Sensitivity of the Cherenkov Telescope Array to a dark matter signal from the Galactic centre

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http://www.cta-observatory.org/consortium_acknowledgments

Data analysis — “benchmark” setup

Template Fitting (3D analysis)

$$\left(\mu_{\mathrm{K}}\right)_k = \mu_k^{\mathrm{CR}} + \mu_k^{\mathrm{GDE}} + \Delta B_k + A^{\mathrm{DM}} \mu_k^{\mathrm{DM}}$$

Generic setup:

CTA Mock Data:

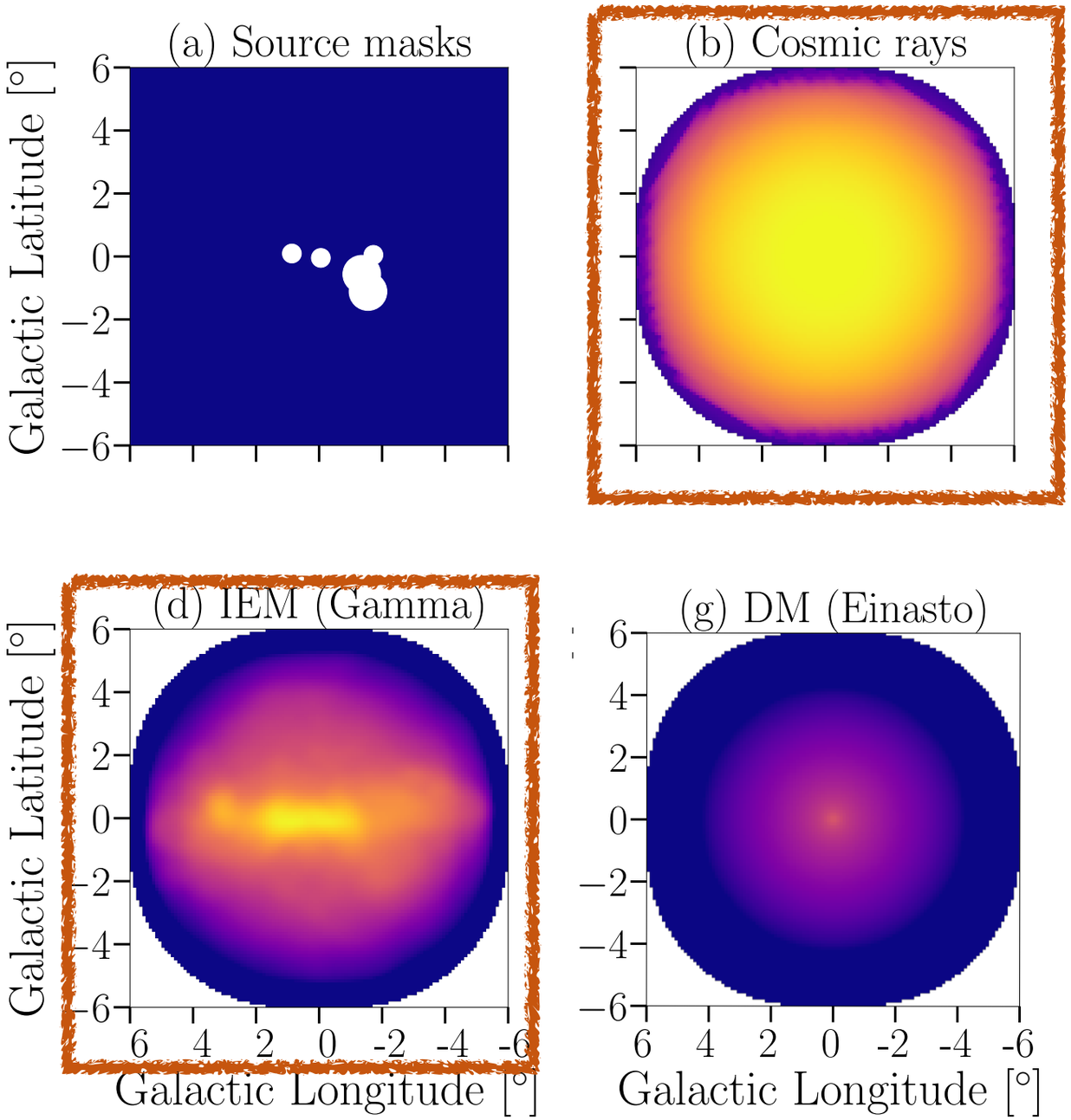
- **Asimov** data set
- **CR + IEM**
- spatial binning: 0.1°
- spectral binning: 54 bins (width corresponding to 2σ energy resolution of CTA) from [0.03, 100] TeV
- PS mask

Model Data:

- template preparation like mock data
- **CR + IEM + DM**
  —> systematic uncertainty added via covariance matrix

$$\left(K_{\mathrm{S}}\right)_{jj'} = \sigma_{\mathrm{S}}^2 \exp\left(-\frac{1}{2}\frac{\left\|\vec{r}_j - \vec{r}_{j'}\right\|^2}{\ell_{\mathrm{S}}^2}\right)$$

Implementation via python package swordfish [Edwards & Weniger; arXiv:1712.05401]



Summary

We derive the CTA's sensitivity to a DM signal in the Galactic centre by

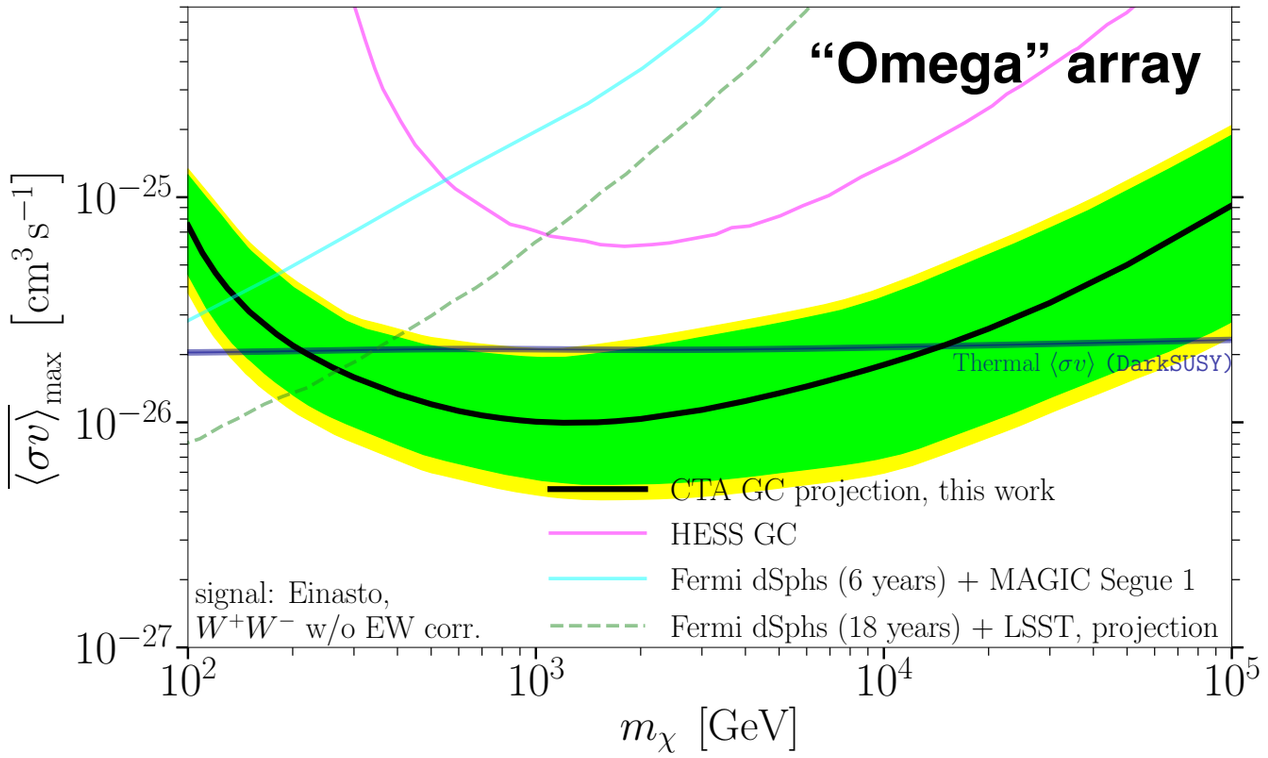
— defining the **most promising data analysis approach** (template-based analysis),

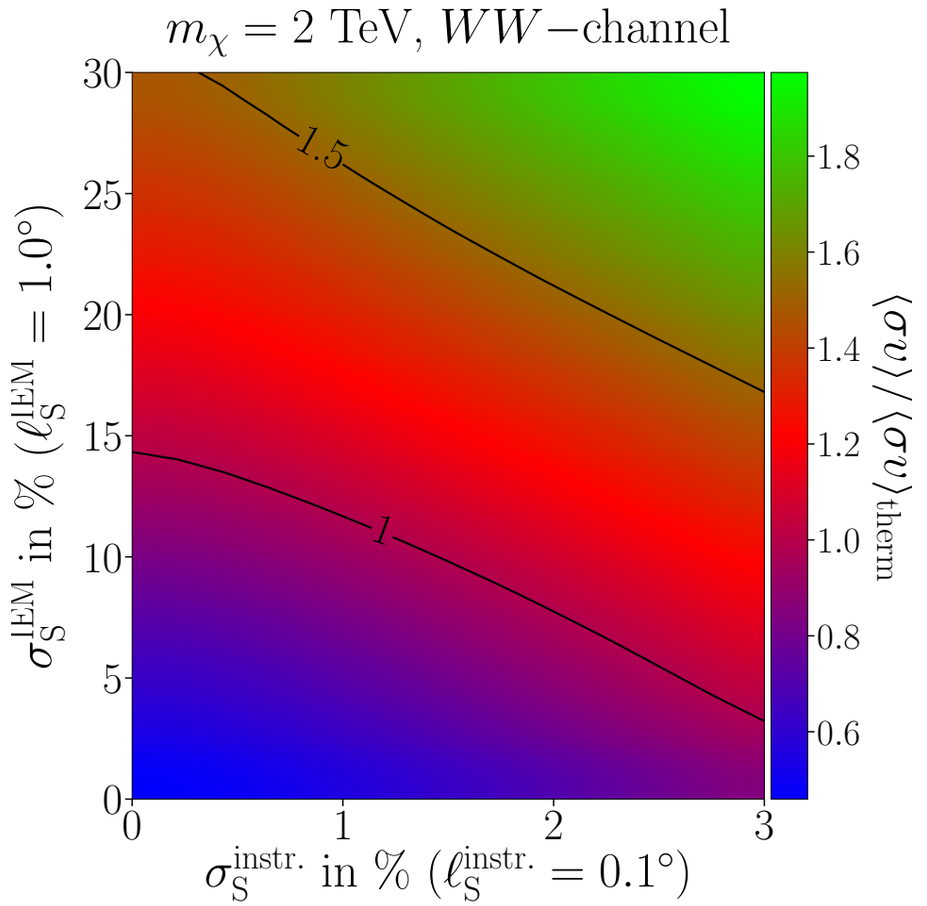
— **studying the impact of instrumental systematic uncertainties** in an agnostic manner (for a possible input of future CTA performance optimisation),

— **quantifying the robustness** of the expected limits with respect to uncertainties of astrophysical emission components like the interstellar emission

—> Will the measured interstellar emission at TeV energies match the current theoretical models?

—> Do we expect surprises in terms of TeV source populations?





CTA offers the opportunity to probe the uncharted territory of the WIMP parameter space beyond the thermal annihilation cross-section at the TeV scale!