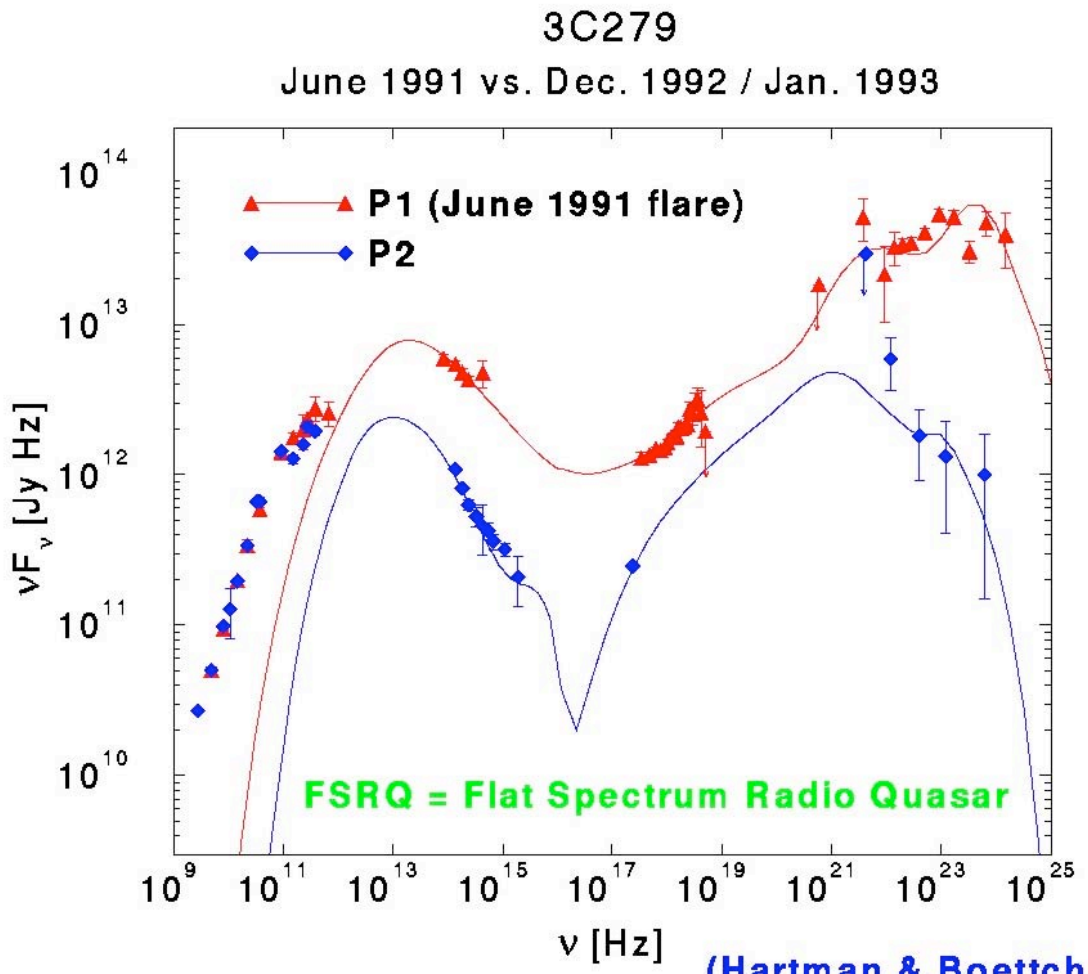
Strategies for Swift Observations of Blazars: Monitoring and Coordinated Observations in 2008-2009

Ann Wehrle
Space Science Institute
La Canada Flintridge, CA and Boulder, CO

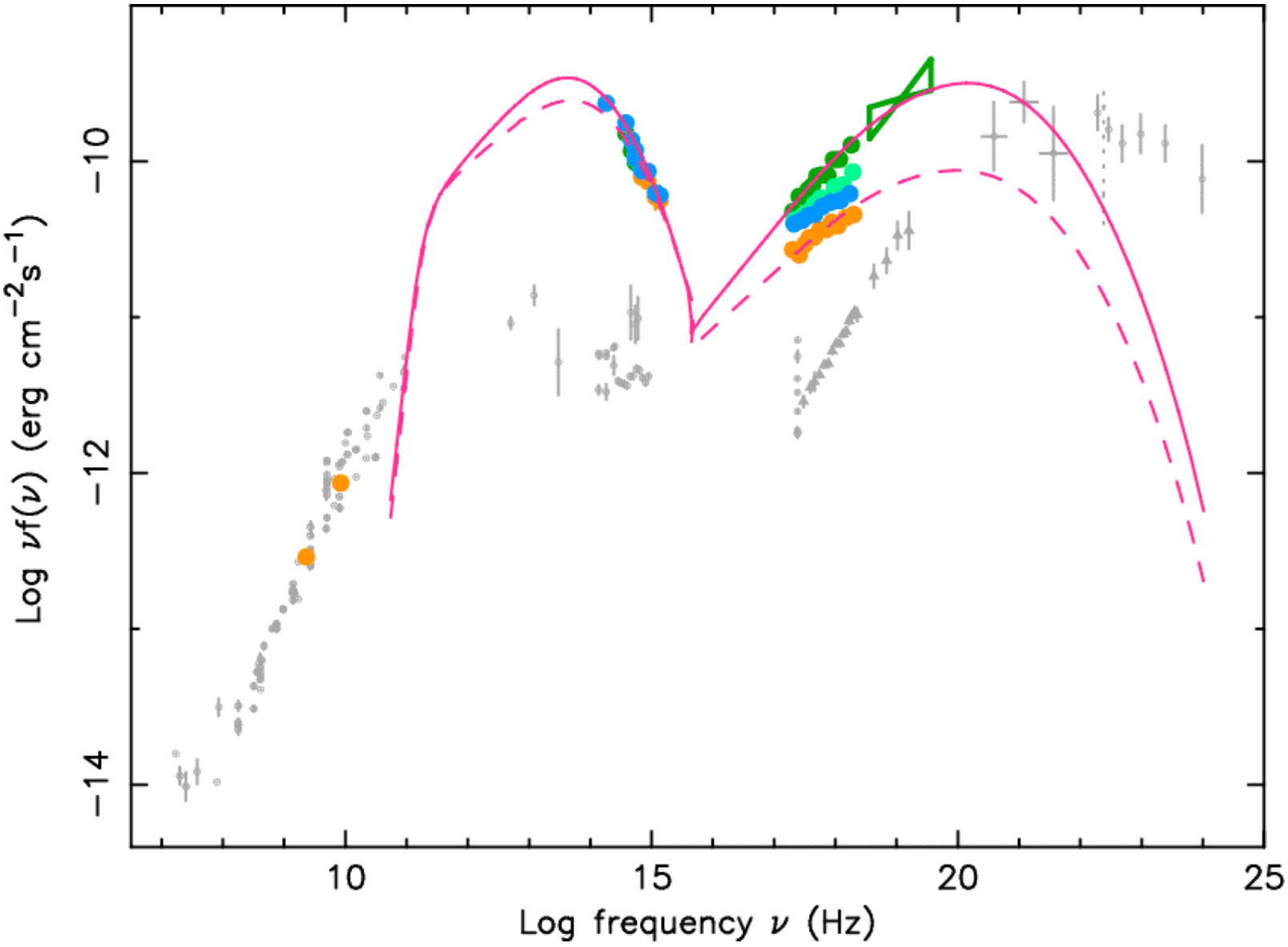
ISS013E54329

Theoretical modelling depends on getting good simultaneous SEDs- before, during, after flares -energy injection, propagation, and loss



(Hartman & Boettch

Giommi et al. 3C454.3 2006, A&A



Our opportunities to collect variability data

Mission	2008	2009	2010	2011	2012
GLAST	X	X	X	X	X
SPITZER	X	END APRIL			
HERSCHEL	LATE 2008	X	X	END	
PLANCK	LATE 2008	X	X	X	
SOFIA			TESTING	TESTING	TESTING
HUBBLE	SM4	X	X	X	X
RXTE	X	END APRIL			
SWIFT	X	X	X	?	?
XMM-NEWTON	X	X	X	X	X
CHANDRA	X	X	X	X	X
AGILE	X	X	X	X	X
INTEGRAL	X	X	X	X	X
SUZAKU	X	X	X	X	X
KEPLER	MID 2008	X	X	END	
(VLBA)	X	X	X	END?	

Spitzer Visibility Windows

- 30-40 days, twice a year
- Spitzer is in drift-away solar orbit trailing behind earth
- Observes in swath centered on 90 degrees from sun

Top 20 Sources for GLAST LAT

LAT Monitored Sources

The following are the sources the LAT team will monitor during the first year (and most likely throughout the mission). The resulting lightcurves will be posted. This list will most likely grow as the mission progresses. EGRET fluxes are above 100 MeV.

Source Type	Source Name	EGRET Name	Average or Min. Flux (10^{-8} γ $cm^{-2}s^{-1}$)	Galactic Lattitude	Redshift	TeV Source
Blazar	0208-512	3EGJ0210-5055	85.5 ± 4.5	-61.9	1.003	
	PKS 0528+134	3EGJ0530+1323	93.5 ± 3.6	-11.1	2.060	
	0827+243	3EGJ0829+2413	24.9 ± 3.9	31.7	0.939	
	Mrk 421	3EGJ1104+3809	13.9 ± 1.8	65.0	0.031	Yes
	W Com 1219+285	3EGJ1222+2841	11.5 ± 1.8	83.5	0.102	
	3C 273	3EGJ1229+0210	15.4 ± 1.8	64.5	0.158	
	3C 279	3EGJ1255-0549	74.2 ± 2.8	57.0	0.538	
	1406-076	3EGJ1409-0745	27.4 ± 2.8	50.3	1.494	
	H 1426+428	NA		64.9	0.129	Yes
	PKS 1622-297	3EGJ1625-2955	47.4 ± 3.7	13.4	0.815	
	1633+383	3EGJ1635+3813	58.4 ± 5.2	42.3	1.814	
	Mrk 501	NA		38.9	0.033	Yes
	1730-130 NRAO 530	3EGJ1733-1313	36.1 ± 3.4	10.6	0.902	
	1ES 1959+650	NA		17.7	0.048	Yes
	PKS 2155-304	3EG2158-3023	13.2 ± 3.2	-52.2	0.116	Yes
	3C 454.3	3EGJ2254+1601	53.7 ± 4.0	-38.3	0.859	
	1ES 2344+514	NA		-9.9	0.044	Yes
HMXB	LSI+61 303 2CG135+01	3EGJ0241+6103	69.3 ± 6.1	1.0		Yes

Swift, GLAST in similar earth orbits

- Slightly different inclinations
- GLAST has huge field of view
- Swift has very flexible pointing
- May be able to observe same spot on the sky about 25% of the time, in phase every 6 days (per N. Gehrels)

Overall Picture 2008-2009

- Take advantage of Swift capabilities to get critical variability data on synchrotron and inverse Compton SEDs: slope, inflection point, amplitude and time delays
- Work simultaneously with Spitzer, GLAST and ground based observatories, including VLBI tracking of blobs emitted at base of jet near times of x-ray and gamma-ray flaring
- Samples: small number of archetypal objects and large number in statistically well-defined blazar survey (Giommi et al. WMAP)

Specific Timelines

Blazars need about 2-6 kiloseconds to get good SNR

- Jan-Feb 2008 (= GLAST launch +60 days)
  - Observe canonical (high payoff, likely to be detected) source 3C279, daily with UVOT, XRT, BAT, 2000 seconds per day (yields 60-frame SED movie)
- March 2008-April 2009 options (Spitzer cryogen end)
  1. Observe GLAST "Top 20", one per day
  2. Observe 5 archetypal sources during GLAST-LAT team planned intensive campaigns, each for 10-30 days, including proposed 30-day Spitzer observations
  3. Observe 100 sources from WMAP sample, simultaneously with Spitzer and GLAST

Sample Visual Timeline

Target 2 Alternatives include 100 sources from WMAP or GLAST LAT Top 20 in WMAP survey

Month	Target 1	Target 2
Jan 2008	3C279	WMAP
Feb	3C279	WMAP
Mar	1 of Top 5 x 30	WMAP
Apr	1 of Top 5 x 30	WMAP
May	1 of Top 5 x 30	WMAP
Jun	1 of Top 5 x 30	WMAP
Jul	1 of Top 5 x 30	WMAP
Aug	Repeat First	WMAP
Sept	Repeat Second	WMAP
Oct	Repeat Third	WMAP
Nov	Repeat Fourth	WMAP
Dec	Repeat Fifth	WMAP
Jan 2009	New Source	WMAP
Feb	New Source	WMAP
Mar	New Source	WMAP
Apr	New Source	WMAP

Summary of Proposed Goals

Obtain Multiwavelength Spectral Energy Distributions:

A. 1 snapshot SED for each of 20 “Top Blazars”
B. 1 60-frame day-by-day SED movie of 3C279 at start of GLAST mission
C. 10 30-frame day-by-day SED movies of archetypal blazars very likely to flare (five objects each observed at six-month intervals for 30 days, with Spitzer)

Use full-coverage SEDs to solve problems of energy injection, propagation and loss in blazars