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Searches for light new particles with BaBar data

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We report on the latest searches for low mass states predicted in several New Physics models performed with the data collected by the BaBar detector at the PEP-II e^+e^- collider.

In particular, we search for single-photon events in a sample corresponding to 53 fb⁻¹ of e^+e^- collision data. We look for events with a single high-energy photon and a large missing momentum and energy, consistent with production of a spin-1 particle A' through the process $e^+e^- \rightarrow \gamma A$ ', $A' \rightarrow invisible$. Such particles, referred to as "dark photons", are motivated by theories applying a U(1) gauge symmetry to dark matter. We find no evidence for such processes and set 90% confidence level upper limits on the coupling strength of $A' \rightarrow e^+e^-$ for a dark photon with a mass lower than 8 GeV. In particular, our limits exclude the values of the A' coupling suggested by the dark-photon interpretation of the muon (g - 2) anomaly, as well as a broad range of parameters. We also present a search for a new muonic dark force mediated by a gauge boson (Z') coupling only to the second and third lepton families. The existence of the Z' boson is probed in $e^+e^- \rightarrow \mu^+\mu^-Z'$, $Z' \rightarrow \mu^+\mu^-$ events, No significant signal is observed. Limits on dark-sector coupling constants are derived, improving the current constraints to the allowed parameter space.

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