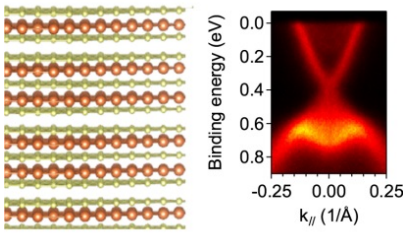



M2-SMNO-nanomat-CMP1

Title	Condensed Matter Physics – level 1 (CMP1)	
	<p>Apogée code: MU5PYM01</p> <p>Number of credits: 3</p> <p>Teaching hours: 26h courses</p>	

Lecturer	<p>Franck Vidal (coordinator) INSP – Office 22-32 – 405 franck.vidal@insp.jussieu.fr</p>
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Objective	<p>This course introduces the fundamental basis of condensed matter physics. The objectives are:</p> <ul style="list-style-type: none"> • to master simple models of phonon band structure calculation and to make the link with thermal properties • to understand and master the main models allowing for the description of the electronic band structure of ordered solids • to use the band structure in order to predict and calculate the electronic properties of a crystalline system • to introduce the physics of semi-conductors and of simple fundamental devices
Content	<p>Phonons & thermal properties: Classical theory of the harmonic crystal, dynamical matrix, acoustic/optical modes. Quantization, phonons. Reminder on Bose-Einstein statistics. Thermal properties of crystalline matter.</p> <p>Electronic properties of crystals: Born-Oppenheimer and independent electrons approximations, core and valence electrons, periodic potential and Bloch theorem, band structure, simple models: tight-binding and nearly free electrons.</p> <p>Metals, semiconductors, insulators: Reminder on Fermi-Dirac statistics, valence and conduction band, electron/hole. Link between the band structure and the electronic properties.</p> <p>Electronic transport: Bloch wave-packet, semi-classical dynamics of electrons, effective mass, electronic transport in the relaxation time approximation.</p> <p>Semiconductors: intrinsic, doping, conductivity, electronic devices (p-n junction, transistors).</p>
Prerequisites	<p>Crystallography: Bravais lattice, reciprocal lattice, diffraction.</p> <p>Quantum mechanics: perturbation theory.</p> <p>Statistical physics: Fermi-Dirac and Bose-Einstein statistics.</p> <p>Mathematics: Fourier transforms and distributions.</p>
Examination	<p>Written examination / 100</p>