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

1 What is this contribution about?

We present our efforts to determine the projected sensitivity of the Cherenkov Telescope Array (CTA) to a gamma-ray signal of (WIMP) dark matter pair-annihilation events in the Galactic centre of the Milky Way in order to probe the thermal annihilation cross-section that is necessary to guarantee the right amount of dark matter being thermally produced in the Early Universe.

2 Why is it relevant / interesting?

The CTA is a next-generation, ground-based gamma-ray telescope whose performance is improved by a factor of ten compared to current-generation telescopes of the same kind. It will exhibit exquisite sensitivity to gamma rays with energies between a few hundred GeV to tens of TeV and therefore be able to probe the parameter space of heavy WIMP-like dark matter particles with masses of a few TeV. It might be the only experiment capable of excluding or corroborating the WIMP hypothesis for particles with such masses in the near future.

3 What have we done?

We have derived the CTA's sensitivity to a dark matter signal in the Milky Way's Galactic centre by (i) defining the most promising data analysis approach (binned template-based maximum likelihood analysis), (ii) studying the impact of instrumental systematic uncertainties in an agnostic manner (for a possible input of future CTA performance optimisation), and (iii) quantifying the robustness of the expected limits with respect to uncertainties of astrophysical emission components like the interstellar emission.

4 What is the result?

The CTA will offer the opportunity to probe the uncharted territory of the WIMP parameter space beyond the thermal annihilation cross-section at the TeV scale for the full range of WIMP annihilation spectra from soft to hard and peaked dark matter density profiles towards the Galactic centre even in the presence of systematic uncertainties. The prospects regarding cored dark matter profiles or large uncertainties on the astrophysical emission components contributing to this complex region are worse but the situation is not completely hopeless.