

論文の内容の要旨

SEARCH FOR AXION-LIKE PARTICLES USING STRONG PULSED MAGNETS AT SPRING-8

(SPring-8 における強パルス磁石を用いた
アクシオン様粒子の探索)

氏名 稲田 聡明

A new terrestrial search for axion-like particles (ALPs) is carried out at SPring-8. The experiment is performed at the BL19LXU beamline, which produces the world's strongest X-ray beams. The search uses a "light shining through a wall (LSW)" method, which converts photons to ALPs and then reconverts the ALPs to photons. The X-ray LSW search using pulsed magnets is carried out for the first time in this thesis. The magnets and its capacitor bank are dedicatedly developed for this search.

During two days of the net run time, four magnets are operated with a peak field of 8.3 T and 5.7 T (the first and second pulse, avg.) and a pulse repetition of about 0.2 Hz. After a total of 27,676 pulses, no signal events are detected, and 95% C.L. limit on the ALP-two-photon coupling constant $g_{a\gamma\gamma}$ is obtained as

$$g_{a\gamma\gamma} < 2.51 \times 10^{-4} \text{ GeV}^{-1}$$

below ~ 0.1 eV. This is the most stringent LSW limit around 0.1 eV and rules out the possibility of ALP re-absorption in the Sun.