LPR-ST
Laser, Plasmă, Radiație - Știință și Tehnologie
409 Atomistilor street, Magurele, Ilfov, Romania, RO-077125
Email: contact@lpr-st.ro; secretariat@lpr-st.ro
Tel: +4021 457 45 50

CETAL Seminar

Quantum Sensors: A roadmap for ESA missions. New searches for physics Beyond the Standard Model (BSM)

Dr. Bogdan MIHALCEA - INFLPR

Abstract:

Fundamental Physics is currently facing enormous challenges, since the existence of Physics Beyond the Standard Model (BSM) is by now established. In the standard lambda-CDM model of cosmology, the mass–energy content of the universe is 5% ordinary matter, 26.8% dark matter, and 68.2% a form of energy known as dark energy. Thus, the scientific community is summoned to discover the nature and detailed behavior of Dark Matter (DM) and of Dark Energy (DE). We will discuss ESA space missions aimed at answering such challenges, with an emphasis on the one entitled International Space Station – Space Optical Clock – Pathfinder (I-SOC-PF). I-SOC PF is conceived to compare atomic clocks (as ultraprecise quantum sensors) on the ground to a fractional frequency uncertainty of 1·10-18, aiming for substantially higher performance than the ACES mission, scheduled for launch in 2025.

The atomic clock of I-SOC PF is now a high-stability flywheel oscillator transferring the on-board time across continents to compare ground clocks in non-common view. I-SOC PF will test with significantly improved accuracy the foundations of General Relativity (GR) and search for a coupling between DM and normal matter, by employing an Earth-scale quantum sensor network based on different types of optical clocks. I-SOC PF also exploits the fact that remarkable progress in the deployment of quantum technologies (QT) opens new pathways for innovative investigations.

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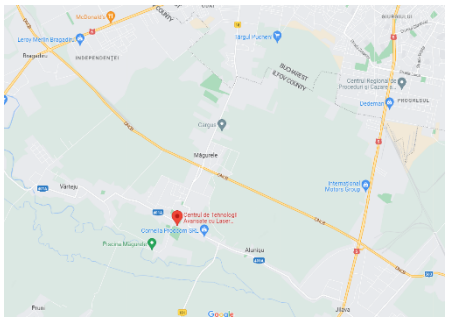

Location:
Seminar Room 1st floor,
Center for Advanced Laser Technology – CETAL
National Institute for Laser Plasma and Radiation Physics
Atomistilor 409, Magurele,
Ilfov 077125, Romania

LPR-ST team