

# First ECFA WORKSHOP.

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## Dark Photon Searches at Future $e^+e^-$ Colliders

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In theories where dark matter is explained by the existence of a ‘dark sector’, interacting with the visible sector of the standard model via gravitation, the photon of the dark sector, the dark photon ( $A_D$ ), might be the only visible manifestation of the dark sector due to kinetic mixing with the (ordinary) photon. The strength of the mixing is given by a mixing parameter ( $\epsilon$ ). This is the same parameter governing both the production cross-section and the decay of the  $A_D$  back to SM particles. Detectors at future e+e- colliders will have excellent momentum resolution and equally excellent track-finding efficiency. These are the features needed to probe for the expected signal of a  $A_D$ , namely a quite small, and quite narrow resonance: If ( $\epsilon$ ) is large enough to yield a detectable signal, its decay width will be smaller than the detector resolution, but so large that the decay back to SM particles is prompt. This study investigates the dependency of the limit on the mixing parameter and the mass of the  $A_D$  using the  $A_D \rightarrow \mu^+\mu^-$  decay mode in the presence of standard model background, using fully simulated signal and background events in the ILD detector at the ILC Higgs factory.

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