The cosmic ray electron spectrum near the Sun and the curious case of the 130 GeV line

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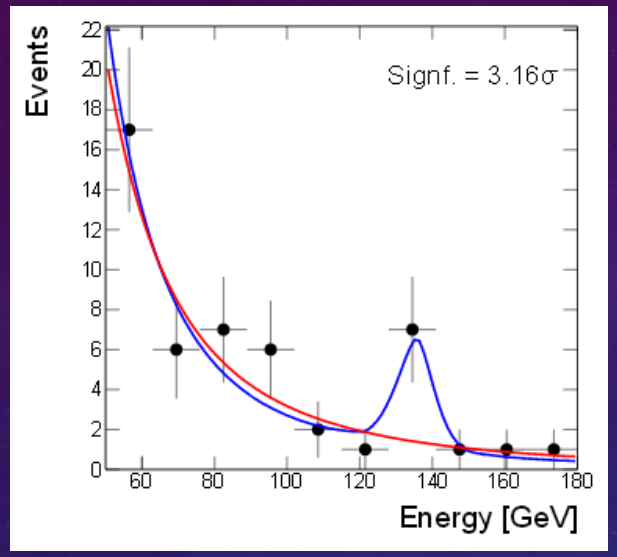
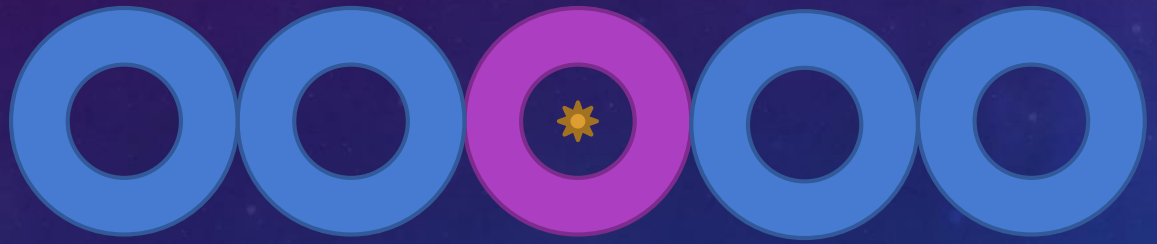
Could expect gamma rays from dark matter in the Sun's potential well if:

- Dark matter annihilates to a long lived state that escapes the Sun and decays
- Dark matter inelastically collides and a halo forms around the Sun

(Press & Spergel, 1985; Schuster, Toro, Weiner, & Yavin, 2010)



130 GeV line (Weniger, 2012; Bringmann et al., 2012; etc.) seen in the Sun (Whiteson [arXiv], 2013). If the 130 GeV line is to be believed as a $\chi\chi \rightarrow \gamma\gamma$ line, we expect $\chi\chi \rightarrow \gamma Z$ continuum radiation



On region: annulus around the Sun

- Inner radius to exclude pion decay from cosmic rays hitting the Sun
- Outer radius because J-factor falls with radius

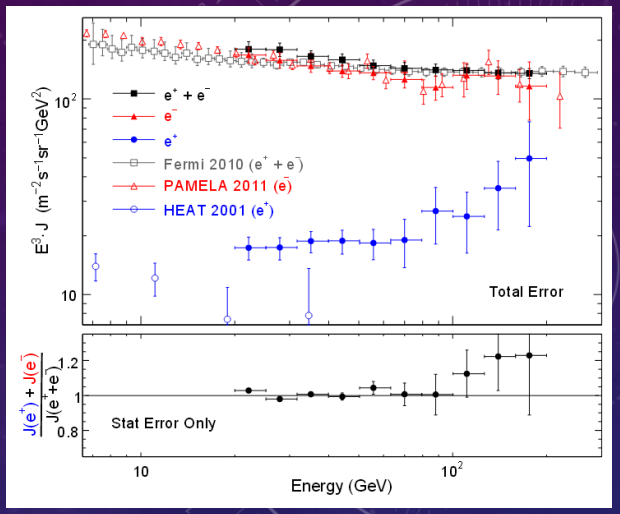
Off region: annuli around fake Suns around ecliptic

- Collection of fake Suns around ecliptic so that on/off regions have same diffuse background

Requires an exposure map in Solar coordinates!

Main background is inverse Compton emission from cosmic ray electrons/positrons upscattering solar photons.

The electron/positron spectrum at Earth has been well measured at Earth by Fermi (Fermi Collaboration 2010 and 2011).



Unfortunately, the inverse Compton emission is important at the same energies we expect the $\chi\chi \rightarrow \gamma Z$ continuum radiation, ~1 – 100 GeV.

Naïve assumption: electron spectrum near the Sun is nearly the same as around the Earth, and is isotropic. OK because electrons that make ~1 – 100 GeV inverse Compton are high energy and less perturbed by the Sun.

Electron spectrum could be slightly different, or dark matter continuum might be present. Want to limit and compare these possibilities.