

# Searches for Dark Forces at e+e- Colliders

Monday, 15 June 2015 16:35 (0:20)

## Content

A new force beyond the Standard Model (SM) is postulated by several SM extensions and its search is well motivated by many puzzling astrophysical effects recently observed in cosmic ray spectra. The mediator of this “dark force” should be a new neutral light vector gauge boson, known as  $U$  boson, weakly coupled to ordinary particles and associated to an abelian gauge symmetry. Moreover, the new symmetry should be broken by a Higgs-like mechanism thus suggesting existence of an additional scalar particle, the dark Higgs ( $h'$ ). In principle, the dark photon would be produced in any process in which a photon is involved but with a rate strongly suppressed by the small coupling. In this respect, high intensity flavor factories are an ideal place to investigate dark forces due to high statistics, good knowledge of backgrounds and clear event topology. At  $e^+e^-$  colliders, dark forces can be probed by exploiting radiative meson decays, dark Higgsstrahlung and Initial State Radiation (ISR) processes. By assuming prompt visible  $U$  decays, the KLOE-2 experiment performed five searches by investigating the Dalitz decay  $\phi \rightarrow \eta U$ ,  $U \rightarrow e^+e^-$ , tagging the  $\eta$  meson by its  $\pi^+\pi^-\pi^0$  and  $3\pi^0$  decays and radiative  $e^+e^- \rightarrow U\gamma$  events with  $U \rightarrow l^+l^-$  ( $l = e, \mu$ ). KLOE-2 searched also for the dark Higgsstrahlung process by assuming the invisible scenario, where  $m(U) > m(h')$  and the dark Higgs escapes detection showing up a missing energy. Complementary searches of dark Higgsstrahlung have been also performed in the BaBar and Belle experiments by considering the visible scenario  $m(U) < m(h')$ . BaBar set also a stringent combined limit on  $U$  coupling by using the ISR process  $e^+e^- \rightarrow U\gamma$  with  $U$  decaying into leptons. Focus will be made on details of setting limits on the coupling strength between the photon and the dark photon in the KLOE-2, BaBar and Belle experiments.

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**Session Classification :** Higgs and photons, electroweak and new physics

**Track Classification :** Higgs and photons, electroweak and new physics