

IV School on Light and Cold Atoms



October 20 – 31, 2025

ICTP-SAIFR, São Paulo, Brazil

Venue: ICTP-SAIFR/IFT-UNESP

Zoom ID: 843 3376 6175

Password: cold

Home

Lecturers

Participants

Posters

Registration

Program

Videos and Files

Photos

Venue

Additional Information

- **Belumat, Gabriel Tardin** (IFSC – USP, Brazil): *Quantum vortices in the dimensional crossover 3D-2D*

Quantum vortices, observed in different experimental platforms ranging from liquid helium to ultracold atomic gases are a hallmark of superfluidity and a key ingredient in explaining type-II superconductivity. In usual three-dimensional (3D) systems, these vortices are lines which interact and may bend, tangle and reconnect. Reducing the system's dimensionality by compressing it in one direction of space, modifies the vortex geometry which can be modelled as a point-like object. Surprisingly point-like vortices and vortex-lines exhibit quite a different behaviour: while in 3D, vortex tangling leads to a turbulence state, in two dimensions (2D), point-like vortices tend to form clusters of same sign circulation giving rise to an effective negative temperature related to an inverse Komolgorov-like cascade of energy. In this project, we propose to follow the dynamics of deterministically created vortex arrays across the dimensional crossover 3D-2D in ultracold atomic systems. Within this approach, we expect to obtain clearer evidences of the particularities of the point vortex model, in particular, the dynamical formation of vortex clusters, and to explore the role of thermal fluctuations when deep in the 2D regime.