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Optimized analysis method for indirect dark matter searches with Imaging Air Cherenkov Telescopes

We describe a dedicated analysis approach for indirect Dark Matter searches with Imaging Air Cherenkov Telescopes. By using the full likelihood analysis, we take complete advantage of the distinct features expected in the gamma ray spectrum of Dark Matter origin, achieving better sensitivity with respect to the standard analysis chains. We describe the method and characterize its general performance. We also compare its sensitivity with that of the current standards for several Dark Matter annihilation models, obtaining gains of up to factors of order of 10. We compute the improved limits that can be reached using this new approach, taking as an example existing estimates for several benchmark models as well as the recent results from VERITAS on observations of the dwarf spheroidal galaxy Segue 1. Furthermore, we estimate the sensitivity of Cherenkov Telescopes for monochromatic line signals. Predictions are made on improvement that can be achieved for MAGIC and CTA. Lastly, we discuss how this method can be applied in a global, sensitivity-optimized indirect Dark Matter search that combines the results of all Cherenkov observatories of the present generation.

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