ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 2 November 2017

17:00 -18:00

3rd Floor Seminar Room

"PHAESTOS: Using Galactic magnetic tomography to trace the origin of the highest-energy particles in the Universe"

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Abstract

The sources of the highest-energy particles in the Universe remain a still-unresolved mystery. The reason is that charged-particle astronomy is severely complicated by magnetic deflections, which, for sources in the local Universe, are dominated by the effect of the Galactic magnetic field. I will discuss the PHAESTOS project - a radically new approach to identifying individual sources of ultra-high-energy cosmic rays (UHECR): constructing a 3-dimensional map of the Galactic magnetic field through optopolarimetric magnetic tomography, and backtracking the paths that UHECR traverse through the Galaxy before reaching us, to improve agreement between their (corrected) arrival directions and the location of their sources on the sky. This approach is becoming possible for the first time thanks to two experimental breakthroughs: the unparalleled wealth of stellar distances that the Gaia mission is in the process of providing; and recent advances in optopolarimetry of point sources that make possible systematic large-area surveys of stars, such as the upcoming PASIPHAE survey. The combination of Gaia and PASIPHAE data enable the construction, for the first time, of a tomographic map of the Galactic magnetic field, paving the way to ultra-high-energy cosmic-ray astronomy. This technique additionally allows the electromagnetic determination of the composition of the highest-energy particles, possibly allowing us once again to use particles from the Universe to experimentally probe high-energy physics, now using collisions at center-of-momentum energies of the order of 100 TeV, beyond the current reach of the LHC.