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Towards a Maximum Likelihood estimate of the dwarf spheroidal galaxies J factor

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The dwarf spheroidal satellite galaxies of the Milky Way appear to be the most dark matter (DM) dominated objects
in the near Universe. Their very low astrophysical background in the γ-ray energy range makes them ideal targets for DM
indirect detection, which can be achieved by searching for its decay or annihilation signals. The latter approach requires the
calculation of the $\mathcal{J}$*-factor*, which quantifies the amount of DM along the line of observation. This quantity has been
previously derived with bayesian techniques, thereby subjecting the results to the effects of priors. We report here the development
of a new fully frequentist approach based on the Maximum Likelihood procedure, which thus allows to build the profile likelihood for
$\mathcal{J}$ and from it the calculation of confidence intervals. The new results are in most cases consistent with the previously
derived ones, being compatible to the 1-σ level; their uncertainties are also compatible and consistently scale with the
dataset size, being smaller for the larger samples; the largest discrepancies are restricted to the systems with the smallest
dataset. We also present possible improvements and extensions to this technique.

Authors: Mr CHIAPPO, Andrea (The Oskar Klein Center, Stockholm University); Prof. CONRAD, Jan (Stockholm University); COHEN-TANUGI, Johann (Université de Montpellier, CNRS/IN2P3); STRIGARI, Louis (Stanford University)

Presenter: Mr CHIAPPO, Andrea (The Oskar Klein Center, Stockholm University)

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