X-ray Selected AGN Paper

Outline and Current Status

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Outline

- Scientific Motivation
- Selected AGN
- Milagro Detector Description
- Data Set
- Flux Limit Calculation
  - Including IR Background Attenuation
- Results
  - Flux Limits
  - Comparison to predictions
- Discussion

- Background and Motivation
  - TeV detections of X-ray Selected AGN
  - SSC and modified Fossati model predictions of blazar emission by Costamante and Ghisellini
  - Cut offs in TeV spectrum from interaction with IR background
- X-ray Selected AGN
  - Extreme blazars from Costamante 2001
    - X-ray selected with bright IR/optical for high synchrotron seed photon contribution to IC peak
    - Include sources between 0-80 deg DEC
      - Note set includes 1ES1959+650 now detected by ACTs

- Milagro Detector
  - Short description of detector
  - Refer to ICRC status paper for details

- Data Set
  - Details of included data
    - 12-15-2000 to 9-7-2003 = 997 days (~905 days exposure)
    - Runs with different triggers, low passing rates excluded
    - Trigger
    - Pointing and PE scale corrections
  - Cuts
    - Nfit>20
    - X2>2.5 (refer to Crab paper for details of gamma-hadron separation
  - Analysis
    - 2 hour direct integration for background estimation
    - Short maps excluded
    - Significance of Crab (6.1σ ~3.7$\sigma/\sqrt{yr}$)

- Flux Limit Calculation
  - Describe calculation of flux limits
  - Correction for IR background
    - Adjust spectra used for sources to include energy dependent IR attenuation
    - IR Models exist based on
      - luminosity evolution (Stecker and de Jager, 2001, fully parameterized)
      - semi-analytic modeling (Somerville and Primack, not fully parameterized)

- Results
  - Flux Limits
    - Unknown spectra so use $dN/dE \propto E^{-2}$ and E^{-3}
    - Limits for both spectra including IR attenuation for source redshift
  - Comparison to Costamante 2001 predictions
    - TeV spectral approx for SSC and Fossati models
    - Convert Costamante predictions to dN/dE (1TeV)
    - Use same spectral approx to get Milagro flux limit
    - Comparison including IR correction (raises limit, lowers prediction)
  - 1ES 1959+650
    - Limits for ACT measured spectra (quiescent and flaring + measured cut off)

- Discussion
  - Sensitivity dependence to declination of source
  - Sensitivity dependence on redshift
  - Effect of spectral index and IR attenuation on flux limits
  - Constrained predictions

Status

- What's done?
  - Data analyzed through Sept 7, 2003
  - Sensitivity studied for declination and IR effects
  - Memo near completion on preliminary data set and flux limits, comparison, and sensitivity discussion
- Still need to...
  - Update limits for more recent data set
  - Calculate Costamante predictions for IR attenuated spectra
  - Convert memo to paper format and add scientific motivation and detector description.

Object	z	α	I_0 U.L.	Predicted I_0
1ES0033+595[a,4]	0.086	2.07 / 2.40	3.65 / 7.07	6.43 / 0.805
1ES0120+340[4]	0.272	2.15 / –	4.66 / –	0.86 / 0.897
RGB0136+391	0.200	2.15 / 4.10	3.81 / 4.87	1.71 / 0.339
RGB0214+517[a,4,5]	0.049	2.05 / 2.88	2.80 / 8.68	18.82 / 0.134
3C66A[1,4]	0.444	3.05 / –	9.10 / –	0.25 / –
1ES0229+200[1,4]	0.139	2.13 / 4.41	5.66 / 8.05	2.96 / 0.796
1H0323+022[1,4]	0.147	2.15 / –	10.4 / –	2.57 / 0.026
1H0414+009[1]	0.287	2.33 / –	17.1 / –	0.65 / 0.209
1ES0647+250[1]	0.200	2.20 / –	2.77 / –	1.76 / 0.581
1ES0806+524[4,5]	0.138	2.22 / –	4.36 / –	4.03 / –
RGB0812+026	0.200	2.18 / –	7.48 / –	1.75 / 0.114
OJ287[2]?	0.306	3.05 / –	11.7 / –	0.75 / –
1H1013+498	0.200	2.36 / –	10.1 / –	0.33 / 0.380
1ES1028+511	0.361	2.51 / –	5.82 / –	1.10 / –
RGB1117+202[4]	0.139	2.05 / –	5.03 / –	3.71 / 0.116
Mrk180[a,1,2,4,5]	0.045	2.10 / –	4.90 / –	26.48 / 0.068
RGB1136+676	0.135	2.10 / –	7.23 / –	2.87 / 0.257
ON325[4]	0.237	2.60 / –	10.9 / –	0.39 / –
1H1219+301[1,4]	0.182	2.11 / –	7.21 / –	2.08 / 0.318
RGB1417+257	0.237	2.17 / –	7.01 / –	1.15 / 0.569
1ES1440+122	0.162	1.99 / 2.70	3.84 / 14.3	2.53 / 0.231
1ES1553+113[2,4]	0.360	2.78 / –	15.1 / –	0.43 / 1.016
RGB1725+118[a,4,5]	0.018	1.93 / 3.10	5.04 / 31.9	42.24 / 0.036
IZw187[a,1,4,5]	0.055	2.06 / –	1.83 / –	16.42 / 0.180
1ES1741+196[a,1,4,5]	0.084	2.07 / 3.64	6.64 / 20.6	11.31 / 0.618
1ES1959+650[a,b]	0.047	2.08 / –	3.86 / –	23.42 / 0.073
BLLac[a,1,4,5]	0.069	2.57 / –	7.61 / –	8.18 / 0.252

Table 5: Differential flux comparison of Costamante and Ghisellini predictions with differential flux upper limits for AGN that transit within 45° of Milagro zenith. $dN/dE = I_0 E^{-\alpha}$, where I_0 is in 10^{-12} phot/cm^2 s TeV. Results are given for two spectra. The first alpha is estimated power law for Fossati type SED model as modified by Costamante and Ghisellini. The second is for the SSC model predictions.
[a] Flux limit falls below predicted flux. [b] TeV detection by ACTs. [1] TeV limit in Costamante 2001. [2] Predicted flux constrained by ACT TeV limit. [4] TeV limit from Veritas, ICRC 2003 [5] Constraining TeV limit from Veritas, ICRC 2003