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【351】Active Magnetic Shielding and Axion-Dark-Matter Search

Thursday 29 August 2019 14:00 (30 minutes)

Despite the tremendous success of the Standard Model of particle physics, there remain several fundamental aspects of the Universe that are still not understood. One such is the violation of the symmetry of simultaneous charge exchange and parity inversion (CP), which allowed the early Universe to become more abundant in matter than in antimatter. For some 65 years the electric dipole moment of the neutron (nEDM) has been giving an increasing insight into this problem.
An nEDM measurement at the Paul Scherrer Institute in Switzerland has finished taking data with enough statistics to go beyond the present limit standing at 3 × 10-26 ecm (90% C.L.) [1]. In my talk I will explain how we measured the nEDM using the Ramsey interferometry of neutrons. Operating at neV energies, we employed an exciting combination of the gravitational, strong and electromagnetic interactions to guide, store and manipulate the spins of polarised ultracold neutrons. The measurement required magnetic field stabilities on a picotesla level, reaching of which was only possible thanks to an active magnetic field compensation system. I will speak about how it works and, in particular, how we design ten-metre-large colis for that system [2]. Finally, I will show how we could use our measurement for an entirely different purpose: a search for an ultra-low-mass axion dark matter [3].

[1] C. Abel et al. https://arxiv.org/abs/1811.04012 (2018)
[2] M. Rawlik et al. Am. J. Phys. 86, 602 (2018)
[3] C. Abel et al. Phys. Rev. X 7, 041034 (2017)

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