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Flash talk: Searching for the unique signature of ALPs using radio telescopes. David Alonso-López

mardi 16 septembre 2025 16:35 (3 minutes)

Radio-loud strong gravitational lensed quasars are a robust probe of axion-like particles (ALPs), one of the most promising dark matter candidates. The coupling of a pseudoscalar field (the ALP) with the electromagnetic field (EM), via a Chern-Simons type term, produces achromatic birefringence, i.e., a rotation of the polarisation angle independent of frequency. In the geometric optics regime, the propagation of light in the presence of an ALP field does not suffer any other deviation from the standard propagation of light in curved spacetimes. This birefringence effect can be used to probe the parameter space of the ALP field with radio polarimetry observations. In particular, the LOFAR-VLBI pipeline is capable to produce sub-arcsecond resolution images of the lensed systems, whose typical size is ~1 arcsec. If polarisation is detected in these lensed quasars, the time delay between the images provides a net difference in the polarisation angle ($\Delta\theta$) that only depends on the ALP field mass and coupling to the EM field, cancelling out other effects such as Faraday Rotation and systematics or calibration errors. By detecting just a single lensed quasar in polarisation with LOFAR, even a non-detection of the birefringence effect ($\Delta\theta=0$) would improve by a factor of 10 current constraints on the ALP field's mass and coupling to the EM field in the ultra-light regime (<10^-18 eV).

Classification de Session: Students presentations