

2nd Edition of the Workshop 'Quarkonia meet Dark Matter' (QMDM)



Monday 18 March 2024 - Friday 22 March 2024

Institute for Advanced Study, Technical University of Munich

Scientific Programme

The workshop is organized in plenary presentation sessions to review novel ideas, plans, and proposals, followed by selected contributing talks and subsequent roundtable sessions. Posters will be presented during an evening reception and remain accessible during the coffee breaks throughout the whole week. The program consists of the following scientific sections.

The assignment of conveners is currently preliminary and may change in the final program.

1. Perturbative regime: Effective field theories and precision calculations for Quarkonia and Dark Matter

Effective field theory (EFT) methods for quarkonia and dark matter systems with long-range interactions in the weakly coupled regime. Precision computations of observables and higher order calculations at zero and finite temperature or finite chemical potential.

Keywords:

Sommerfeld & bound-state effects, non-relativistic EFT (NREFT), potential non-relativistic EFT (pNREFT), soft-collinear effective theory (SCET), theoretical uncertainties, quarkonium suppression, dark matter relic abundance, precise prediction of indirect detection signal, electroweakly charged Dark Matter, Minimal Dark Matter, SUSY, dark sectors.

Conveners:

Miguel Escobedo, Stefan Lederer, Kalliopi Petraki, Antonio Vairo and Peter Vander Griend.

2. Non-perturbative regime: Strongly coupled DM and quarkonia systems, phase transitions of QCD and new physics particles in the early Universe

Strongly coupled EFTs, lattice simulations, and further techniques:
Linking computational methods for QCD phase transitions in collider experiments and dark sector phase transitions in the early Universe.

Keywords:

Phase transitions, lattice simulations, strongly coupled EFTs, generalized Wilson loops, non-perturbative dispersion relations, low energy factorisation, 3D reduction, quantum computing, strongly coupled dark sectors, squeeze-out mechanism, Glueballs, strongly interacting massive particles (SIMPs).

Conveners:

Nora Brambilla, Philipp Schicho, Johannes H. Weber and Graham White.

3. Production and transport theory of Quarkonia and Dark Matter inside a plasma

Methods for describing the non-equilibrium evolution of heavy quark pairs in a quark-gluon plasma and of DM in the early Universe. Thermalization inside a thermal medium, freeze-in and freeze-out mechanism.

Keywords:

Open quantum system formalism, Lindblad equation, Quarkonium transport, DM freeze-in and freeze-out, kinetic equilibration, Schwinger-Keldysh formalism, non-Hermitian operators, QFTs at finite temperature and chemical potential.

Conveners:

Tobias Binder, Julia Harz, Gramos Qerimi and Xiaojun Yao.

4. Gravitational waves, astrophysical and collider phenomenology

Stochastic gravitational wave background as a probe of early Universe phase transitions. Status and prospects for dark matter direct, indirect, and collider searches. Experimental results for Quarkonia, quark-gluon plasma physics, and future perspectives.

Keywords:

NANOGrav excess, gravitational waves, indirect and direct detection signatures, collider searches, viable parameter space, neutron stars, axions.

Conveners:

Matthew Baumgart, Simone Biondini, Jacquelyn Noronha-Hostler and Pedro Schwaller.