

The Legacy of EGRET on CGRO (1)



Gottfried Kanbach, MPE
for the
EGRET collaboration



The 'founding' Co-PIs

R. Hofstadter (1915-1990)
Stanford University



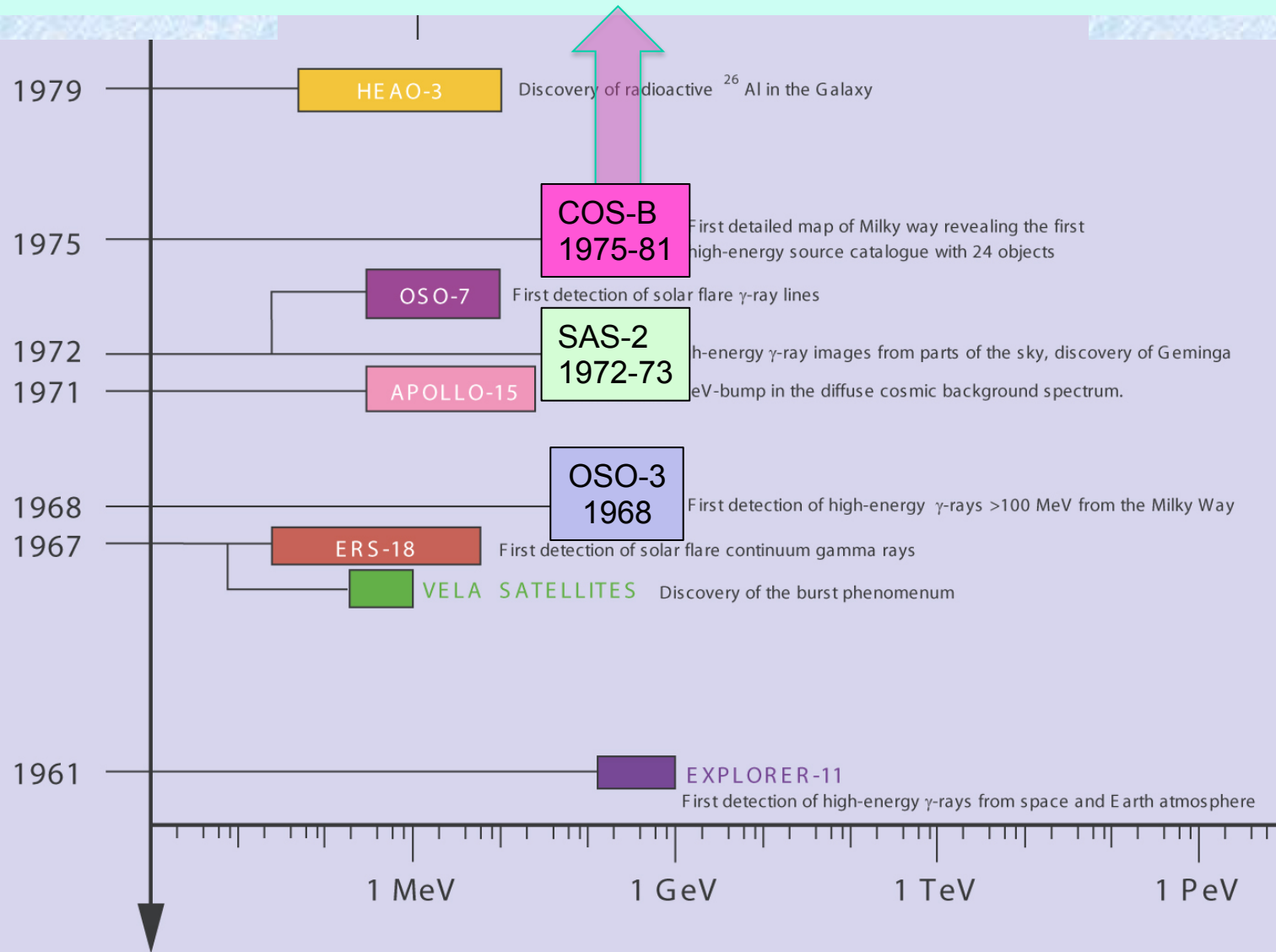
Carl Fichtel (NASA/GSFC)

Klaus Pinkau (MPE)

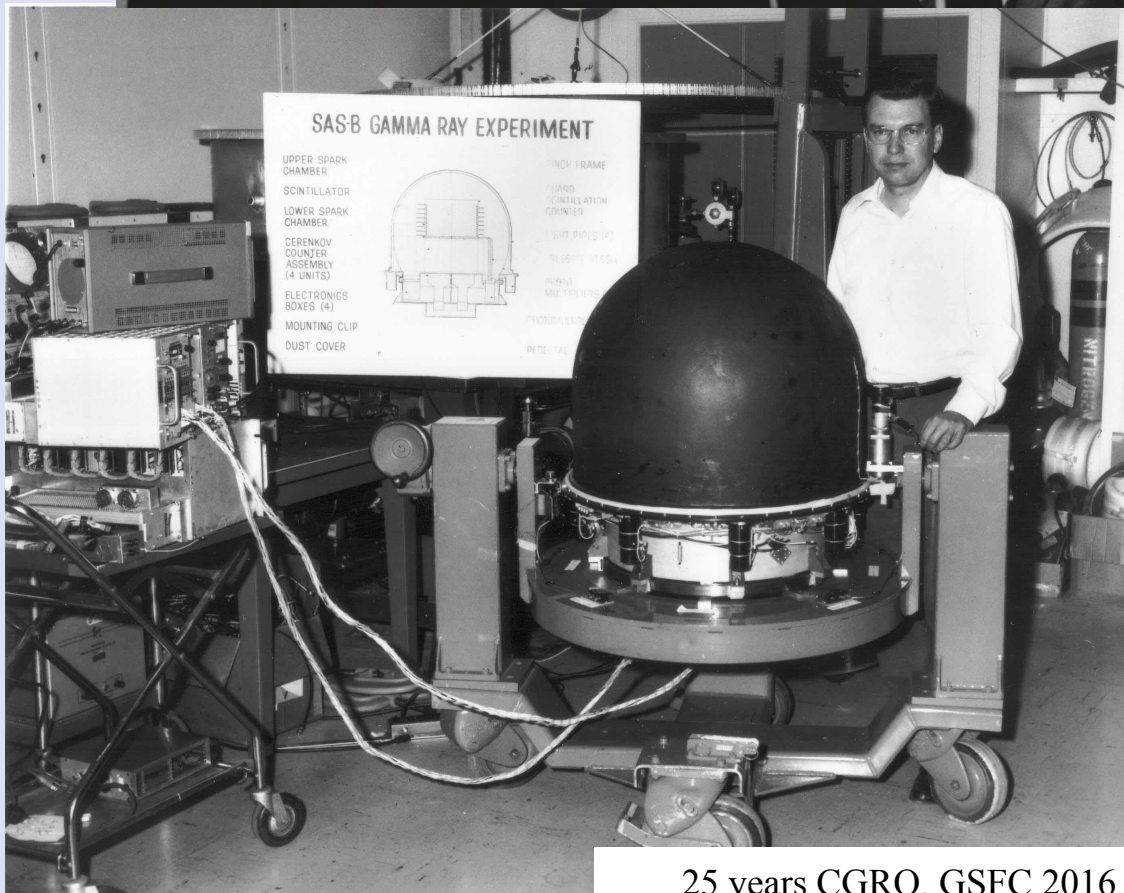


25 years CGRO, GSFC 2016

The roots of γ -ray astronomy: 1960-1980



GSFC: Carl Fichtel and his team

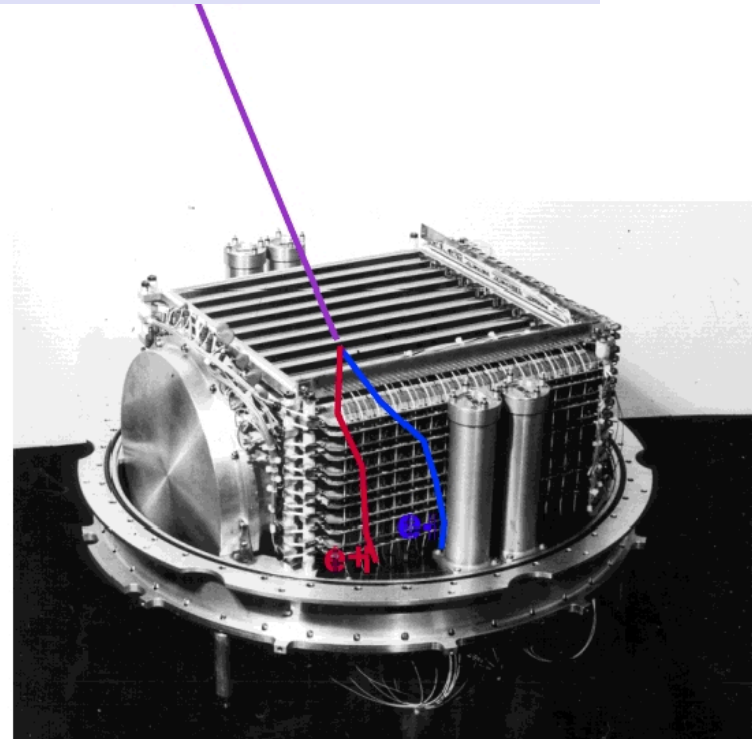


SAS-2 1972-73

25 years CGRO, GSFC 2016

MPE: Sparkchamber Development

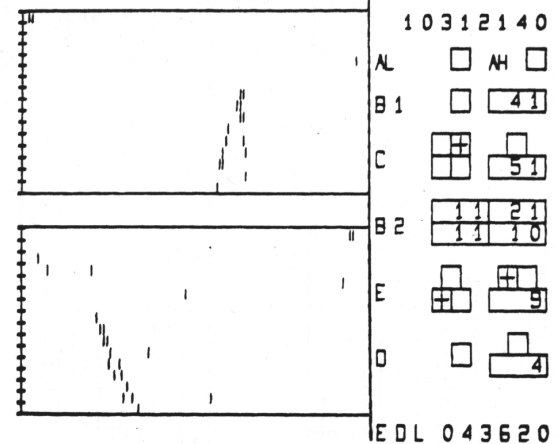
Pinkau, Schönfelder, Mayer-Hasselwander, Reppin, Sommer



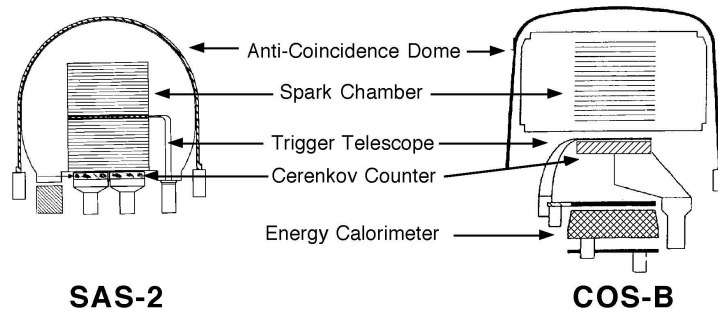
COS-B (ESO): 1975-1982

RO, GSFC 2016

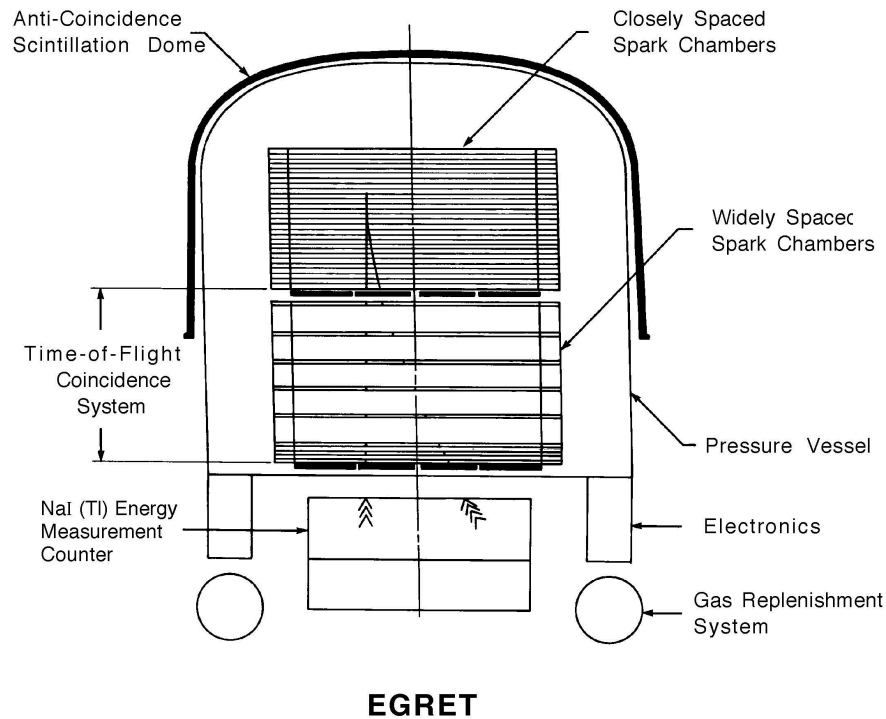
Aug. 12, 1975



Gamma Ray Telescopes



1 m



Scaling up SAS-2 and COS-B →

**Energetic Gamma-Ray
Experiment Telescope (EGRET):**

Energy Range: 30 MeV – 30 GeV

Sensitive Area: $\approx 1200 \text{ cm}^2$ ($>100 \text{ MeV}$)

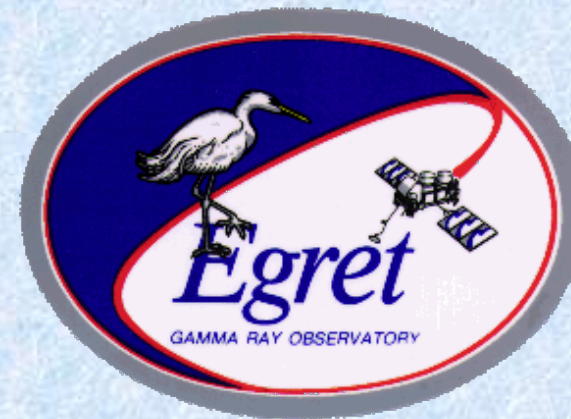
Angular resolution: $0.1^\circ - 0.4^\circ$

Energy resolution: $\approx 15\%$

Field of View: 40° dia.

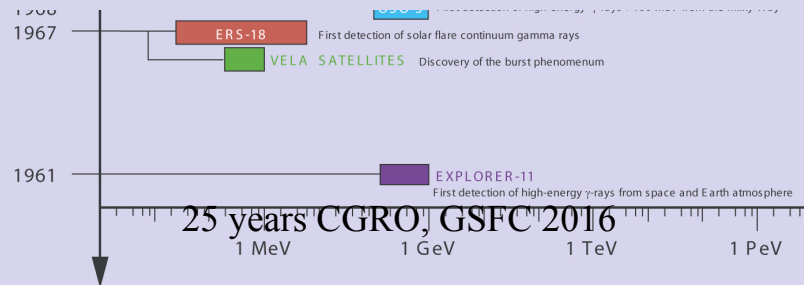
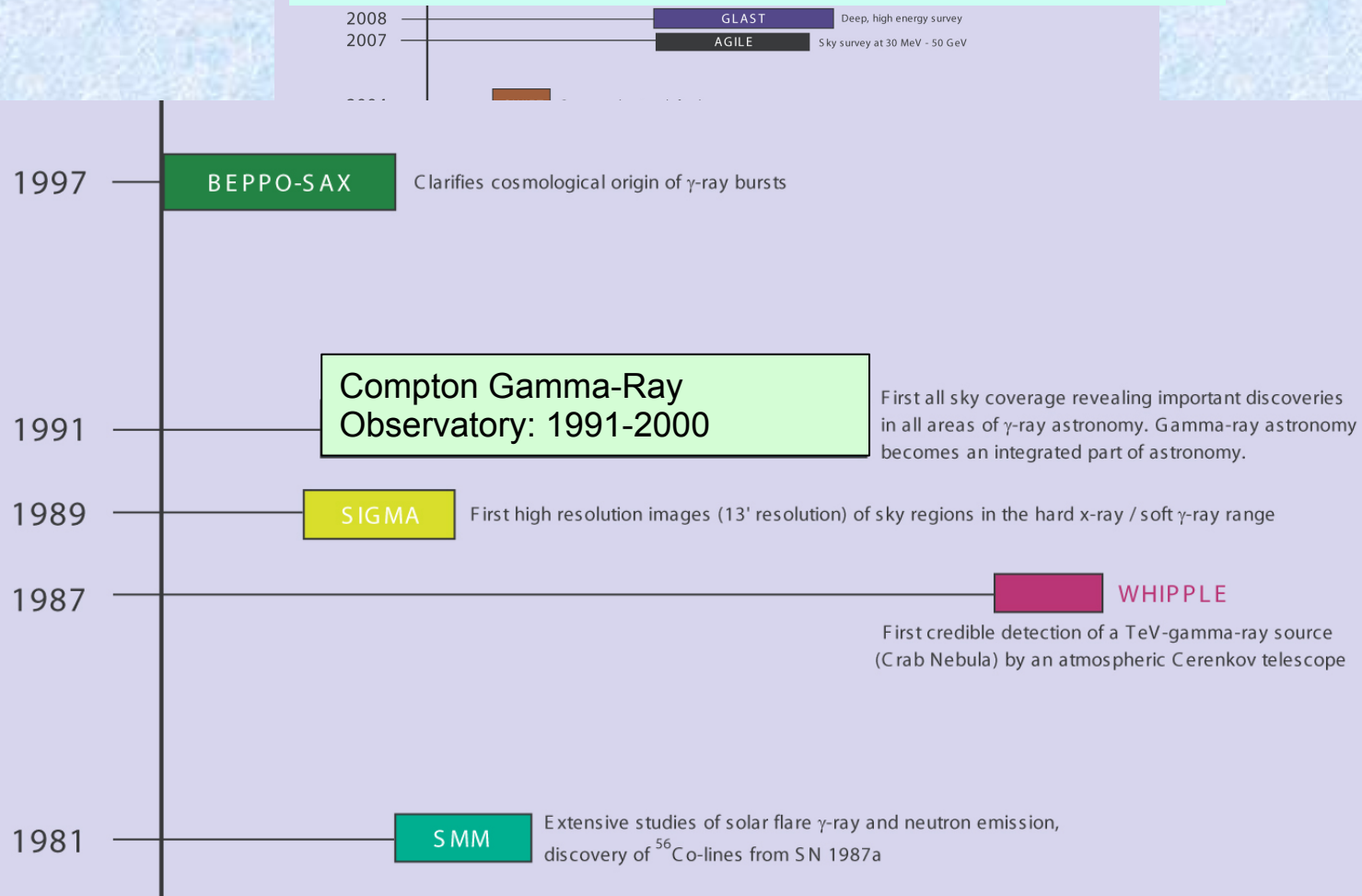


Sensitivity improvement ≈ 30 times

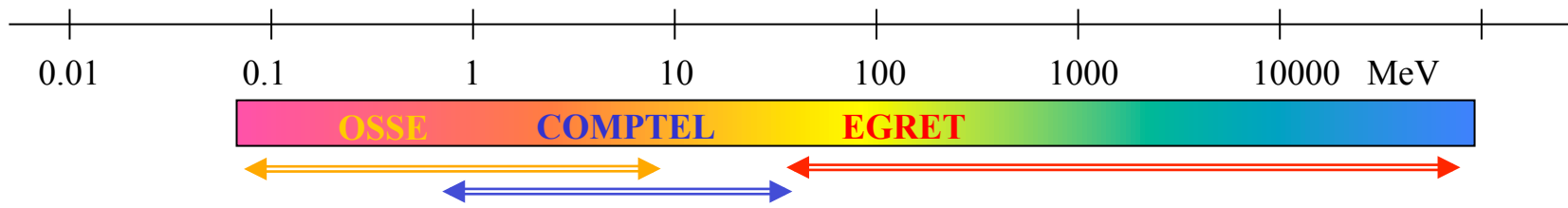
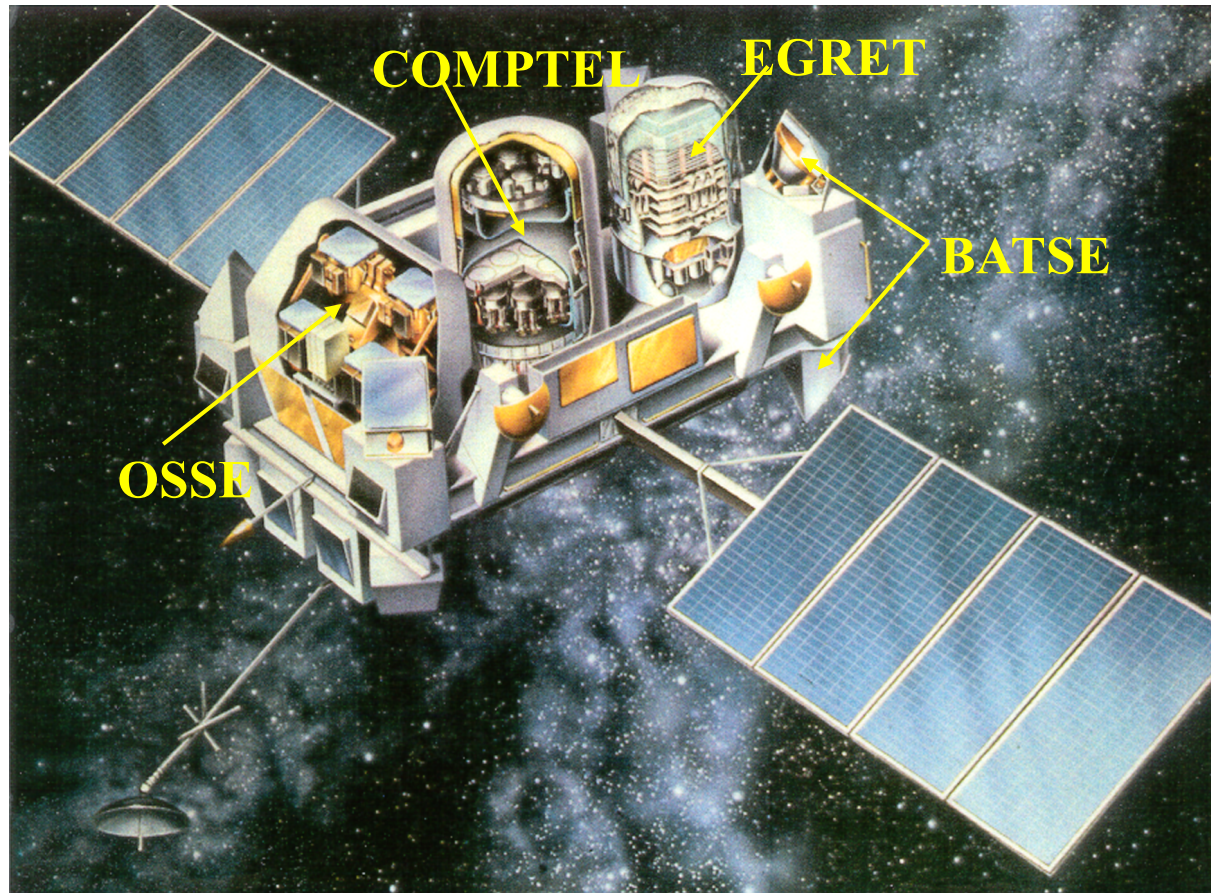


25 years CGRO, GSFC 2016

Breakthrough: 1980-2000



Compton Gamma-Ray Observatory (1991-2000):
a ,Great Observatory‘ for a complete sky survey at high energies



25 years CGRO, GSFC 2016

EGRET Subsystems:

Tracking detector: gas filled wire spark chamber w. trigger telescope

→ image pair conversion events: γ -ray direction

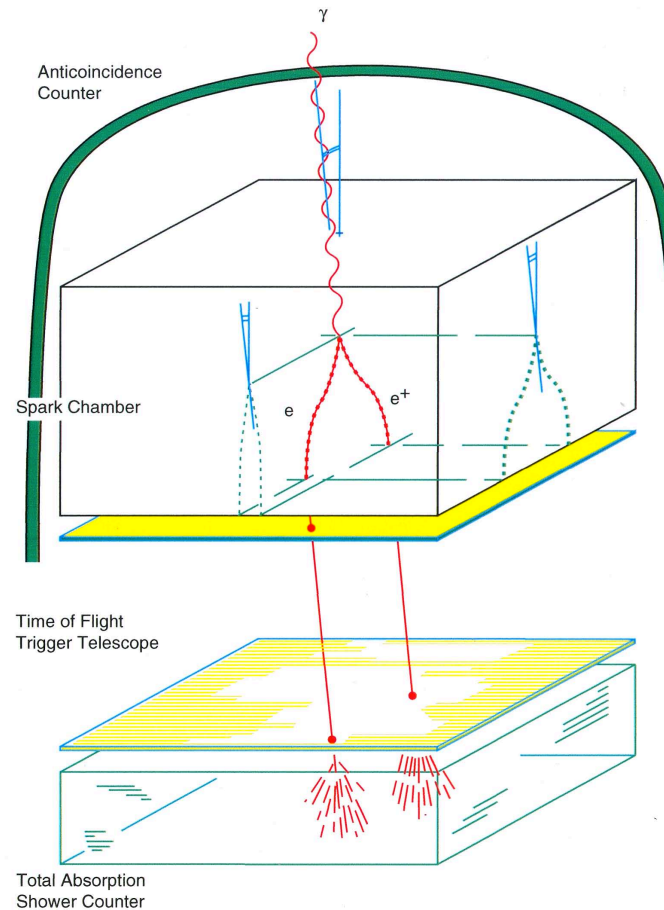
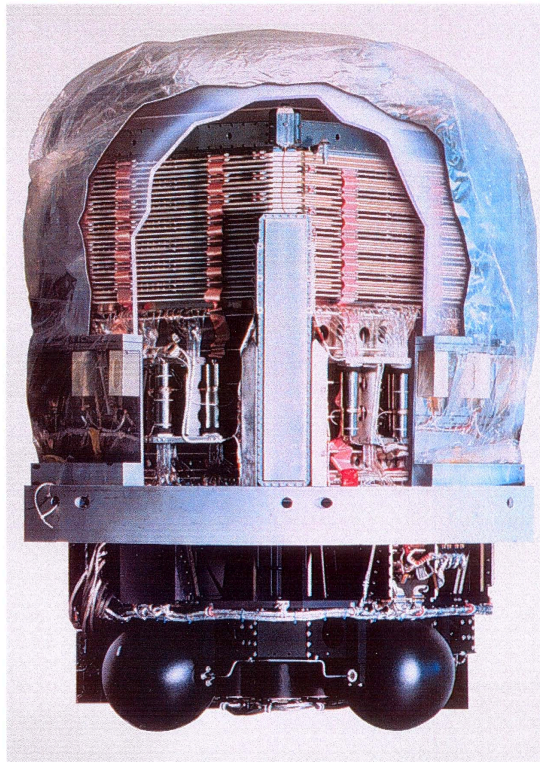
Total Absorption Shower Counter: NaI Scintillator

→ energy measurement (calorimeter)

Anticoincidence detector: plastic scintillator

→ veto shield against charged particle background

Abb. 16



Everybody seems to be happy with the successful completion and calibration of the instrument (MPE, Dec 1987)



... but the launch was still about 3 years away

... finally the 5th of April 1991 arrived ...



... eagerly awaited by Gottfried, Gerry, and Corinna



MONDAY, April 8, 1991

HEADLINES

TODAY'S NEWS AT A GLANCE

SPACE: Next launch is a commercial Delta rocket scheduled for liftoff Friday. It will carry a Comtel Corp. communications satellite.

WEATHER: Early morning fog, turning partly cloudy with a 40 percent chance of showers or thunderstorms. High in the mid-80s; low in the mid- to upper 60s. Weather, 8A.

NATION: Author who skewers Nancy Reagan in a new book as greedy and promiscuous says she is convinced the former first lady ran the U.S. government, 3A.

Two of three people killed by gunmen who took 41 hostages at an electronics store were shot in the back, coroner's officials say. The third suffered "multiple gunshot wounds," 3A.

BUSH President Bush is preparing for another battle with Congress, labor unions and environmentalists — this time over free trade with Mexico, 4A.

WORLD: Three thousand people gather in Moscow for Orthodox Easter services, the first such services in decades, 4A.

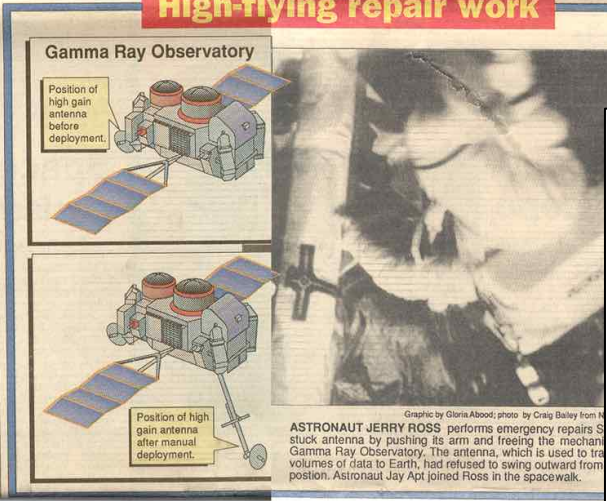
Albanians vote in runoff elections that either will grant communists unchecked power in parliament or give the opposition an important say in running the poor Balkan nation, 4A.

BREVARD: Youths accused of slaying Titusville gas station manager have conversation taped while in jail holding cell; lawyers want to keep tape from being used at trial, 1B.

Holocaust survivor tells her story to 400 for

Gamma Ray is on its way

High-flying repair work

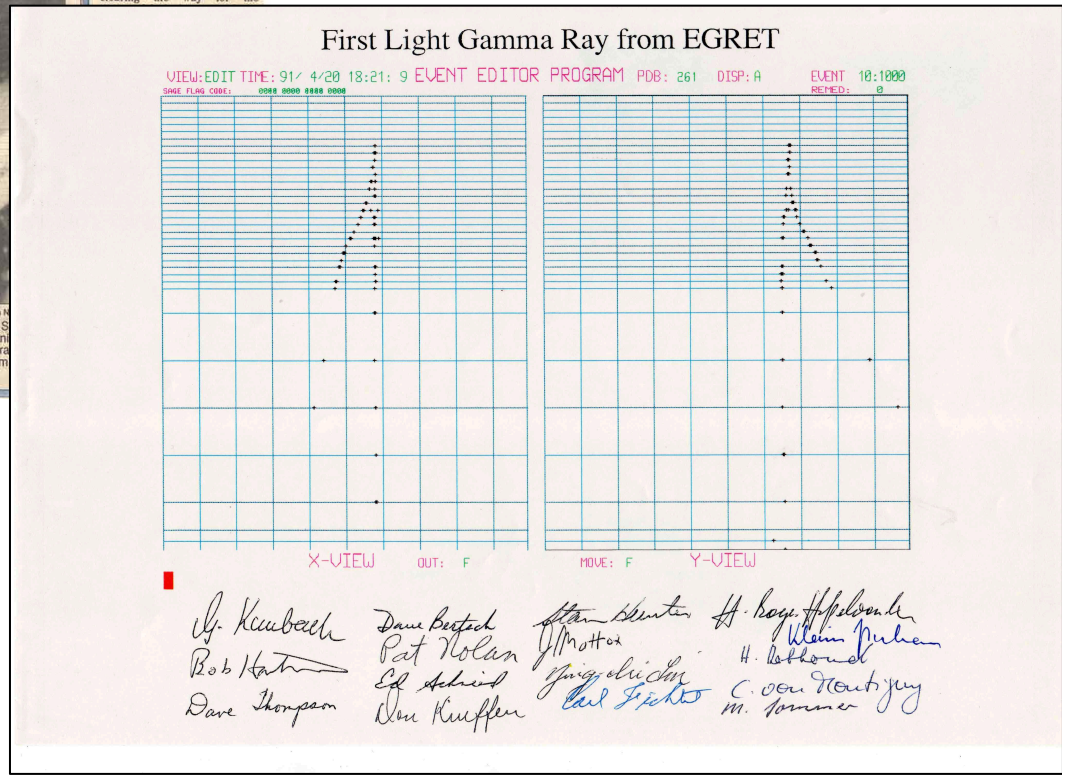


By I.K. Brown
FLORIDA TODAY

HOUSTON — U.S. astronauts took an unexpected walk outside their spaceship Sunday — the first time since 1985 — to repair a jammed antenna on the Gamma Ray Observatory.

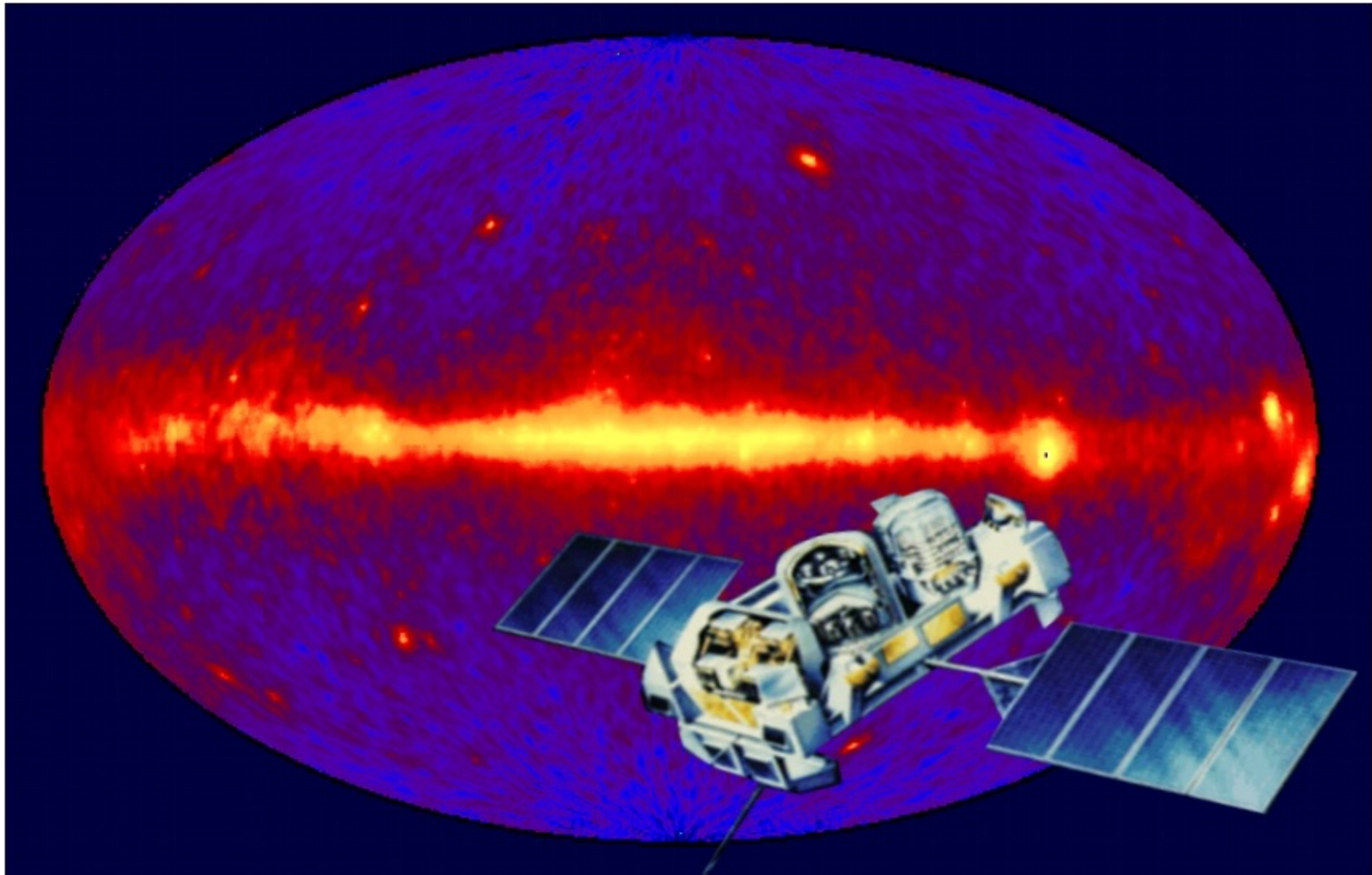
Shuttle astronaut Jerry Ross freed the antenna on his first try, clearing the way for the

„whole lotta shakin' goin'on“
by Jerry Ross and GRO is on the way...



... the sky survey begins with the first recorded gamma-ray

All Sky Survey (Phase 1): Apr 1991 – Nov 1992



25 years CGRO, GSFC 2016

Major discoveries during Phase 1 (Apr 1991 – Nov 1992): (only a subset of all discoveries & publications)

Extragalactic Sources:

- Blazar 3C279: Hartman et al., *ApJ* 385, L1, 1992
- LMC: Sreekumar et al., *ApJ* 400, L67, 1992
- BL Lac Mkn 421: Lin et al., *ApJ* 401, L61, 1992

Galactic Sources:

- 1EG Catalog: Fichtel et al., *ApJ Suppl.* 94, 551, 1994
- Geminga: Bertsch et al., *Nature* 357, 306, 1992
- PSR B1706-44: Thompson et al., *Nature* 359, 615, 1992

Various others:

- GRB910503: Schneid et al., *A&A* 255, L13, 1992 ,→ more GRBs
- Solar Flare: Kanbach et al., *A&A Suppl.* 97, 349, 1993

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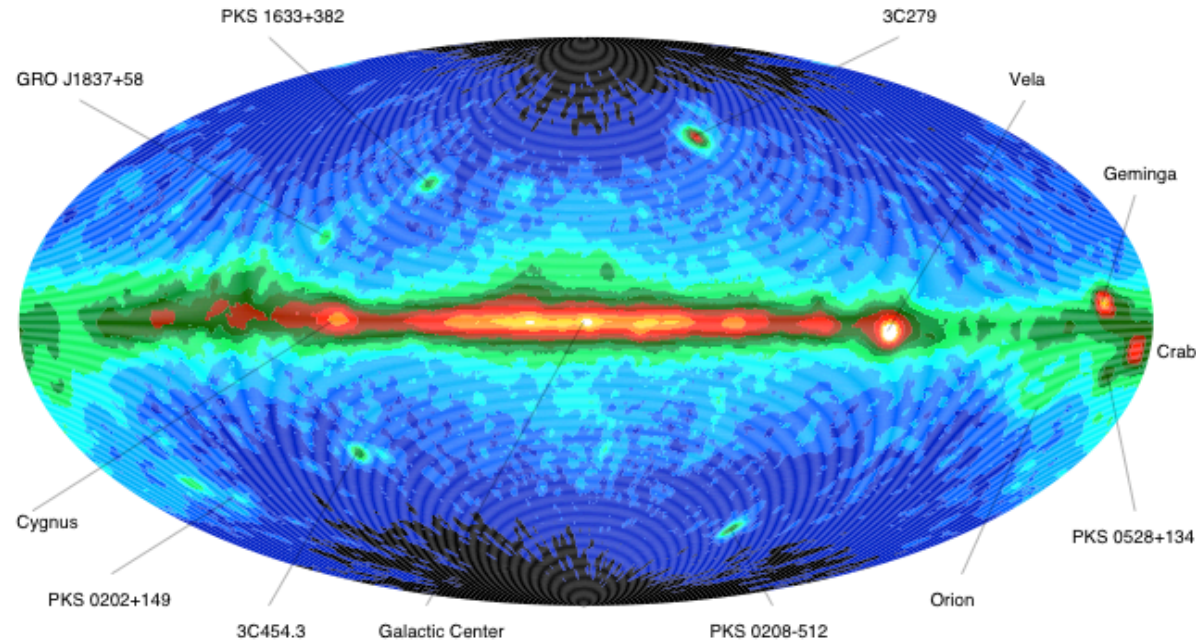
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EGRET Sky Survey
Phase 1:
Apr 1991 – Nov 1992



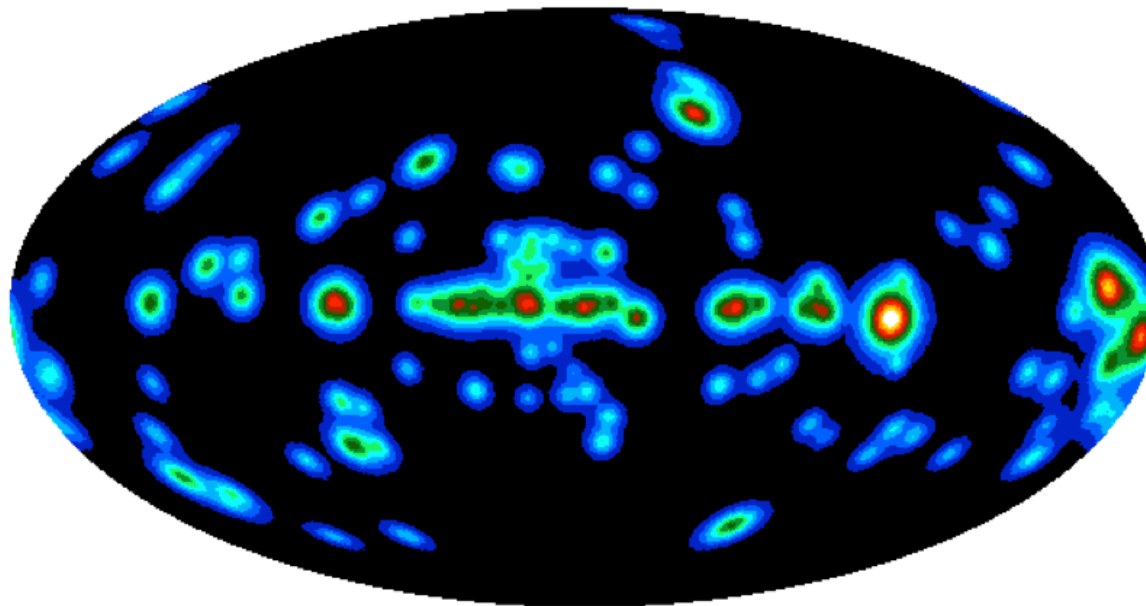
1EG Catalog:
~ 130 sources
(Fichtel et al., 1994)

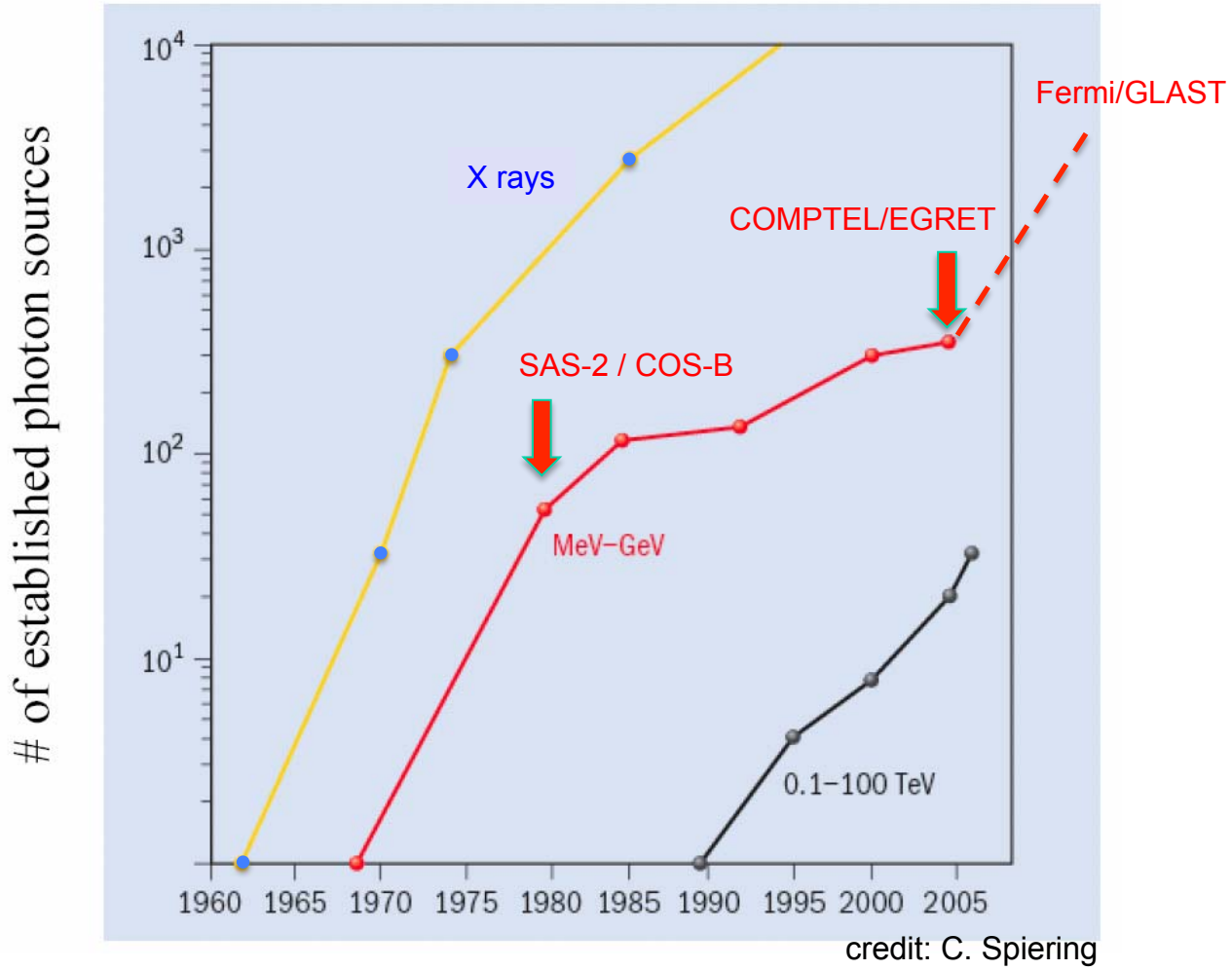
Pulsars: **5**

Unidentified Sources:
35 at $b > 10^\circ$
43 at $b < 10^\circ$

Blazars: **44**

+ LMC, GRB,
Solar Flares





25 years CGRO, GSFC 2016

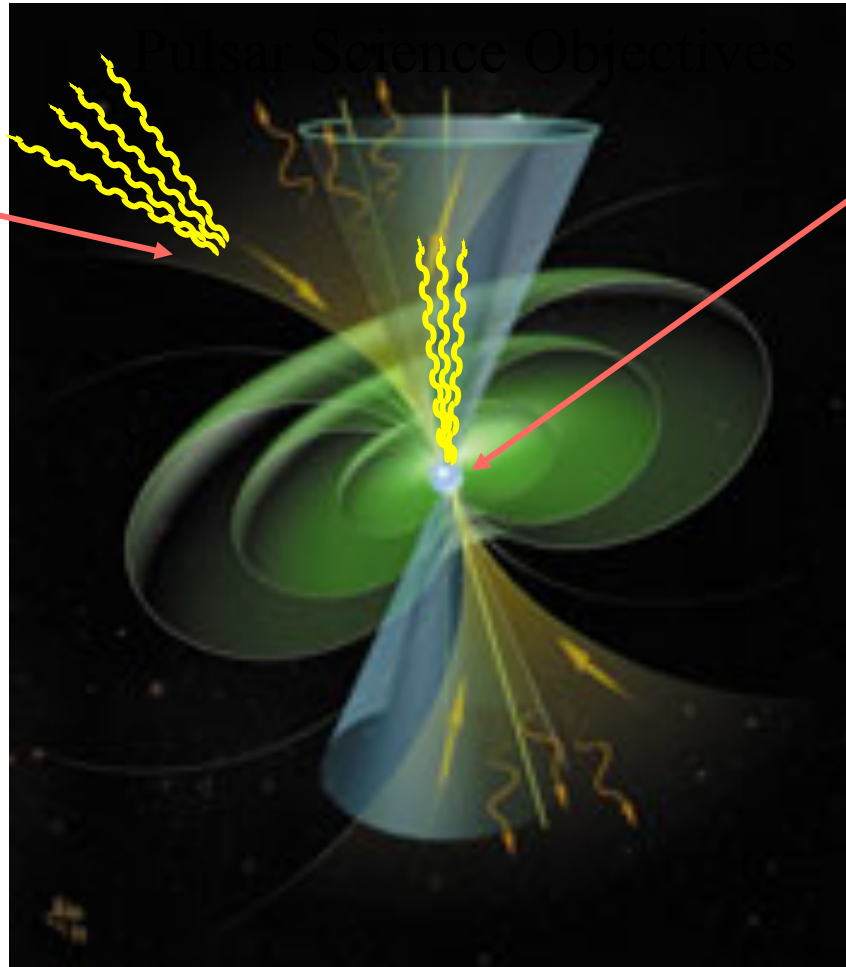
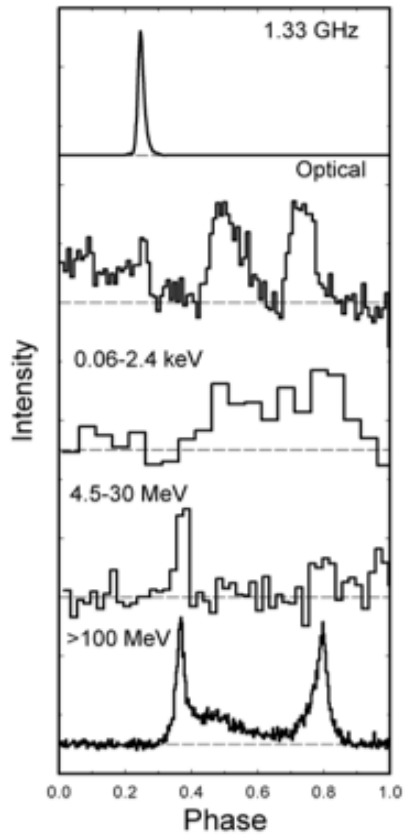
Gamma Ray Pulsars

Outer Gap

Emission: multi- λ
lightcurves

out of phase

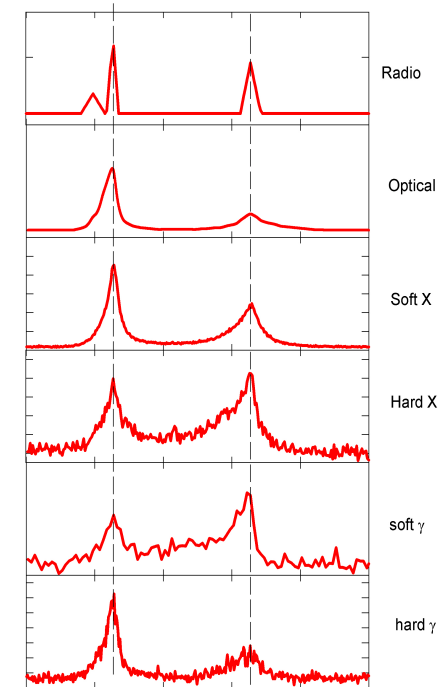
Prototype: Vela



Polar Cap Emission:
multi- λ lightcurves

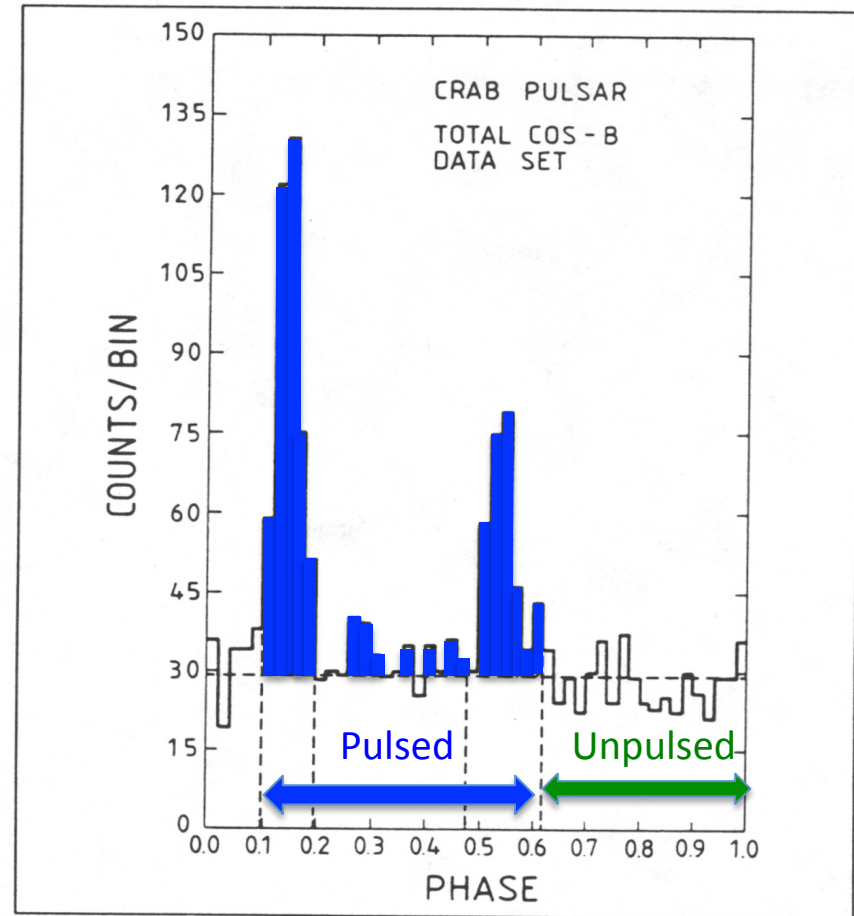
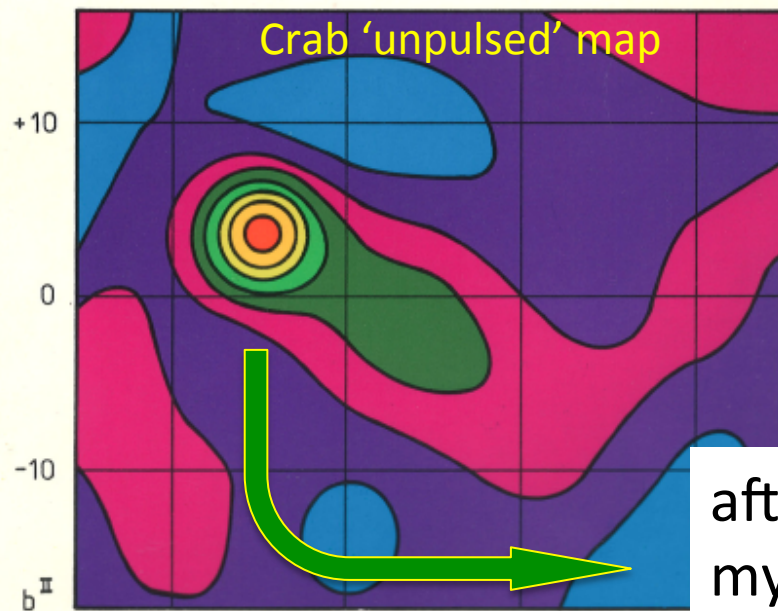
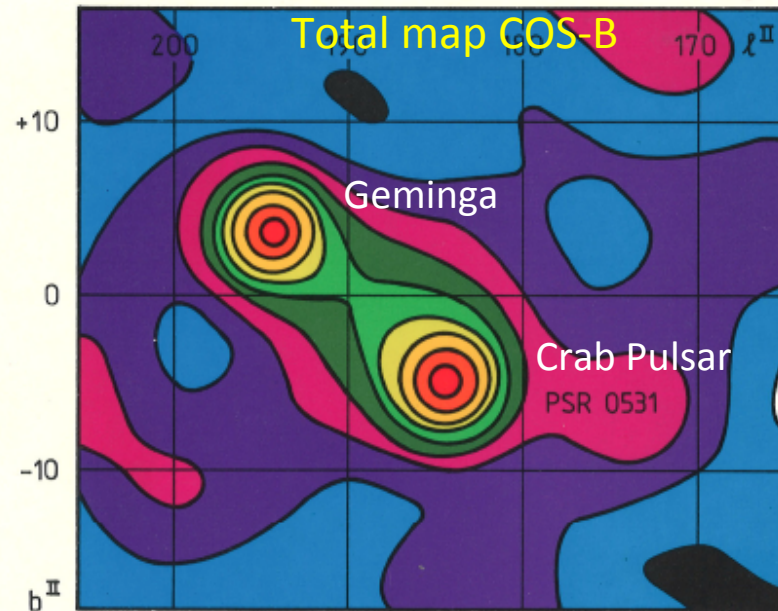
in phase

Prototype: Crab



The 'mysterious other source' in the gal. anticenter:

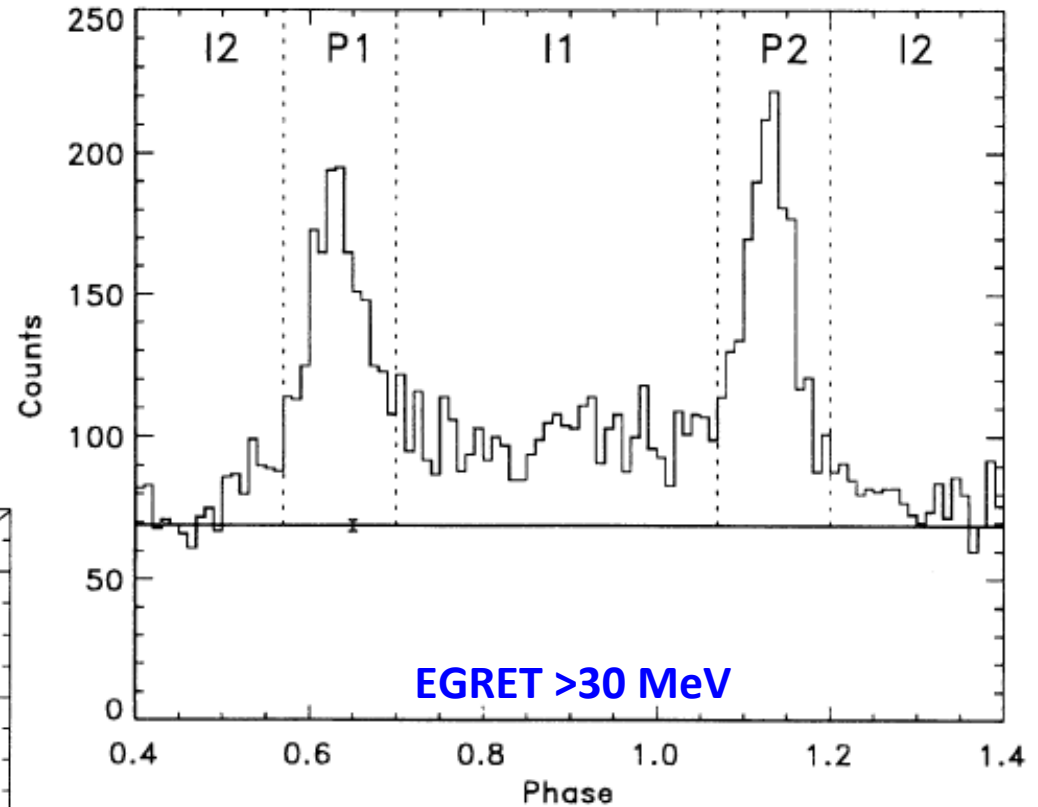
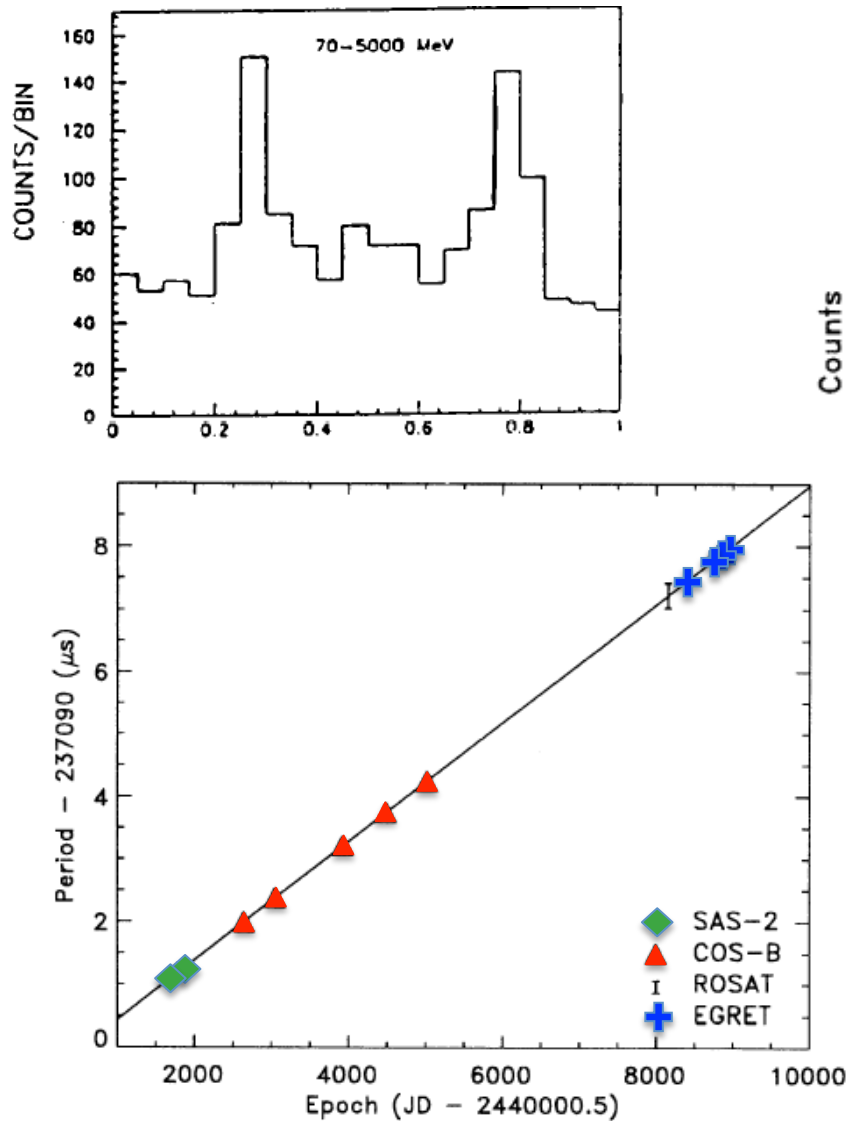
γ 195+5, 'Geminga', 2CG 195+4



after ~20 years the
mystery was solved with ROSAT & EGRET:
it is a pulsar!

Analysis of ROSAT and EGRET data in 1992 revealed Geminga as a pulsar with 0.237 s periodicity

Geminga in COS-B data (1975-81)

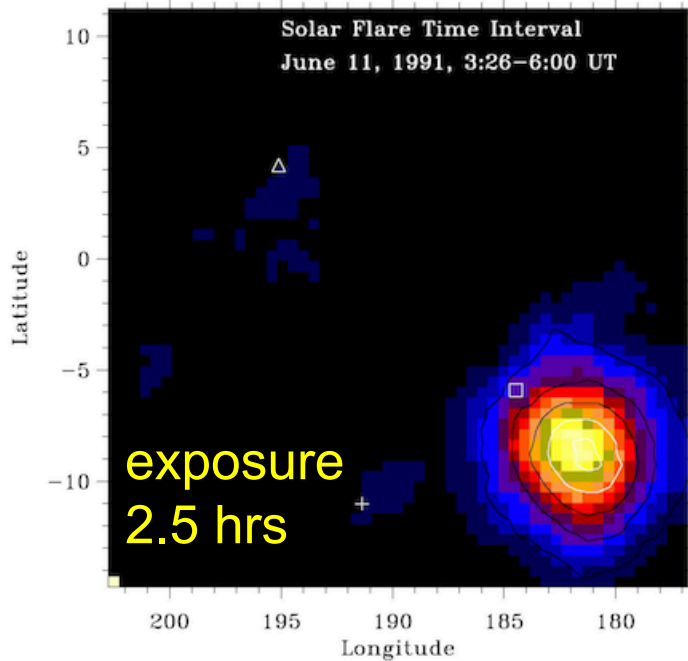
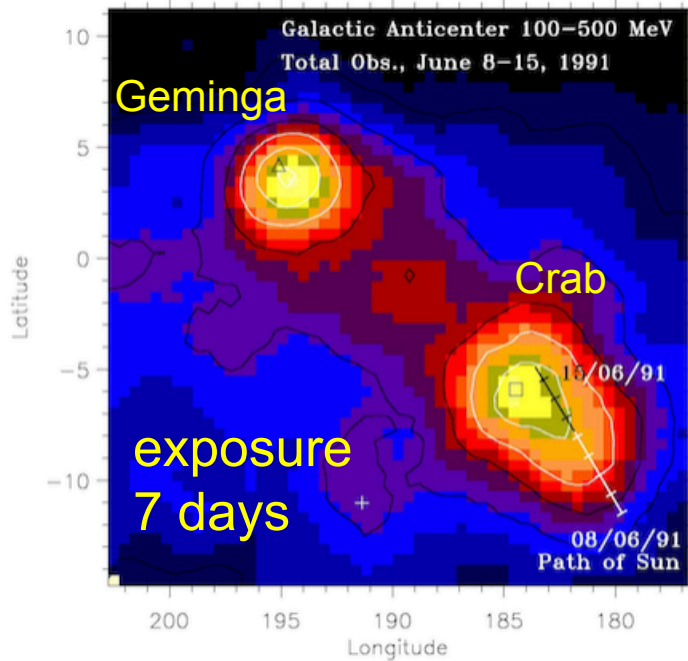


Bertsch et al., *Nature* 357, 306, 1992, 1992

Mayer-Hasselwander et al., *ApJ* 421. 276, 1994:

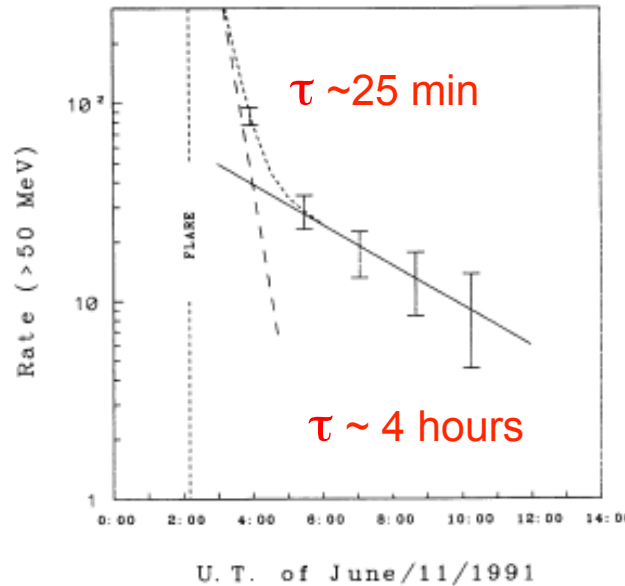
Geminga is an extremely stable 300.000 year old pulsar at a distance of 800 light-years

→Prototype of many Fermi pulsars

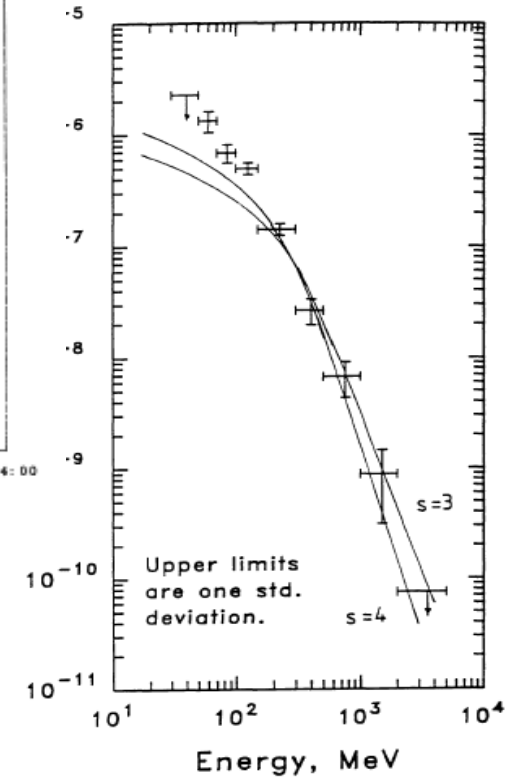


The long-duration X-class solar flare on June 11, 1991:

Time profile:
short and long components



Spectrum:
Proton (π^0 decay)
and Electron
(Bremsstrahlung)



After 5 years of CGRO, party at MPE...



now... onward and upward...with Dave Thompson

25 years CGRO, GSFC 2016