Physics in 2D Materials

Lecturer

Taro Wakamura (LPS Orsay)

5 lectures (2 hours each) in May-June-July
Date: Every Thursday from 10am (23 in May, 6,13,20 in June, 4 in July)
Place: Amphi Moyen, Bât 510 (Except 13/6. On 13th in June it is at the seminar room 208a)

Overview

Graphene and other two-dimensional (2D) materials have been attracting a lot of attention in the field of condensed matter physics. This course aims at comprehensive understanding of distinctive physical properties in diverse 2D materials through the state-of-the-art research results. The field is so broad that the course focuses on several important materials and topics, including graphene, transition-metal dichalcogenides (TMDCs), hexagonal boron-nitride (h-BN), black phosphorus and Xene (artificial 2D materials). Heterostructures composed of different 2D materials and graphene superlattices are also the topics of the course. The lectures will be given in English, and the details of each lecture are shown below.

Lecture Plan

Lecture 1: Graphene 1

1.1 Overview of 2D materials and their heterostructures
1.2 How to fabricate 2D materials –Examples for graphene-
1.3 Fundamental physical properties of monolayer and bilayer graphene
1.4 Graphene in magnetic fields

Lecture 2: Graphene 2

2.1 Graphene superlattices
2.2 Superconductivity and graphene
2.3 Graphene spintronics

Lecture 3: Transition-metal dichalcogenides (TMDCs) 1

3.1 Semiconducting TMDCs
3.2 Superconducting TMDCs
3.3 Magnetic TMDCs

Lecture 4: TMDCs 2/Hexagonal boron-nitride (h-BN)/Black phosphorus

4.1 Topologically nontrivial TMDCs
4.2 Important physical properties of h-BN
4.3 Important physical properties of black phosphorus

Lecture 5: Xene/2D heterostructures

5.1 Overview and properties of Xene
5.2 Amazing world of 2D heterostructures
5.3 Examples of experimental work on graphene heterostructures