

Invitation

to the seminar of Division of Elementary Particle Physics of the
Institute of Physics of the Czech Academy of Sciences



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Messengers from Imaginary Time: Instantons and Non-Perturbative physics — from quantum mechanics to QCD and experimental searches

Abstract: The universe we observe is real, yet the path integral that governs it runs over complex field configurations — invisible to perturbation theory, the default tool of quantum field theory. What it misses is a whole zoo of topological, non-perturbative objects: solitons and monopoles, domain walls and cosmic strings, sphalerons, baryon junctions, and instantons.

These are not abstractions: confinement is non-perturbative, and the masses and spins of the hadrons around us have no perturbative explanation. Taking instantons as the guiding example, the talk follows them from a particle tunneling through a double well — messengers from imaginary time ($t \rightarrow -i\tau$) — to the heart of QCD: the θ -vacuum, strong CP and its axion, and chiral symmetry breaking, meeting topology and resurgence. A second example is the baryon junction — a gluonic Y-topology that may carry baryon number rather than the valence quarks.

The second half turns to experiment: can such objects be detected? We review instanton searches at HERA and the LHC, the junction search at RHIC, and the prospects opened by the Electron-Ion Collider — no confirmed signal has been seen yet, but the next decade may change that.

When: Thursday, November 12, 2026 at 2PM

Where: Dvořák hall, FZU, Pod Vodárenskou věží 1, Prague

For more information, please see <https://indico.fzu.cz/event/348/>