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Dark matter searches with mono-photon signature at future e+e- colliders

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In this contribution, recent results on the sensitivity of future lepton colliders to WIMP dark matter (DM) pair production are reviewed. Considered are processes with mono-photon signature, when DM production is accompanied by a hard photon emission from the initial state radiation, through which the process can be identified.
Corresponding study was performed with full detector simulation for the International Large Detector (ILD) concept at the International Linear Collider (ILC), for a centre-of-mass energy of 500 GeV. In the effective field theory (EFT) approach scales of up to 3 TeV can be tested for different operator types and DM masses almost up to half the collision energy. The sensitivity benefits from the polarised beams, which can reduce the main SM background from neutrino pair production substantially. Systematic uncertainties are also significantly reduced when combining data with different polarisation configurations.
Similar study was performed to investigate potential for detecting DM at the Compact Linear Collider (CLIC) running at 3 TeV. When considering the ratio of the mono-photon energy distributions for left-handed and right-handed polarised electron beams, most systematic uncertainties cancel out, resulting in the best limits on the DM pair-production cross section. These limits can be then translated, using simplified DM models, into exclusion limits for DM and mediator
masses for fixed values of the mediator couplings to SM and DM particles.
Finally, pair-production of DM particles at the ILC and CLIC was also studied for scenarios with small mediator masses and small mediator couplings to the SM particles. Limits on the production cross section can be extracted from the two-dimensional distributions of the reconstructed mono-photon events. Limits on the mediator coupling to electrons are presented for a wide range of mediator masses and widths. For mediator masses up to the centre-of-mass energy of the collider,
limits expected from the mono-photon analysis are more stringent than the limits from direct resonance search in SM decay channels.

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