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Probing the nature of Dark Matter at the ILC

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We analyse the potential of the proposed international linear collider to detect Dark Matter (DM) and determine its properties. In many models stability of Dark Matter particles D is ensured by conservation of a new quantum number referred to as D-parity. Our models also contain charged D-odd particles $D^{\pm}$ with the same spin as D. In this work, we study two minimal consistent models corresponding to scalar and fermionic DM. The first of which is the inert higgs doublet model (I2HDM), which is a Z_2 symmetric Two Higgs Doublet Model, with the lightest neutral scalar being identified as D. The latter contains an SU(2) doublet of vector-like Dirac fermions, and an additional neutral singlet fermion. In this model, D is a mixture of neutral fermion singlet and doublet. For minimal fermionic DM, we perform an analysis of constraints of the parameter space, coming from DM relic density, DM direct detection, and collider. We propose a method to determine the mass of DM and distinguish its spin, in the process \$$e^+e^- \to D^+D^- \to DDW^+W^- \; toDD(q\bar{q})(\ell\nu)$ with a signature dijet + μ (or e) + missing mass.

Presenter: LOCKE, Daniel (University of Southampton)