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Searches for Dark Photons at Belle II

Wednesday 9 June 2021 16:10 (10 minutes)

Belle II is a B-Factory experiment designed to produce precision measurements of CP violation in the weak sector as well as search for Beyond the Standard Model particle physics. The e^+e^- collisions are created by the SuperKEKB accelerator which has achieved a world record of instantaneous luminosity of $2.4 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$. One of the highest priorities for the early data of the experiment is the search for dark photons that decay to dark matter. A dark photon is a mediator within the dark sector which mixes with the Standard Model (SM) photon. The experimental signature is a single energetic photon observed in the detector. A dark photon would produce an excess of events in the single photon recoil mass. A particularly challenging case is when the visible photon carries the full beam energy, which corresponds to a low-mass dark photon. There is a significant background from the SM process $e^+e^- \rightarrow \gamma\gamma$, where one of the photons is missed due to detector imperfections. This has motivated us to study the structure of the sub-detectors and compare the data and Monte Carlo response. By understanding the photon detection sensitivity of the sub-detectors, we will estimate the background for dark photon studies. This talk will discuss the “single photon search” and the approach to quantifying this background.

Author: Ms WAKAI, Miho (University of British Columbia)

Presenter: Ms WAKAI, Miho (University of British Columbia)

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