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Hints at axion-like particles from TeV astrophysics

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Axion-like particles (ALPs) are a generic prediction of many extensions of the Standard Model. They are very light pseudo-scalar bosons which mainly couple to two photons. In the presence of an external field, photon-ALP oscillations take place. They play a leading role in very-high-energy (VHE) astrophysics. The aim of my talk is to report on two hints at ALPs. One comes from the fact that conventional physics prevents Flat Spectrum Radio Quasars (FSRQs) to emit above about 30 GeV — barring ad hoc proposals – because of the existence of the broad line region (BLR). But MAGIC has detected them up to 400 GeV. I show that photon-ALP oscillations in the jet magnetic field, inside standard emission models, allows VHE photons to overcome the BLR and be emitted with the observed SED. As a case study we have taken PKS 1222+2167. A second hint comes from the analysis of the largest sample of IBL and HBL BL Lacs out to z = 0.6. After EBL de-absorption, we have found that the best-fit to the emitted spectral indices is a parabola as a function of z, thereby implying that they are statistically correlated, a fact that looks mysterious. Putting ALPs into the game and redoing the same analysis, the above best-fit becomes a straight line with z = constant, Hence the previous correlation disappears, in agreement with physical intuition.

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