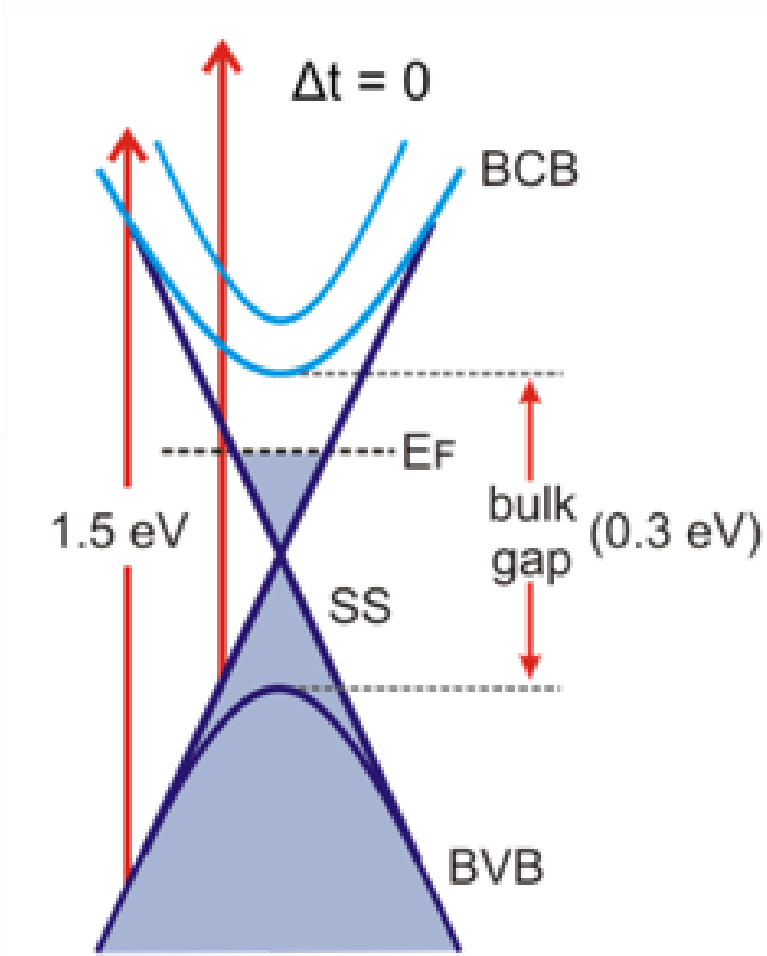
ν : Light Frequency



Accessing Unoccupied States with Time Resolved ARPES

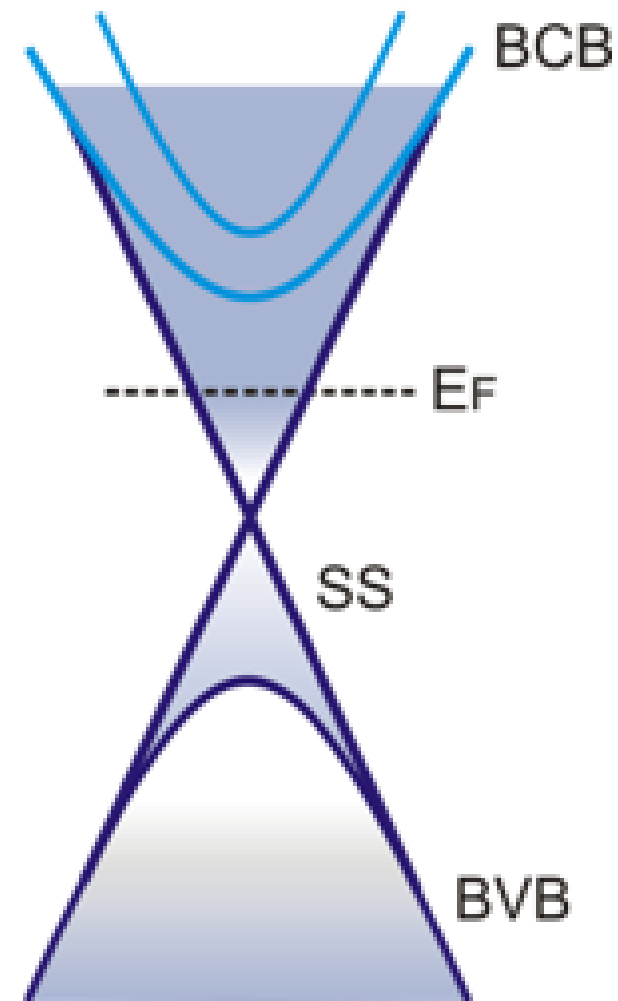


Pump Beam Acting on States



Pump Occupied Band Structure

$\Delta t > 0$



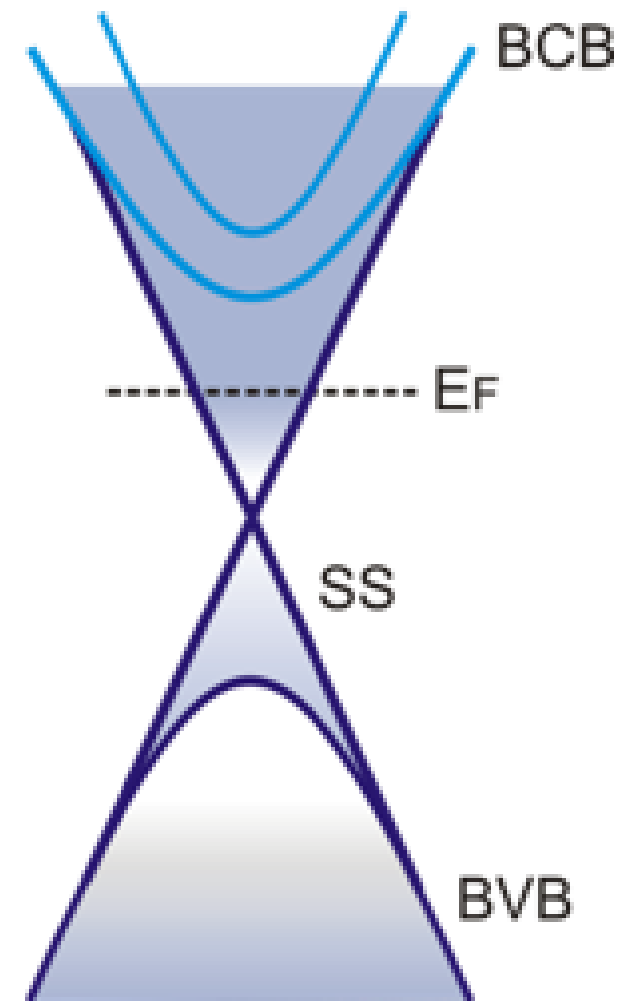
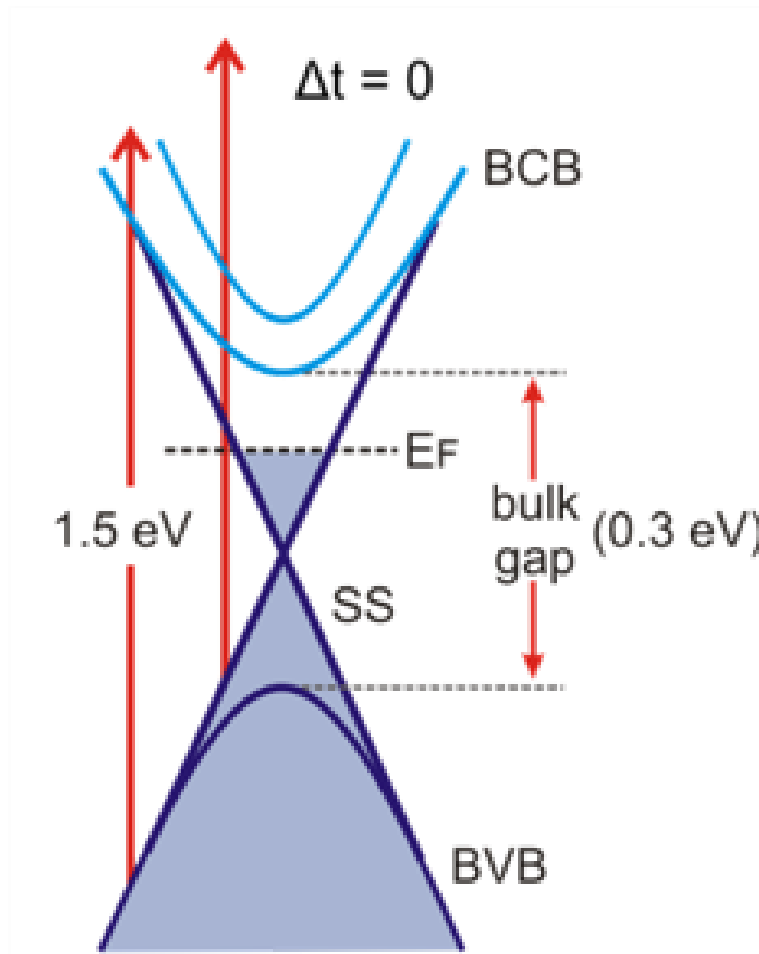
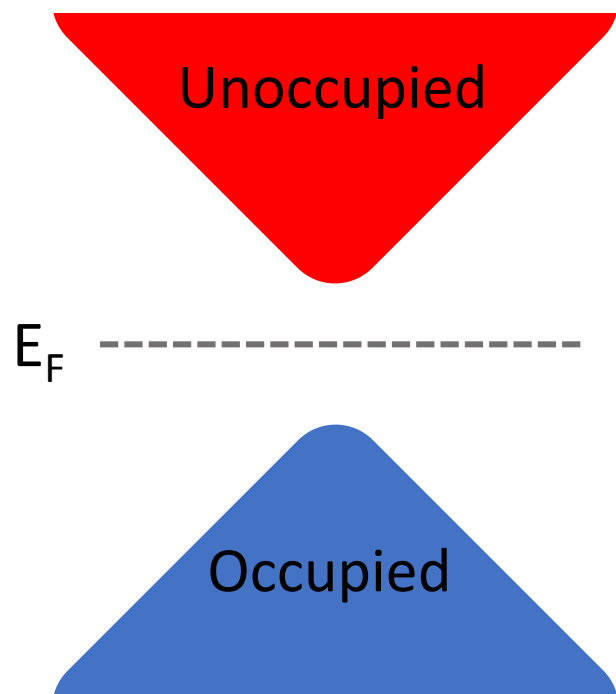
Accessing Unoccupied States with Time Resolved ARPES

Pump Occupied Band Structure

Pump Beam Acting on States

$\Delta t > 0$

Magnetic Topological Insulator



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