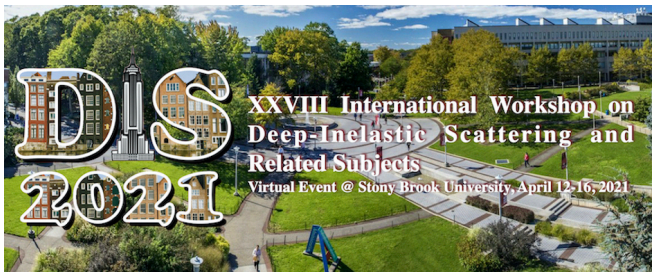

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Dark matter searches with mono-photon signature at future e^+e^- colliders

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One of the primary goals of the proposed future collider experiments is to search for dark matter (DM) particles using different experimental approaches. High energy e^+e^- colliders offer unique possibility for the most general search based on the mono-photon signature. As any e^+e^- scattering process can be accompanied by a hard photon emission from the initial state radiation, analysis of the energy spectrum and angular distributions of those photons can be used to search for hard processes with invisible final state production and to test the nature and interactions of the DM particles. Dedicated procedure of merging the matrix element calculations with the lepton ISR structure function was developed to model the Standard Model background processes contributing to mono-photon signature with WHIZARD.

We consider production of DM particles at the International Linear Collider (ILC) and Compact Linear Collider (CLIC) experiments. Detector effects are taken into account within the DELPHES fast simulation framework. Limits on the light DM production in a generic model are set as a function of the mediator mass and width based on the expected 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 light mediators, for masses up to the centre-of-mass energy of the collider, results from the mono-photon analysis are more stringent than the limits expected from direct resonance search in SM decay channels.

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