

Funded PhD Project

Semiconductor / semimetal heterostructures: a platform for topological optoelectronics

[University of Warwick](#), UK, and [CY Cergy Paris Université](#), France

This is a co-tutelle project in the [EUTOPIA alliance](#). The student will likely spend 2 – 2.5 years in Warwick and 1 – 1.5 years in Paris. There will be further opportunities for travel and collaboration, for example via the [OPERA network](#) and using synchrotron radiation / laser facilities.

The project will suit candidates with a strong background in experimental physics, physical chemistry or materials engineering. Experience with any of the following would be advantageous: ultra-high vacuum (UHV), epitaxial growth, surface science, or X-ray photoelectron spectroscopy (XPS).

The theme of this experimental project is the growth by molecular beam epitaxy (MBE) of topologically non-trivial semimetals which are compatible with the family of III-V semiconductors (GaAs, InSb, etc.). These materials are highly promising for spintronic and electronic applications, which could underpin highly energy-efficient computing and data storage or scalable quantum computing. We will focus on the Weyl semimetals from the (Ta,Nb)(As,P) family, and on the topological semimetal InBi. These can be grown by MBE on III-V family substrates. Very recently we demonstrated, for the first time, growth of an InSb/TaAs/InSb heterostructure. This opens up the possibility to tailor quantum structures for fundamental investigations and optoelectronic devices. The MBE systems in Warwick allow in situ analysis of films as they grow, by electron diffraction, XPS and scanning tunnelling microscopy. We can also transfer samples by UHV suitcase to other analysis facilities. The project will involve MBE growth of semiconductor / semimetal heterostructures and their analysis by advanced methods such as synchrotron surface X-ray diffraction (SXRD) and ultra-fast angle resolved photoelectron spectroscopy (ARPES). A range of these methods is accessible in Paris, and you will join the group of Prof. Christine Richter in CY Cergy Paris Université for at least a year of your studies. Extensive hands-on training and support in MBE growth and surface science will be provided along with a range of taught postgraduate modules tailored to your needs.

For further information and to apply, please contact Dr. Gavin Bell gavin.bell@warwick.ac.uk and [Physics Postgraduate Admissions](#).