Contribution ID: 9 Type: Contributed Talk

## The GeV Galactic Center Excess in 2022

Wednesday 12 October 2022 14:45 (15 minutes)

The Galactic center excess (GCE) remains one of the most intriguing discoveries from the Fermi Large Area Telescope (LAT) observations. I will revisit characteristics of the GCE tested under an updated set of highresolution galactic diffuse gamma-ray emission templates. This diffuse emission, which accounts for the bulk of the observed gamma rays, is ultimately due to cosmic-ray interactions with the interstellar medium. Using recent high-precision cosmic-ray observations, in addition to the continuing Fermi-LAT observations and observations from lower energy photons, we constrain the properties of the galactic diffuse emission. A large set of diffuse gamma-ray emission templates has been used which account for a very wide range of initial assumptions on the physical conditions in the inner galaxy. In addition, I will present how wavelet-based techniques allow us to probe and remove the emission form sub-threshold point sources at low latitudes. I will give an update on the spectral and morphological properties of the GCE and their physical implications. In particular, a high-energy tail is found at a higher significance than previously reported. This tail is very prominent in the northern hemisphere, and less so in the southern hemisphere. This strongly affects one prominent interpretation of the excess: known millisecond pulsars are incapable of producing this high-energy emission, even in the relatively softer southern hemisphere, and are therefore disfavored as the sole explanation of the GCE. The annihilation of dark matter particles of mass  $40^{+10}_{-7}$  GeV (95% CL) to b quarks with a cross-section of  $\sigma v = 1.4^{+0.6}_{-0.3} \times 10^{-26} \text{ cm}^3 \text{ s}^{-1}$  provides a good fit to the excess especially in the relatively cleaner southern sky. Dark matter of the same mass range annihilating to b quarks or heavier dark matter particles annihilating to heavier Standard Model bosons can combine with millisecond pulsars to provide a good fit to the southern hemisphere emission as well, as can a broken power-law spectrum which would be related to recent cosmic-ray burst activity.

## Track

Dark Matter

**Primary author:** Dr CHOLIS, Ilias (Oakland University)

**Co-authors:** Dr ZHONG, Yi-Ming (Kavli Institute for Cosmological Physics, University of Chicago); Dr MCDER-MOTT, Samuel (Fermi National Accelerator Laboratory); Mr SURDUTOVICH, Joseph (Carleton College)

**Presenter:** Dr CHOLIS, Ilias (Oakland University)

**Session Classification:** Parallel 7