

## SEMINAR ANNOUNCEMENT

### DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Faculty of Engineering

Website: <https://www.eng.nus.edu.sg/ece/>

**Area: Microelectronic Technologies & Devices**

**Host: Assoc Prof Yang Hyunsoo**

<b>TOPIC</b>	:	<b>Recent Advances in van-der Waals Heterostructures-based Spintronics</b>
<b>SPEAKER</b>	:	<b>Prof. Stephan Roche, ICREA and Catalan Institute of Nanoscience and Nanotechnology, Spain</b>
<b>DATE</b>	:	<b>13 September 2019, Friday</b>
<b>TIME</b>	:	<b>11am to 12pm</b>
<b>VENUE</b>	:	<b>EA-06-04, Engineering Block EA, Faculty of Engineering, NUS</b>

### ABSTRACT

I will discuss how physical properties of graphene can be strongly enriched and manipulated by harvesting the large amount of possibilities of proximity effects with magnetic insulators, strong spin-orbit coupling SOC materials such as transition metal dichalcogenides (TMD) and topological insulators (TI). First I will introduce some foundations of spin transport for Dirac fermions propagating in supported graphene devices or interfaced with strong SOC materials, with a particular emphasis on how spin dynamics is monitored by the nature of SOC induced in graphene by nearby TMDs and TIs. Such proximity effect will be revealed by giant spin lifetime anisotropy, with spins oriented in the graphene plane relaxing much faster than spins pointing out of the plane. This anisotropy, arising from the specific nature of the SOC induced in the graphene layer and crucially on the symmetry of the graphene/TMD & TI interfaces, also inspires ways for manipulating spin properties using proximity effects, such as inducing and tailoring Spin Hall effect by proximity effects. Finally, I will present some spin transport results in quasiballistic graphene devices, as well as some universal features in polycrystalline graphene, all results reinforcing the promising future of graphene and other 2D materials in improving mainstream spin-based memories or advancing spin logics technologies.

### BIOGRAPHY

Stephan Roche is an ICREA Research Professor leading the "Theoretical and Computational Nanoscience" group at the Catalan Institute of Nanoscience and Nanotechnology in Barcelona (Spain) since 2009 ([www.icn2.cat](http://www.icn2.cat)). Before he has been working as Assistant Professor at the University Joseph-Fourier (Grenoble, France) and permanent researcher at the Commissariat à l'Energie Atomique from 2000 till 2009. He was qualified to the rank of Full Professor at the Université Joseph-Fourier (Grenoble, France) in 2004.

He is a theoretician with more than 25 years of experience in the study of transport theory in low-dimensional systems, including graphene, carbon nanotubes, semiconducting nanowires, organic materials and topological insulators. He has published more than 200 papers in journals such as Review of Modern Physics, Nature Physics, Chem. Soc. Rev., Nano Letters and Physical Review Letters (40 papers) and is the co-author of book "Introduction to Graphene-Based Nanomaterials: From Electronic Structure to Quantum Transport" (Cambridge University Press, 2014, new edition to appear in January 2020). In 2009 Prof. Roche was awarded the Friedrich Wilhelm Bessel Research Award by the Alexander Von-Humboldt Foundation (Germany) and since 2011 he has been actively involved in the European Graphene Flagship project and appointed as co-leader of the spintronics work package, in charge of all theoretical and computational activities.

Since mid-July 2019 he is Visiting Professor at the National University of Singapore.