

# Searches for Axion-Like Particles with NGC1275

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Axion-like particles (ALPs) can induce localised  $O(10\%)$  oscillatory modulations in the spectra of photon sources passing through astrophysical magnetic fields. Ultra-deep Chandra observations of the Perseus cluster contain over 500,000 counts from the central NGC1275 AGN and represent a dataset of extraordinary quality for ALP searches. We use these to search for X-ray spectral irregularities from the AGN. The absence of irregularities at the  $O(30\%)$  level allows us to place leading constraints on the ALP-photon mixing parameter  $g_{a\gamma\gamma} \sim 1.5 - 5.4 \times 10^{-12} \text{ GeV}^{-1}$   $m_a \sim 10^{-12} \text{ eV}$ , depending on assumptions on the magnetic field realisation along the line of sight. At  $O(10\%)$  level two modulations are present at high statistical significance, an excess in the 2-2.2 keV region and a deficit at 3.4-3.5 keV. We are unable to account for these through conventional instrumental or astrophysical processes and, interpreted as a signal, they would correspond to an ALP-photon coupling in the range  $g_{a\gamma\gamma} \sim 1 - 5 \times 10^{-12} \text{ GeV}^{-1}$ .

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