

PAST PHD SEMINARS

Friday 27 January 2023

Development and characterization of the novel Hybrid Detector for Microdensity (HDM)

Speaker: Enrico Pierobon, University of Trento and TIFPA

Abstract: Ion therapy has the potential to be a superior treatment for certain types of cancer and other diseases. However, to fully exploit this potential, it is important to overcome treatment uncertainties. One way to describe the radiation quality is through Microdosimetry, which records energy deposition at the cellular level, taking into account the non-deterministic nature of the energy deposition of ionizing radiation. To further improve the characterization of radiation field quality, a new quantity is proposed that replaces the “Mean Chord Length” approximation, used in standard microdosimetry, with the actual particle track length. To measure this new quantity, a two-stage detector, Hybrid Detector for Microdosimetry (HDM) is proposed. It consists of a commercial microdosimeter: Tissue Equivalent Proportional Counter (TEPC) and four layers of Low Gain Avalanche Detectors (LGADs) strips, in charge of particle tracking. HDM has been investigated and validated using Monte Carlo simulations and currently a dedicated readout is under development.

Friday 03 March at 11:15

Inflationary helical magnetic fields with a sawtooth coupling

Speaker: Chiara Cecchini, University of Trento and TIFPA-INFN

Abstract: The origin of large-scale magnetic fields in the Universe is one of the long-standing problems in cosmology. An intriguing possibility is that they are remnants of primordial fields that originated during inflation as the amplification of quantum vector perturbations.

We discuss the generation of helical magnetic fields by considering a model free from strong coupling or large back-reaction. Conformal invariance is broken only during inflation by coupling the electromagnetic sector to a time-dependent function with a sharp feature, thus preventing magnetic field amplitude from decaying.

Scale-invariant quadratic gravity is a suitable framework to test the model, providing a natural physical interpretation. We show that fully helical magnetic fields are generated with values in agreement with the lower bounds on fields in the Intergalactic Medium derived from blazar observations. This model holds even at large/intermediate energy scales of inflation, contrary to what has been found in previous works.

Friday 31 March at 11:15

Photonic limiter based on exceptional point spectral degeneracies

Speaker: Salamat Ali, University of Trento

Abstract: We propose a new type of photonic reflective limiter which respects a pseudo-Parity-Time (PT) symmetry. The system consists of two optically similar cavities with differential loss and it is prepared in a way that at low incident light powers demonstrates an exceptional point (EP) spectral degeneracy which supports a high resonant transmission. For high powers of the incident light, a non-linear (Hermitian) mechanism is activated, leading to a detuning of one of the cavities and a subsequent lift of the spectral degeneracy. The resulting resonant modes have either low Q-factor or are unstable due to the non-linearity. Consequently, the resonant transmission is dramatically suppressed while the reflectivity reaches values of order unity. We capitalize on this sudden (self-induced) drop of transmittance in order to propose these PCs as a new architecture for reflective limiters and switches.