

Laser wakefield based axion-like particle generation and detection

The axion, a theoretically well-motivated particle, has been searched for extensively via its hypothetical interactions with ordinary matter and fields. In this talk, an axion detection approach utilizing the ultra-intense electromagnetic fields produced by laser-plasma interactions will be reported. We have developed particle-in-cell (PIC) simulation method that incorporates the axion field, the electromagnetic fields, and their interactions. By using such code we proposed a new scheme for axion generation and detection. A laser pulse firstly drives a nonlinear bubble structure inside a gas plasma and a tailor pulse propagates inside the bubble. The coupling between the laser field and the wakefield can generate axions, which then interact with both of the two fields and generate secondary electromagnetic fields. The radiated EM fields show high order frequency and spatial mode compared with the laser pulse, which gives a possible way to detect the axions. In further, to increase the detection ability, we propose a seeded photon scheme to enhance the conversion from axions to photons and it could be used in the light shining through a wall scheme for axion detection.

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