Visit to FERMI

29 September 2026

FERMI beamlines & Labs

- **6 groups**
- **7 - 8 students per group**
- Each group will **visit** 4 of the **FERMI beamlines / laboratories**:
  - DiProI, MagneDyn;
  - TIMER, TIMEX;
  - T-Rex, TeraFERMI.
- **Scientific applications**:
  - Femtomagnetism (Flavio Capotondi; Marco Malvestuto);
  - Structural dynamics (Filippo Bencivenga, Emiliano Principi);
  - Electron dynamics (Federico Cilento, Paola Di Pietro)

Visit Program

	G1	G2	G3	G4	G5	G6
9:30-10:30	FERMI lecture (Giannessi) T1					
10:30-11:30	Femtomagnetism (T1 - Seminar room)		Structural dynamics (T1 - Teaching Room)		Electron Dynamics (Baita Fermi)	
11:30-12:30	MagneDyn DiProI	DiProI MagneDyn	TIMER TIMEX	TIMER TIMEX	TeraFERMI T-ReX	T-ReX TeraFERMI

Lunch break at the facility canteen

	G1	G2	G3	G4	G5	G6
14:00-14:30	FERMI Control Room (by bus)					
14:30-15:30	Electron dynamics (Baita FERMI)		Femtomagnetism (T1 - Seminar room)		Structural dynamics (T1 - Teaching Room)	
15:30-16:30	TeraFERMI T-ReX	T-ReX TeraFERMI	MagneDyn DiProI	DiProI MagneDyn	TIMER TIMEX	TIMEX TIMER

Femtomagnetism (G1,G2,G3,G4)

Ultrafast magnetism and femtomagnetism: from fundamental mechanisms to X-ray and XUV probes

Since the discovery of laser-induced demagnetization on femtosecond timescales, understanding how spins respond to ultrashort optical excitation has become a central question in condensed matter physics. This lecture reviews that story: the microscopic mechanisms still debated today and the experimental techniques developed to probe them. During the visit to the MagneDyn beamline at FERMI, students will see these measurements in practice, with examples from all-optical switching and quantum-materials research.

DiProI: Ultrafast Imaging of Magnetism

In this tutorial, we will introduce you to the DiProI endstation at the FERMI free-electron laser and show you how ultrashort extreme-ultraviolet (EUV) pulses can be used to explore magnetism on femtosecond timescales. We will explain how resonant scattering and coherent imaging allow us to visualize magnetic domains, domain walls and nanoscale structures, and how they evolve following excitation by an optical laser pulse. We will discuss how the combination of ultrafast time resolution, nanoscale sensitivity and magnetic contrast provides a direct way to follow spin dynamics and explore the correlation between electron, spin and phonon dynamics. Finally, we will introduce some of the experiments performed at DiProI.

Structural Dynamics (G3,G4,G5,G6)

In these short lectures, we will show you how to obtain information on structural dynamics using time-resolved experiments based on FEL light. Specifically, we will present: i) time-resolved x-ray absorption spectroscopy for monitoring ultrafast electronic dynamics in condensed matter; ii) nanoscale transient grating experiments, a novel approach that is employed for a number of studies, ranging from phonon dynamics in nanostructures and thin films to spin-waves spectroscopy.

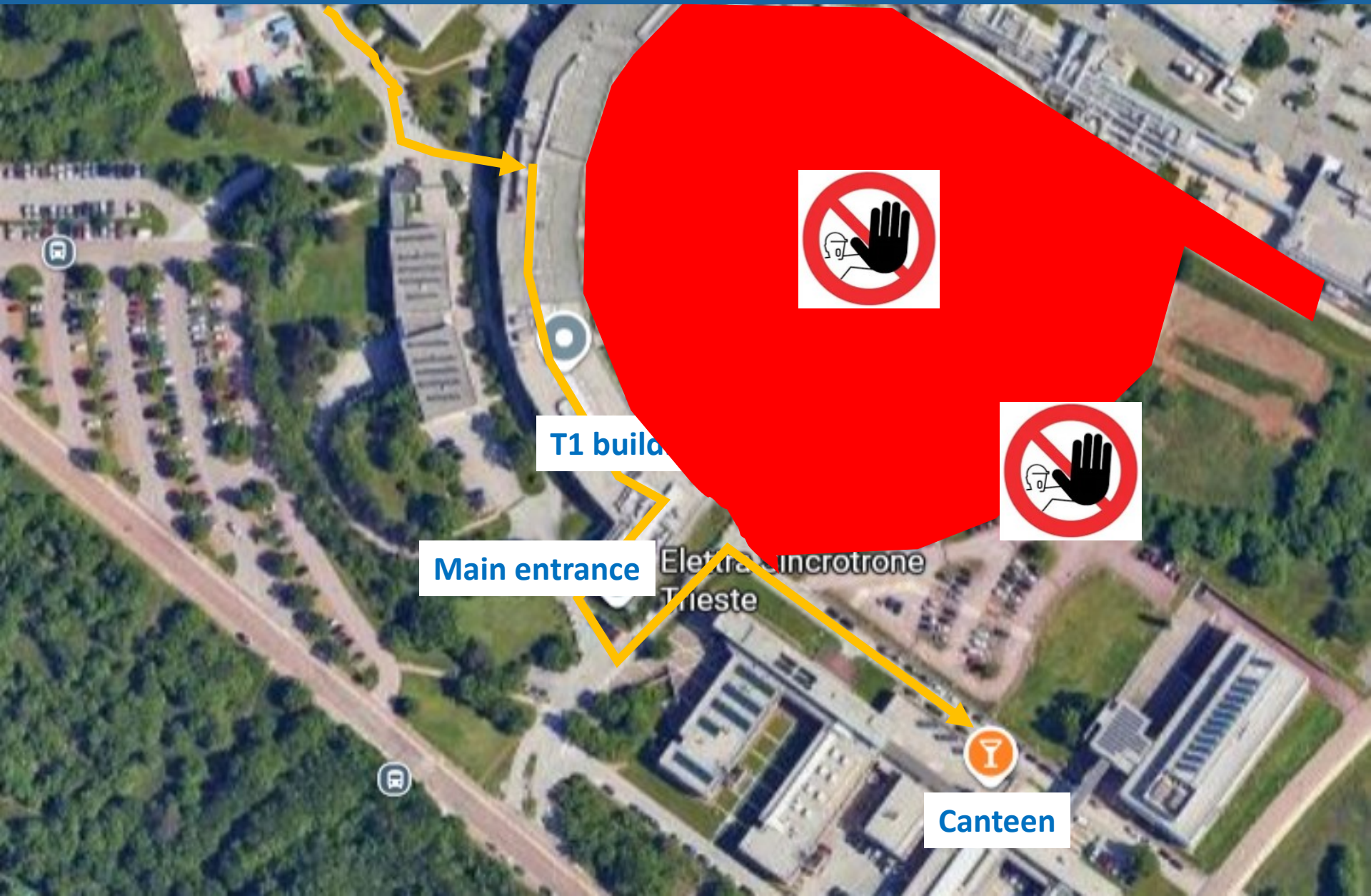
Electron Dynamics (G1,G2,G5,G6)

The **T-ReX** facility makes use of table-top laser sources producing ultrashort laser light pulses (namely, light pulses with a duration of about 10^{-13} s) to seed a variety of time-resolved spectroscopies based on the pump-probe approach. Among these, we host Time and Angle-Resolved Photoemission Spectroscopy (TR-ARPES) and several setups for Time-Resolved Optical Spectroscopies (Reflectivity, Transmittivity, Second Harmonics and Fluorescence), with photon energies ranging from the UV to the near-infrared. Here we will explain how these spectroscopies can be used to study the intertwined degrees of freedom of complex materials.

Electrodynamics studies at **TeraFERMI** are based on pump-probe experiments, where the highly intense, broadband and short THz pulses delivered by the beamline are used as a pump beam. Here we present the specifications of the beamline and the experimental approaches developed in the laboratory.

WARNING! Due to the Elettra 2.0 construction site, groups may only move along the designated routes

Path to the Canteen



VUO safety courses are mandatory!

- You must take the following three VUO courses and pass the tests!

Radiation protection training & Safety training for FERMI Users

Course Content	
Training Unit Description	Learning Material
Radiological risk in FERMI Experimental Hall	Slides
Safety risk in FERMI Experimental Hall	Slides
Access to the construction site for the realization of Elettra 2.0	Slides