



Title:	<i>Nuclear Magnetic Resonance and Magnetic Resonance Imaging: main aspects and applications to different research fields</i>
Lecturers:	A. Lascialfari, F. Palesi, T. Recca
Duration:	25h
CFU:	4 CFU
Period:	January - June 2025
Content:	<p>Basics of NMR and MRI (10 hours)- A. Lascialfari</p> <ul style="list-style-type: none">* principles of magnetic resonance : classical and quantum view* main NMR parameters : T1, T2 and absorption spectra* experimental apparatuses in short* MRI signal and weighted images* Imaging equation and basic sequences* some hints on physics of diffusion-MRI and functional-MRI <p>Advanced MRI techniques (4 hours) - F. Palesi</p> <ul style="list-style-type: none">* brain structural architecture and connectivity : diffusion weighted imaging* brain activation, brain function, and functional brain connectivity: functional MRI <p>NMR spectroscopy (6 hours) - T. Recca</p> <ul style="list-style-type: none">* NMR spectroscopy : foundations, spectrometers and samplese* Proton NMR spectrum: shielding and chemical shift, integration, coupling* ^{13}C NMR experiment: NOE effect and ^1H decoupling* From spectrum to structure: exercises* Acquire a ^1H spectrum: basic operations* Examples of NMR applications and discussion <p>NMR in solid state physics: examples (5 hours) - A. Lascialfari</p> <ul style="list-style-type: none">* phase transitions* molecular magnets : quantum effects and quantum simulation* magnetic nanoparticles* high-T_c and low-T_c superconductors
Notes	The exam consists in a seminar on one of the topics covered in the course, followed by a discussion.