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## Angle Resolved Photoemission Spectroscopy Study of Sr4Ru3O10 single crystals and Intrinsic Bi2Te3 Topological Insulator Thin Films

Monday, 16 November 2015 12:00 (20 minutes)

In the first half of this talk will focus on three-layered strontium ruthenate single crystals. Strontium ruthenates of the Ruddlesden-Popper (R-P) series Sr<sub>n+1</sub>Ru<sub>n</sub>O<sub>3n+1</sub> have been subject to intensive research since they exhibit distinct collective physical phenomena that are due to the change of the number n of the RuO<sub>6</sub> octahedra layers in the unit cell. The phenomena observed range from unconventional spin-triplet superconductivity in Sr<sub>2</sub>RuO<sub>4</sub> (n=1) [1], quantum critical metamagnetism in Sr<sub>3</sub>Ru<sub>2</sub>O<sub>7</sub> (n=2) [2]; and anisotropic ferromagnetism and proposed orbital-dependent metamagnetism inSr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> (n=3) [3].

Little is known in literature about the microscopic origin of the metamagnetic transition in Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</s Previous experimental and theoretical work on Sr<sub>3</sub>Ru<sub>2</sub>O<sub>7</sub> (n=2) have suggested a band structure-based model of metamagnetism to explain its phase diagram [4]. According to this model, it is expected to find van Hove singularities in the density of states near the Fermi level. The same scenario is expected to be valid for Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> [5]. Experimental information on the near Fermi level electronic structure of Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> [10</sub> [2]. Experimental information on the near Fermi level electronic structure of Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> [3]. Experimental information on the near Fermi level electronic structure of Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub>. In this presentation, I will show the first electronic structure measurements on Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> performed at synchrotron using angle resolved photoemission spectroscopy (ARPES) [6]. In particular, I will discuss the near Fermi level band dispersion and the Fermi surface topology of Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub> single crystals. Next, I will discuss band dispersions of Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub>, which reveal a complex density of states that is susceptible of giving rise to van Hove singularities near the Fermi level; a situation expected to be the origin of the magnetic fluctuations in Sr<sub>4</sub>Ru<sub>3</sub>O<sub>10</sub>.

In the second half of this talk, I will discuss ARPES data on intrinsic Bi<sub>2</sub>Te<sub>3</sub> topological insulator thin films. Topological insulators (TIs) are materials with an insulating bulk interior and spin-momentum-locked metallic surface states as a result of a band inversion from large spin-orbit interaction [7]. Bismuth telluride (Bi<sub>2</sub>Te<sub>3</sub>) is one of the 3D topological insulators (TIs) that have received a considerable amount of attention as potential candidates for room temperature spintronics and quantum computational devices[7]. However, despite significant progress in TI material preparation, growing high-quality TI materials for transport experiments is still a major challenge. Often, bulk carrier conduction complicates direct observation of surface effects in transport measurements.

Here, I will give a brief overview of our current research on thin films of topological insulator [8]. Our combined in-situ spectroscopy, especially angle resolved photoemission spectroscopy study of molecular beam epitaxy grown Bi<sub>2</sub>Te<sub>3</sub> reveal topological surface states without a contribution from the bulk bands at the Fermi energy[8]. Investigation of the effect of pure oxygen exposure at atmospheric pressure; and the effect of ex-situ contamination in air show that the surface electronic band structure of our Bi<sub>2</sub>Te<sub>3</sub> films are not affected by in-vacuo storage and exposure to oxygen; whereas major changes are observed when exposed to ambient conditions [8]. In future, we might perform these investigations at synchrotron in order to cover a wider spectral range with an intense and highly polarized continuous spectrum with the purpose of making detailed study of the valence photoemission spectra of our topological insulator thin film samples. References

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## **Summary**

Use of soft x-rays (ARPES) on two different systems: Sr4Ru3O10 single crystals and Bi2Te3 topological insulator thin films.

Primary author: Mr NGABONZIZA, Prosper (University of Twente, MESA+ Institute for nanotechnology)

**Co-authors:** Prof. BRINKMAN, Alexander (MESA+ Institute for Nanotechnology, University of Twente); Dr DOYLE, Bryan (University of Johannesburg); Dr CARLESCHI, Emanuela (University of Johannesburg); Dr FRANTZESKAKIS, Emmanouil (Van der Waals-Zeeman Institute, University of Amsterdam); Prof. GOLDEN, Mark S. (Van der Waals-Zeeman Institute, University of Amsterdam); Mr DE JONG, Nick (Van der Waals-Zeeman Institute, University of Amsterdam)

**Presenter:** Mr NGABONZIZA, Prosper (University of Twente, MESA+ Institute for nanotechnology)

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