Science goals and associated observations for the "Blazar and Other AGN" Science Analysis Group

The basic framework we will work with towards understanding blazars is that they are dominated by relativistically-boosted emission from jets pointing close to us. The jets are presumably powered by accretion onto supermassive black holes in the centers of AGN.

Some science goals are not new, and answers might have been hinted at by the EGRET data, but in many cases, the evidence might be limited, and much better insight will be gleaned from GLAST data. I include phenomenological goals, as well as tests of models.

The table I envision should be organized as follows:
first, the main science goal or a theme;
second, the target or alternate targets;
third, the kind of required data;
and fourth, the supporting multi-wavelength data.

Science goal (1): Does the "blazar sequence" scheme hold for a large sample of objects?
(this scheme states that (a) the L_syn is inversely related to E_peak-syn,
(b) E_peak-syn follows E_peak-Comp, and (c) that the ratio L_Comp/L_syn is directly related to L_syn)

Targets: Some number (at least ~ 20) blazars with nearly-contemporaneous broad-band data, allowing to fit for the position of synchrotron and Compton peaks

Approach: phenomenological fitting of the nearly-simultaneous spectra (single snapshots probably OK) to verify previous claims

Other data needed: Redshifts essential; nearly - simultaneous snapshots in IR, optical, X-ray bands

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Science goal (2): Are SSC models in trouble for the HBL-type blazars?
(those are often TeV blazars, where gamma-ray peak
is presumably due to SSC rather than ERC, as they have no bright emission lines)

Targets: HBL blazars Mkn 421, Mkn 501, 1ES1959+65

Approach: SSC model precludes flares that are seen only in one, but not in the other component: "orphan" flares pose substantial problem to SSC models; a few were reported in previous data, but no clear consensus

Other data needed: good coverage in soft X-rays and in the TeV band

Science goal (3): Are single-zone synchrotron + Compton models applicable?
Is Self-Compton or External Compton more applicable for objects with strong emission lines?

Target(s): Bright blazars in flaring states: 3C279, 1622+398, PKS 0528+134

Approach: Gamma-ray flares (presumably Compton component) should obey the simple quadratic (for SSC) or linear (for ERC) relationship against the amplitudes of the IR/Opt/UV flares (presumably synchrotron component)

Other data needed: Simultaneous monitoring in the IR/opt/UV bands, at a cadence allowing to temporally resolve the flares (implied by the GLAST data)

Science goal (4): Are synchrotron and Compton components produced co-spatially?

Targets: The same as in the SG (2): HBL blazars Mkn 421, Mkn 501, 1ES1959+65

- **Approach:** if those are indeed produced by the same electron population, the light curves for the synchrotron and Compton component flares should be strictly simultaneous, meaning no measurable leads or lags of the IR/opt/UV and gamma-ray flares

Other data needed: As in SG (3): Simultaneous monitoring in the IR/opt/UV bands, at a cadence allowing to temporally resolve the flares (implied by the GLAST data)

Science goal (5): What is the content of the innermost part of the relativistic jet?
Is there a substantial e+/e- component to those?
Are they most likely Poynting flux dominated?

Targets: As in SG (3): Bright blazars in flaring states: 3C279, 1622+398, PKS 0528+134

Approach: search for X-ray "precursors" to gamma-ray flares; presumably if jets are particle dominated to begin with, one should see "bulk-Compton" radiation prior to dissipation events - the intensity of the "precursors" should reveal the total e+ / e- content of the jet

Other data needed: Good coverage in soft X-rays during active state, pre-flare data essential

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Science goal (6): Total charged particle content / kinetic energy of the blazar jets as compared to the radiative output

Targets: blazars with synchrotron component peaking in IR or optical, but which have very hard X-ray spectra - such as BL Lacertae, PKS 1510-089

Approach: inferences about the particle content from modeling of the Compton component – presumably the "low end" of the distribution is due to less energetic but much more numerous particles (thus sources with hard X-ray spectra are best)

Other data needed: simultaneous coverage in hard X-rays

Science goal (7): are gamma-ray flares related to dissipation of magnetic energy?

Targets: AO 0235+164, 3C454.3, others

Approach: monitoring of the IR/optical polarization near the peak of the synchrotron component, and correlation of polarization direction changes with gamma-ray flares

Other data needed: good optical polarization coverage, at good (< hour) temporal resolution