

Discovery potential for ALPs on FASER and FASER 2.

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The FASER (ForwArd Search ExpeRiment) is a very forward detector on LHC, which locates 480 meters downstream of the ATLAS detector along the beam line. It accepts particles in the geometry range of $\theta < 10^{-3}$ from the ATLAS Interacting Point (IP). Due to the curvature of the LHC tunnel, the FASER detector is placed outside the main tunnel. So there's about 100 meters rock in thickness for all the particles to traverse from the ATLAS IP before they reach the FASER detector. This elegant design depresses the huge background from p-p collisions for axion-like particle research, while sufficiently utilizing the high center of mass energy on LHC. As simulated by MC, the number of light particles with θ less than mrad is still considerable in p-p collision with 13 TeV. So there will be enough statistics during LHC Run 3 and HL-LHC for FASER to be sensitive for searching ALPs with masses up to 300 MeV and couplings around $10^{-4} GeV^{-1}$. This report will briefly introduce the detector structure of FASER, then focus on introducing the discovery potential for ALPs with all types of couplings (photon, fermion, gluon).

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