Prospects for Observations of Microquasars with GLAST LAT

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Abstract

The Gamma-ray Large Area Space Telescope (GLAST) is a next generation high energy gamma-ray observatory due for launch in Fall 2007. The primary instrument is the Large Area Telescope (LAT), which will measure gamma-ray flux and spectra from 20 MeV to > 30 GeV and is a successor to the highly successful EGRET experiment on CGRO. The LAT will have better angular resolution, greater effective area, wider field of view and broader energy coverage than any previous experiment in this energy range. This poster will present performance estimates with particular emphasis on how these apply to studies of microquasars. The LAT's scanning mode will provide unprecedented uniformity of sky coverage and permit measurements of light curves for any source. We will show results from recent detailed simulations that illustrate the potential of the LAT to observe microquasar variability and spectra, including source sensitivity and ability to detect orbital modulation briefly.

Microquasars Simulations

GLAST's Data Challenge 2 (DC2) provided a detailed simulation of the sky and the LAT's response. 5 x-ray binaries were included with flux and spectra from EGRET measurements and known orbital periods.

- 55 day simulated orbit
- full GEANT4 simulation of LAT response
- full time dependence in simulations: AGN, solar flares, GRBs
- > 200k CPU hrs to produce

Very simple modeling of microquasars in this exercise:

- Simple power law
- Complete orbital modulation

Microquasars and GLAST

GLAST Overview

In normal operations the LAT will continually scan the sky, obtaining essentially complete sky coverage every 3 hours (two orbits). This uniformity of sky coverage, together with the large effective area and good angular resolution should permit many advances in the study of microquasars in the GeV range.

Microquasars and GALAXY

GMRT

High

Galactic

diffuse

Point Source sens. (>100 MeV): 3x10^-6 cm^-2 s^-1

Field Of View: 2.4 sr

LAT Performance

Energy Resolution ~10% (~5% off-axis)

PSF (68%) at 100 MeV ~ 3.5° front; 5° total

PSF (68%) at 10 GeV ~ 0.1°

LAT's energy resolution should permit many advances in the study of microquasars in the GeV range.

Improve and extend EGRET measurements

Fixed FOV assembly for survey mode and continuous monitoring of the full sky - all microquasar candidates

Spectral index fit yields ~2.21

Feasibility Analysis of LS I +61 303 and LS 5039

LS I +61 303 in 55 days

E > 500 MeV

Rise double gaussian + flat bkg

(50)= (170,166.21,0.98 x 3.4)

All data phase

LS +61 303 phase

60 GeV

Global phase for observed period

LS I +61 303 sky

Summary:

- Preliminary feasibility analysis
- GLAST will leverage survey mode to provide continuous monitoring of all microquasars
- Complicated regions will take longer observing periods
- Will exploit better PSF at higher energies to refine locations

LS 5039 in 55 days

E > 500 MeV

Rise double gaussian + flat bkg

(50)= (18,466.85,1.25 x 0.58)

All data phase

LS 5039 phase

5-10 GeV

Global phase for observed period

LS 5039 in one year

E > 100 MeV

60 GeV

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The DC2 Sky

Composition of the Milky Way:

- 1/2 of total generated photons on the sky

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