The Radio-Gamma Ray Connection of EGRET Blazars:

Correlation, Regression and Monte Carlo Analysis

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EGRET Blazars

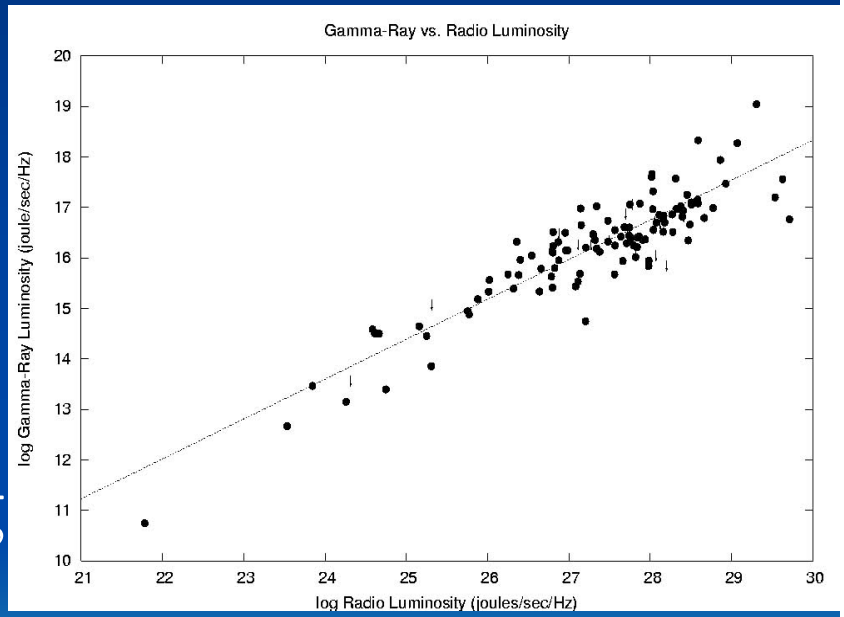
- 66+ blazars identified in 3rd catalogue
- 126 unidentified sources at |b| >10
- Many attempts to identify more gamma-ray blazars (Mattox; Wallace; Halpern)
- Most recently, Stanford group (Sowards-Emmerd et al.) using uniform multi-wavelength criterion (“Figure of Merit”)

New Gamma Ray Blazar Sample

- Using Sowards-Emmerd criterion ("plausible identifications"), increase to 122 sources
- "Figure of Merit" criterion includes info on X-ray detection, compact radio flux and spectrum

Statistics

- Calculate correlation and regression coefficients
- $L_\gamma = (K) \times (Lr^{0.79+/-0.04})$
- Mucke;Impey;Lister all suggest Monte Carlo analysis for understanding observed correlations



Monte Carlo Analysis

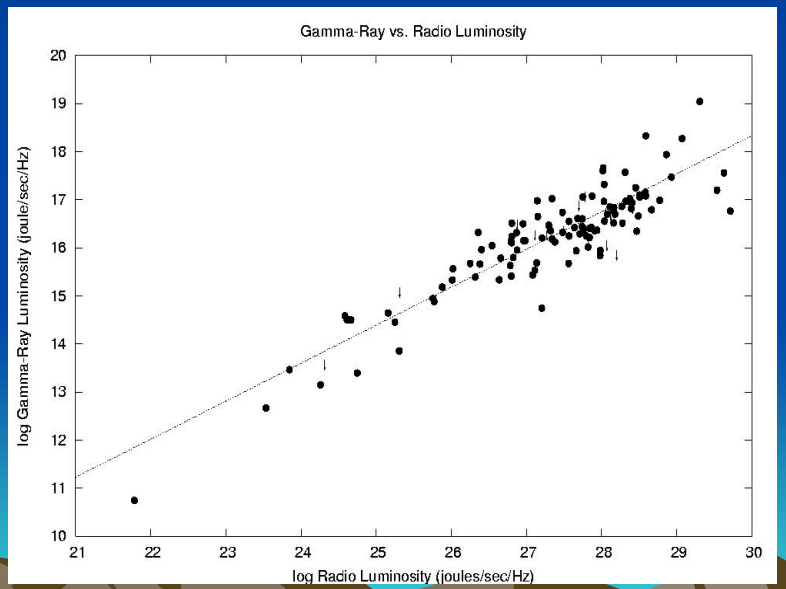
- Assume radio luminosity function $N(L)=N_0(L/L_0)^a$ (Following Lister 1997)
- Assume Lorentz factor distribution
- Assume physical relationship between L_r and L_γ (SSC or ECS)
- Use Monte Carlo to simulate parent population
- Pick sources above threshold fluxes in radio and gamma-rays

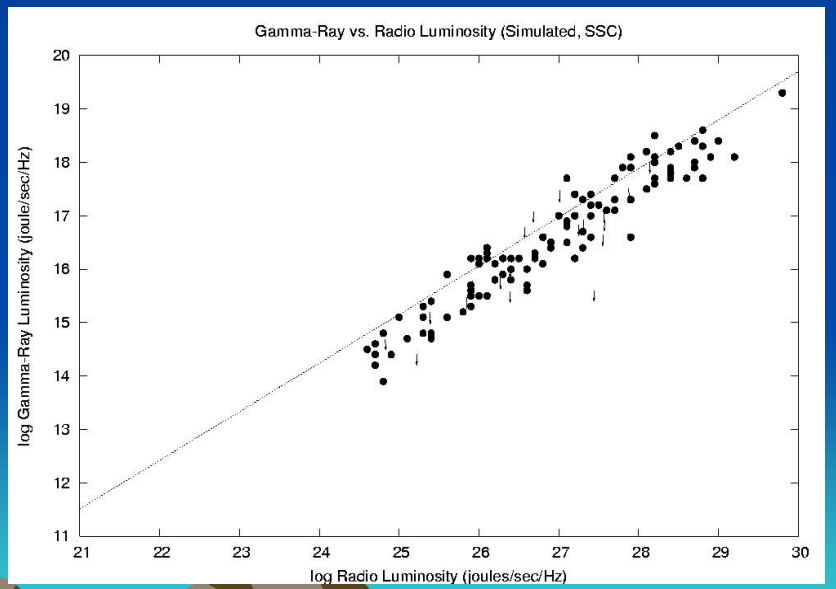
SSC and ECS Models

- Assume linear models (and “single blob”)
- SSC: $L_{\gamma obs}$=(const) x $L_{Rint}\delta^{3+\alpha}$
- Only true if source parameters don’t differ greatly! But, we begin with simple approx.
- ECS: $L_{\gamma obs}$=(const) x $L_{Rint}\delta^{4+2\alpha}$
- Only true if radio luminosity is proportional to “seed” luminosity of ECS . Again, a simple first step…

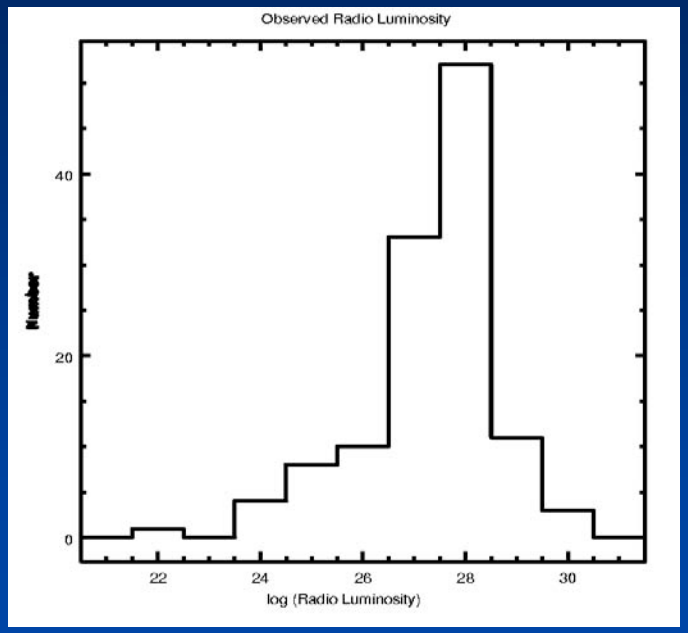
Comparing Regression Analysis

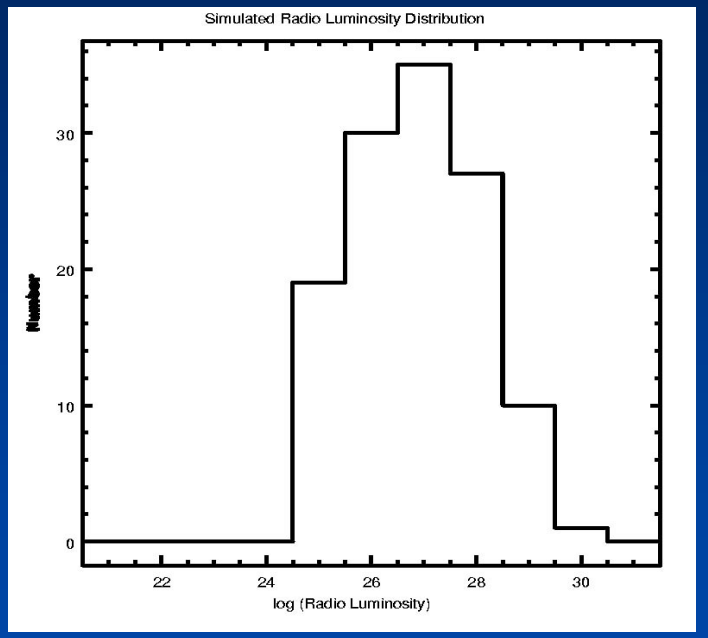
- Simulated slope=0.91+/- 0.04 (0.79 +/-0.04 observed)
- Note lack of low lum. sources in simulation
- But regression is not enough...

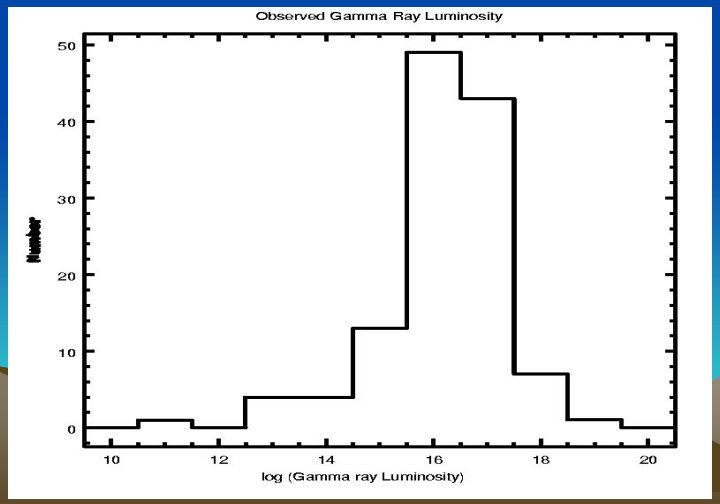


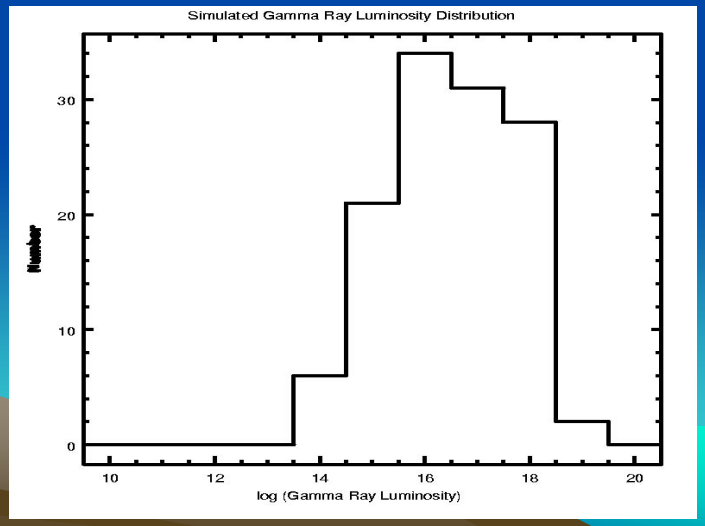


Comparing Distributions

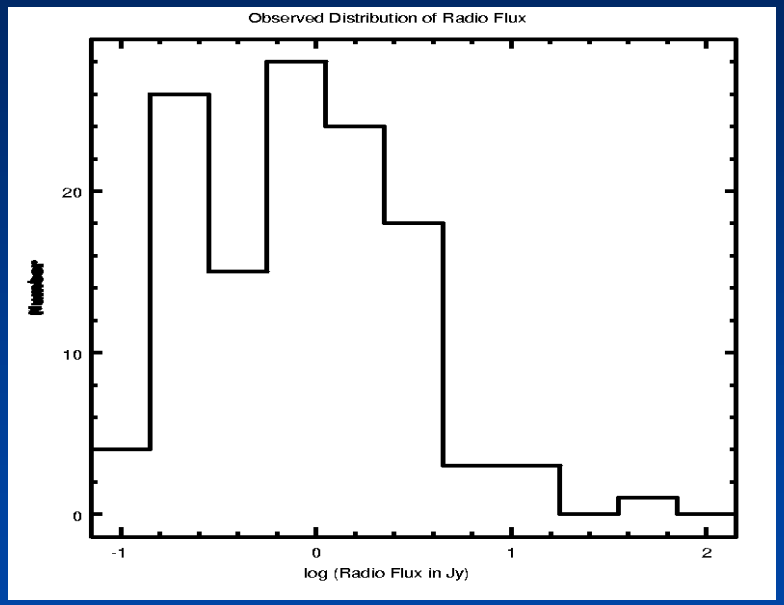


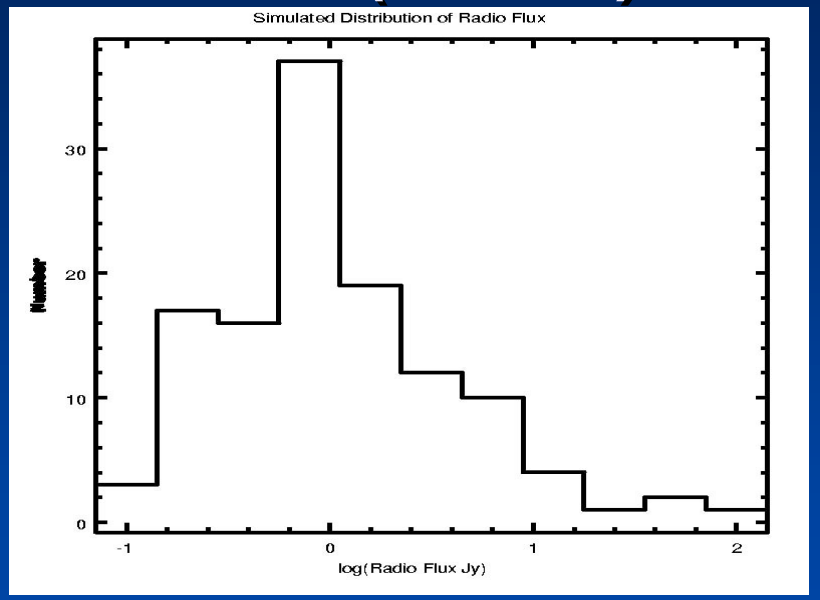


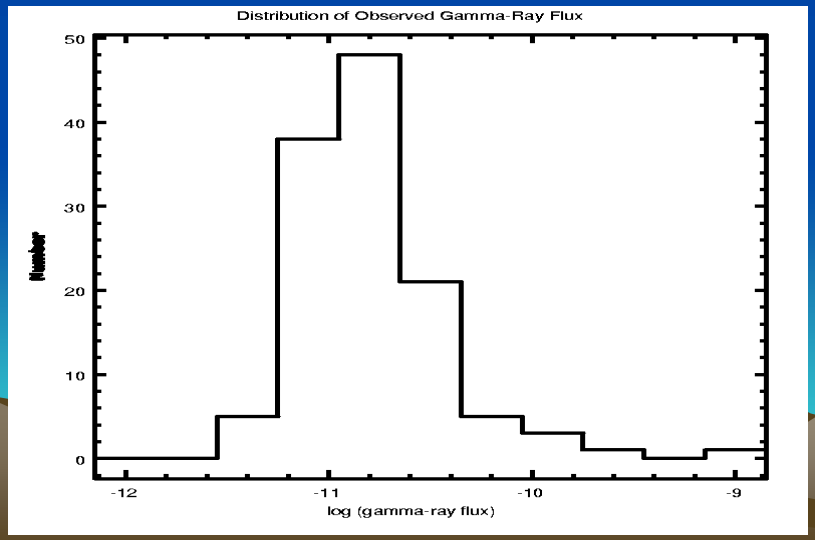


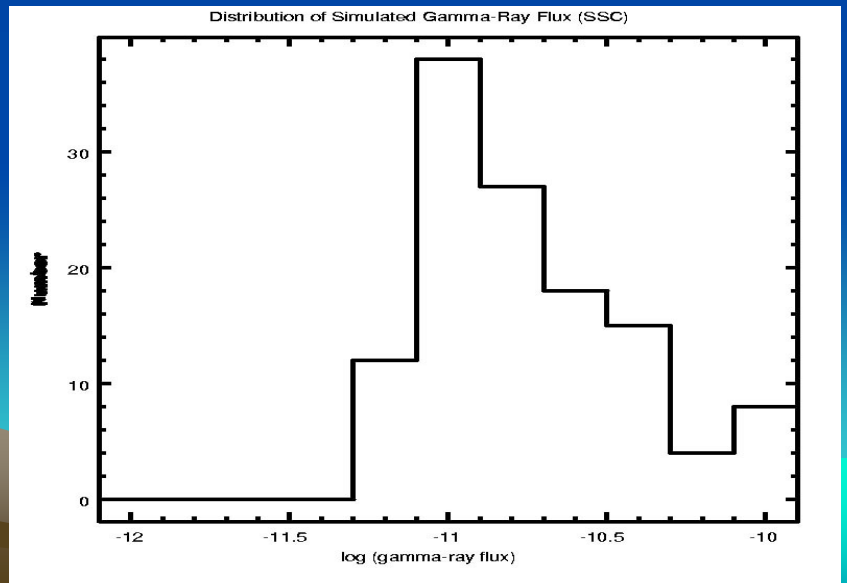


More Distributions (Flux)

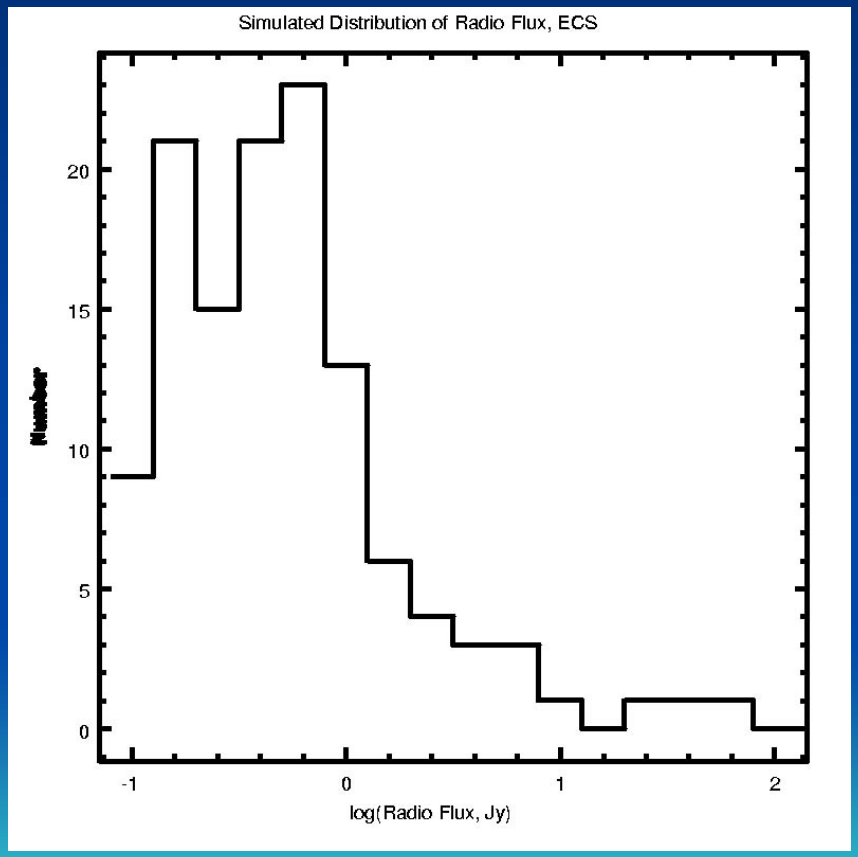


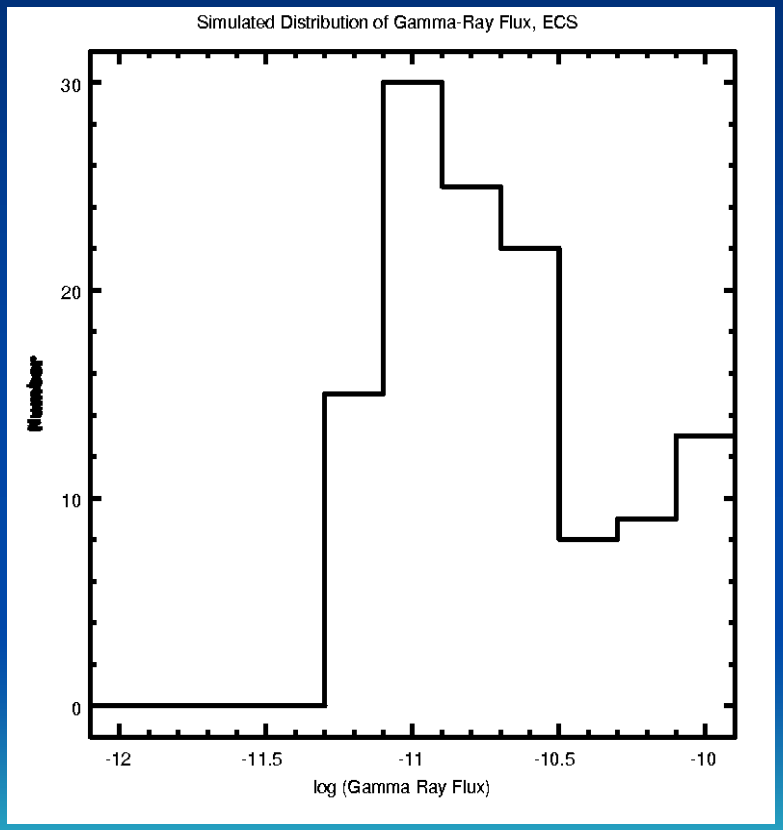






ECS Distributions





Conclusions and Future Work

- Radio/gamma ray regression slope is flatter than linear
- Simulated regression slope is also flatter than linear, but steeper than that observed (under SSC or ECS)
- Need to look at more detailed models (might fit data better)
- GLAST should clarify agreement between models and observations (regression, distributions, etc.)
- See work of Lister and students + future journal submissions