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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−→γA′, A′→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′→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−→μ+μ−Z′, Z′→μ+μ− 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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