Hemispheric dependence of the pseudoscalar Q in Pass 8 of the Fermi LAT data

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Abstract

A recent study by Tashiro et al. (2015) proposed a mechanism through which the helicity of an extragalactc magnetic field could be estimated by measuring a CP-odd pseudoscalar Q. A significant observation in their study was the apparent dependence of this pseudoscalar on the hemisphere where it is measured. In this study, we extend the original analysis using 100 weeks of data from Pass 8 of the Fermi Large Area Telescope (LAT) to better understand this dependence.

1 Method and Setup

1.1 Setting up a Monte-Carlo simulation

If there was no intervening magnetic field between source and detector, the probability that a photon hits any point on the sphere is identical to the corresponding probability at any other point. Therefore, it is possible to model this by setting up a monte-carlo simulation such that $\cos\theta$ and ϕ are uniformly distributed over $[-1, 1]$ and $[0, 2\pi]$ respectively. Figure **??** shows the measured value of Q for a montecarlo simulation with 10551 photons in the low energy bin, 1348 photons in the intermediate bin and 550 in the highest energy bin. This process was then repeated 100 times and averaged.

2 Calculating Q from the Fermi Data

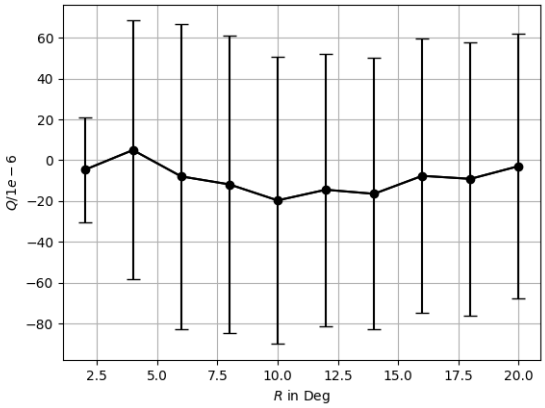

Figure 1: Monte-Carlo simulation of the pseudoscalar Q if there were no intervening field. It is evident from the plot that the mean value of Q always zero within the error-bars

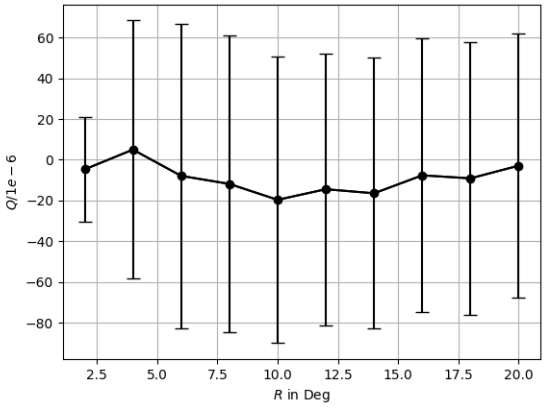

Figure 2: Monte-Carlo simulation of the pseudoscalar Q if there were no intervening field. It is evident from the plot that the mean value of Q always zero within the error-bars