

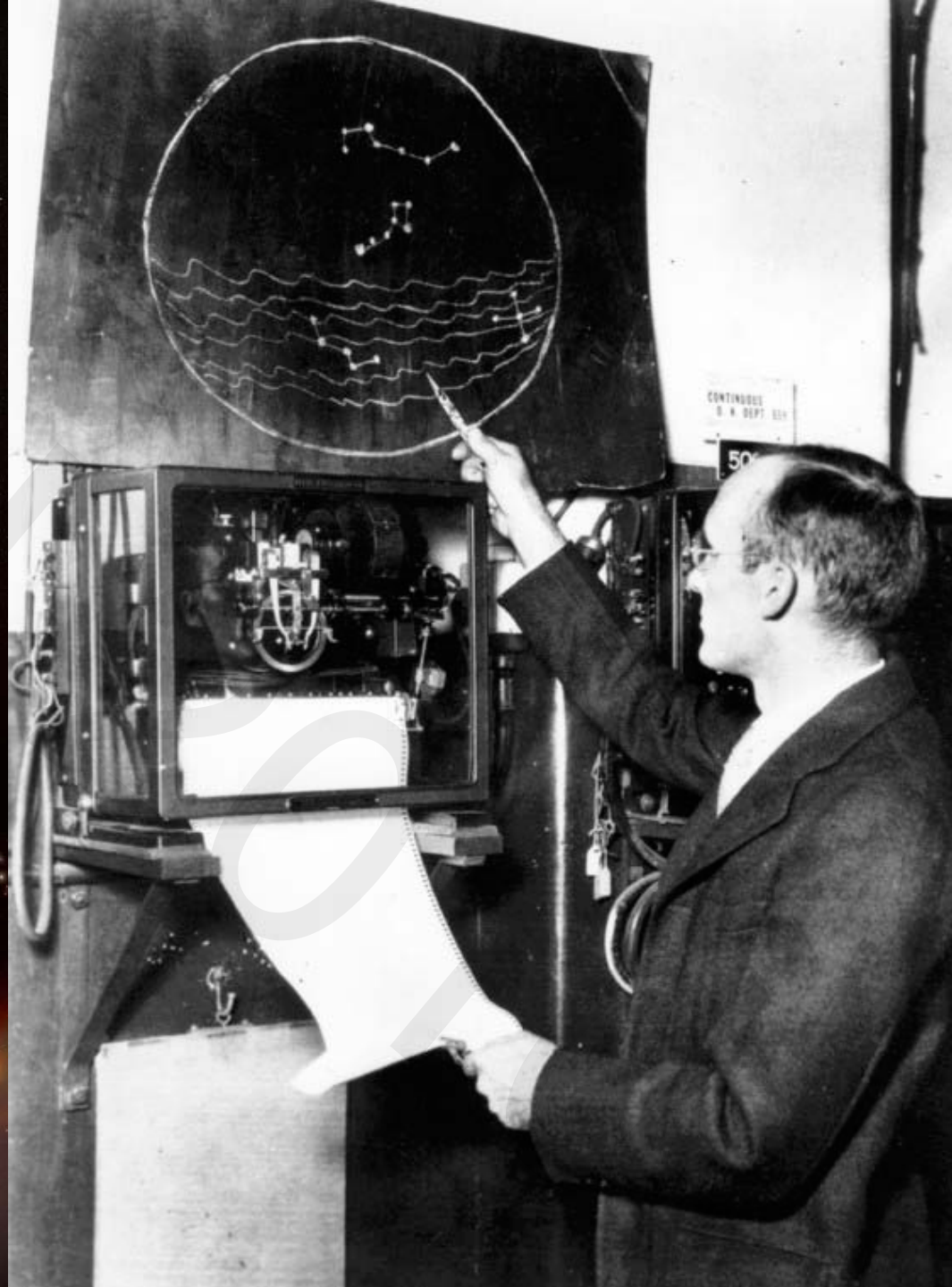


Fermi

Gamma-ray Space Telescope

WG3: Populations & Unassociated

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- **1FGL: N=1451 sources with TS>25** (N=1043 at $|b|>10$ deg)

Table 6
LAT 1FGL Source Classes

Description	Designator	Number Assoc. (ID)
Pulsar, X-ray or radio, identified by pulsations	psr (PSR)	7 (56)
Pulsar, radio quiet (LAT PSR, <i>subset of above</i>)	PSR	24
Pulsar wind nebula	pwn (PWN)	2 (3)
Supernova remnant	† (SNR)	41 (3)
Globular cluster	glc (GLC)	8 (0)
Micro-quasar object: X-ray binary (black hole or neutron star) with radio jet	mqo (MQO)	0 (1)
Other X-ray binary	hxb (HXB)	0 (2)
BL Lac type of blazar	bzb (BZB)	295 (0)
FSRQ type of blazar	bzq (BZQ)	274 (4)
Non-blazar active galaxy	agn (AGN)	28 (0)
Active galaxy of uncertain type	agu (AGU)	92 (0)
Normal galaxy	gal (GAL)	6 (0)
Starburst galaxy	sbg (SBG)	2 (0)
Unassociated		630

Notes. The designation “†” indicates potential association with SNR or PWN (see Table 7). Designations shown in capital letters are firm identifications; lower case letters indicate associations. In the case of AGN, many of the associations have high confidence (Abdo et al. 2010l). Among the pulsars, those with names beginning with LAT were discovered with the LAT. For the normal galaxy class, five of the associations are with the LMC. In the FITS version of the 1FGL catalog, the † designator is replaced with “spp”; see Appendix D.



- Extragalactic background ($\log N - \log S$)
- Luminosity function of blazars (FSRQs, BLLs)
- Search for New Populations (possibly mis-classified as blazars)
 - radio galaxies
 - young radio sources
 - radio-quiet BL Lacs
 - radio-quiet quasars
 - truly new class of sources (e.g., DM candidates, MSPs)

Are we doing everything we can?



- Gamma-ray source identification at limit of other MWL catalogs
- What other MWL catalogs to use in associations as immediate as 2FGL/2LAC
 - Interferometric all-sky: AT20G, CLASS
 - VLBI: VCS and VERA-type
 - Coverage in Galactic plane lacking

Table 9
Catalogs Used for the Automatic Source Association and Results

Name	Objects	P_{prior}	N_{ass}	N_{false}	(\hat{N}_{false})	Ref.
LAT pulsars	56	0.1	56	n.a.	0.4	1
High \dot{E}/d^2 pulsars	84	0.024	24	n.a.	0.6	2
Low \dot{E}/d^2 pulsars	1461	0.011	1	n.a.	0.3	2
Millisecond pulsars	139	0.278	20	n.a.	1.0	2
Pulsar wind nebulae	69	0.049	27	0.3	0.9	1
High-mass X-ray binaries	114	0.010	3	n.a.	0.3	3
Low-mass X-ray binaries	187	0.050	8	0.4	0.5	4
Small ($<20'$) SNRs	157	0.021	11	0.7	0.7	5
O stars	378	0.015	1	< 0.1	< 0.1	6
WR stars	226	0.013	11	0.3	0.2	7
LBV stars	35	0.026	2	0.3	0.6	8
Open clusters	1689	0.013	1	0.1	0.4	9
Globular clusters	147	0.272	8	< 0.1	0.5	10
Nearby galaxies	276	0.066	5	0.4	0.4	11
Starburst galaxies	14	0.5	2	< 0.1	< 0.1	12
Blazars (BZCAT)	2837	0.308	487	8.9	6.8	13
Blazars (CGRaBS)	1625	0.238	282	4.7	4.1	14
Blazars (CRATES)	11499	0.333	490	17.2	17.8	15
BL Lac	1122	0.224	218	2.8	2.8	16
AGN	21727	0.021	11	0.7	0.8	16
QSO	85221	0.166	147	7.3	4.9	16
Seyfert galaxies	16343	0.041	24	2.0	1.6	16
Radio-loud Seyfert galaxies	29	0.1	4	< 0.1	< 0.1	1
VLBA calibrator survey	4558	0.266	484	11.5	10.1	17
Small ($<40'$) TeV sources	92	0.037	42	0.6	0.8	18
Large ($>40'$) TeV sources ^b	11	n.a.	13	n.a.	7.5	18
Large ($>20'$) SNRs ^b	117	n.a.	48	n.a.	18.1	5
Dwarf galaxies ^b	14	n.a.	7	n.a.	2.1	1
1st <i>AGILE</i> catalog ^a	47	n.a.	52	n.a.	18.6	19
3rd EGRET catalog ^a	271	n.a.	107	n.a.	25.4	20
EGR catalog ^a	189	n.a.	66	n.a.	9.1	21
Bright source list (0FGL)	205	n.a.	195 ^c	n.a.	3.9	22



■ Are we selecting “out” new source types by classifying them as blazars?

- New microquasars? (flat-spectrum radio, bright X-ray)
- Gamma-ray pulsars? (but stable, curved g-ray spectrum)
- Gamma-ray nova?
- Multiple associations?

Fermi LAT Detection of a New Galactic Plane Gamma-ray Transient in the Cygnus Region: Fermi J2102+4542, and its Possible Association with V407 Cyg

ATel #2487; [C.C. Cheung \(NRC/NRL\)](#), [D. Donato \(NASA GSFC\)](#), [E. Wallace \(U. Washington\)](#), [R. Corbet \(NASA GSFC\)](#), [G. Dubus \(U. Grenoble\)](#), [K. Sokolovsky \(MPIfR\)](#), [H. Takahashi \(Hiroshima U.\)](#); on behalf of the [Fermi Large Area Telescope Collaboration](#)
on 18 Mar 2010; 16:52 UT

*Distributed as an Instant Email Notice (Request for Observations)
Password Certification: Julie McEnery (julie.mcenery@nasa.gov)*

Subjects: Gamma Ray, >GeV, Transients

Referred to by ATel #: [2498](#), [2506](#), [2511](#), [2529](#), [2536](#), [2546](#)

The Large Area Telescope (LAT), on board the Fermi Gamma-ray Space Telescope, has detected a transient gamma-ray source in the Galactic Plane: Fermi J2102+4542. Preliminary analysis of the Fermi-LAT data indicates that on the 13th and 14th of March 2010, the source was detected with a >100 MeV flux of $(1.0 \pm 0.3) \times 10^{-6}$ ph cm⁻² s⁻¹ and $(1.4 \pm 0.4) \times 10^{-6}$ ph cm⁻² s⁻¹, respectively (statistical only) -- corresponding significances on these days are 8 sigma and 6 sigma. A systematic uncertainty of 30% should be added to this number. There is no previously reported gamma-ray source at this location.

Combining data for the period from Mar 12 0:0:0 UTC and ending Mar 16 ~8:30 UTC, the preliminary LAT position is (J2000.0): RA = 315.60 deg., Dec = 45.71 deg. (l, b = 86.96 deg., -0.55



- LAT gives spectra, variability
- Swift coverage of all LAT sources
- Radio
 - Typically 1-10 NVSS sources in LAT error circle
 - VLA X-band sub-mJy in <1 min
 - VLBA X-band survey (10 sigma ~ 10 min.... 20 sources / day for faintest LAT sources)

Blue = Radio-selected blazars (MOJAVE-1)

Red = Gamma-ray selected blazars (1FM)

Decl. $> -30^\circ$

$|b| > 10^\circ$

