# 北京大学量子材料科学中心
## International Center for Quantum Materials, PKU

# Turning 'off' and 'on' the topological edge states in ultra-thin $Na_3Bi$


## Mark Thomas Edmonds
*Department of Physics and Astronomy at Monash University*


**Time: 10:00am, Oct 12, 2018 (Friday)**

**时间: 2018年10月12日（周五）上午10:00**

**Venue: w563, Physics building, Peking University**

**地点：北京大学物理楼，西663会议室**

## Abstract


$Na_3Bi$ in bulk form represents a zero-bandgap topological Dirac semimetal (TDS), but when confined to few-layers is predicted to be a quantum spin Hall insulator with bulk bandgap of 300 meV.[1] Furthermore, application of an electric field to few-layer $Na_3Bi$ has been predicted to induce a topological phase transition from conventional to topological insulator.[2]

I will discuss our efforts to grow epitaxial few-layer $Na_3Bi$ via molecular beam epitaxy, and probe its electronic structure and response to an electric field using scanning probe microscopy/spectroscopy and angle-resolved photoelectron spectroscopy. We are able to demonstrate that monolayer and bilayer $Na_3Bi$ are quantum spin Hall insulators with bandgaps >300 meV. Furthermore, via application of an electric field the bandgap can be tuned to semi-metallic and then re-opened as a conventional insulator with bandgap ~100 meV.[3] The demonstration of an electric field tuned topological phase transition in ultra-thin $Na_3Bi$ provides a viable platform for the creation of a topological transistor.


References


[1] C. Niu et al., Phys. Rev. B (2017) 95, 075404

[2] H. Pan et al., Scientific Reports (2015) 5, 14639

[3] J. Collins et al., arXiv :1805.08378


## About the Speaker

Dr Mark Edmonds received his PhD from La Trobe University in 2014. From 2014-2016 he was a postdoc fellow at Monash University working with Prof. Michael Fuhrer. In 2016 he was awarded an Australian Research Council Discovery Early Career Research Award to realise novel electronic phases in two-dimensional materials, and is now a lecturer in the Department of Physics and Astronomy at Monash University. His research focuses on the growth and characterization of novel electronic materials for the development of next generation electronic devices, using spectroscopic tools such as scanning tunnelling microscopy (STM) and angle-resolved photoelectron spectroscopy (ARPES).