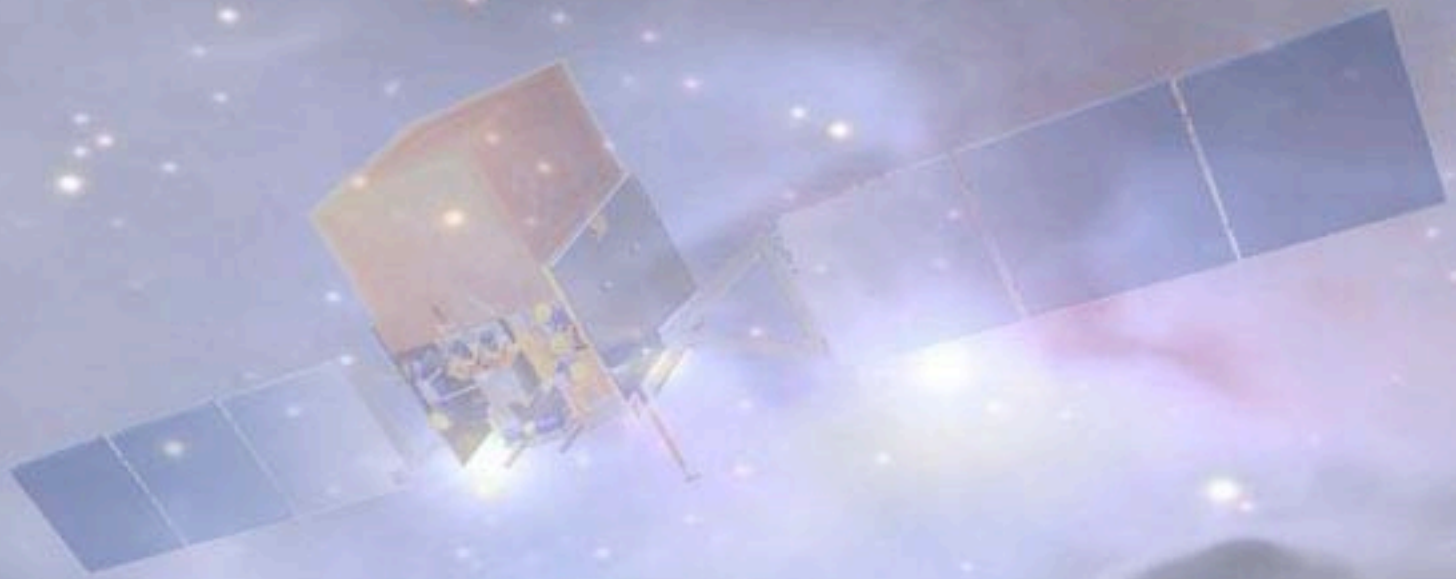
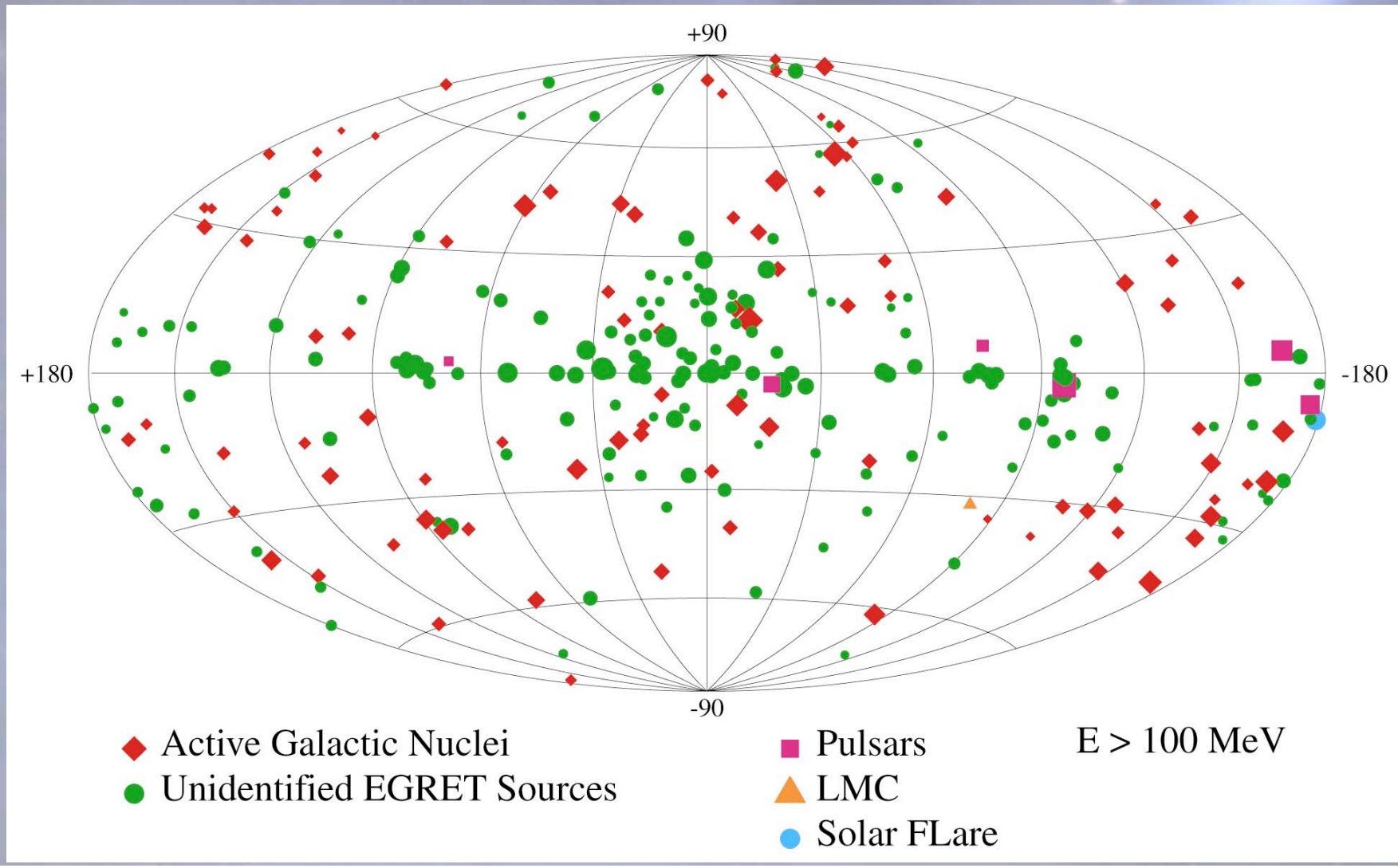
A comprehensive approach to γ-source identification



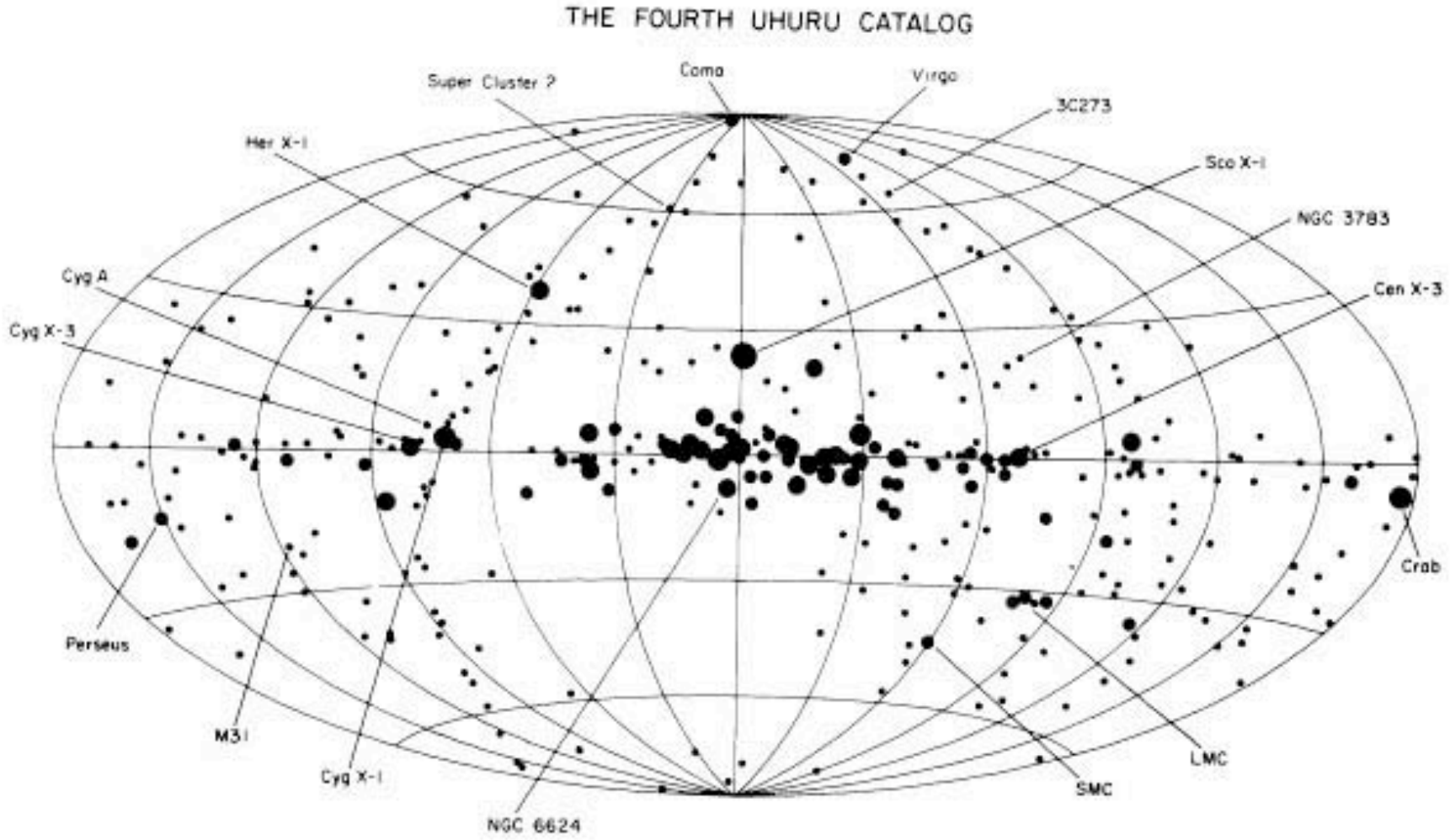
Patrizia Caraveo & Olaf Reimer
on behalf of the LAT UNID Team

The state of the art in γ-ray astronomy

•271 sources 172 UGO



Is it an anomalous situation ?



339 sources

206 without ID

The presence of unidentified sources is normal, when a field is (still) in its infancy

Genuinely **new** class of objects

Known objects with a **new** phenomenology

Known (catalogued) objects, floating in big error boxes

Improving angular resolution if always beneficial

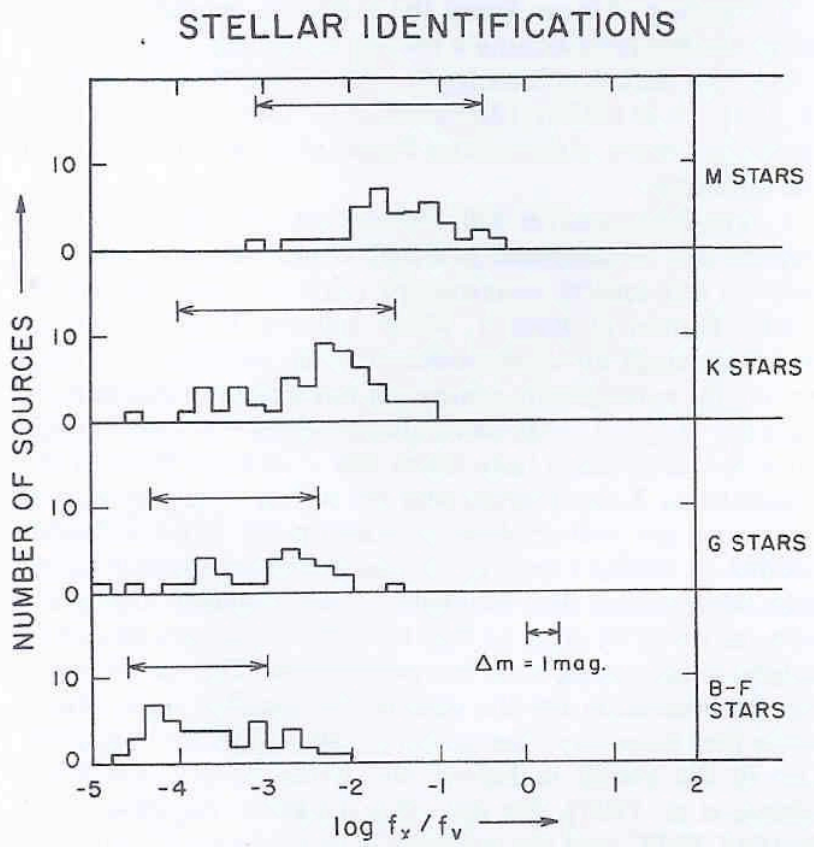
In the X-ray domain, focussing techniques dramatically improved angular resolution

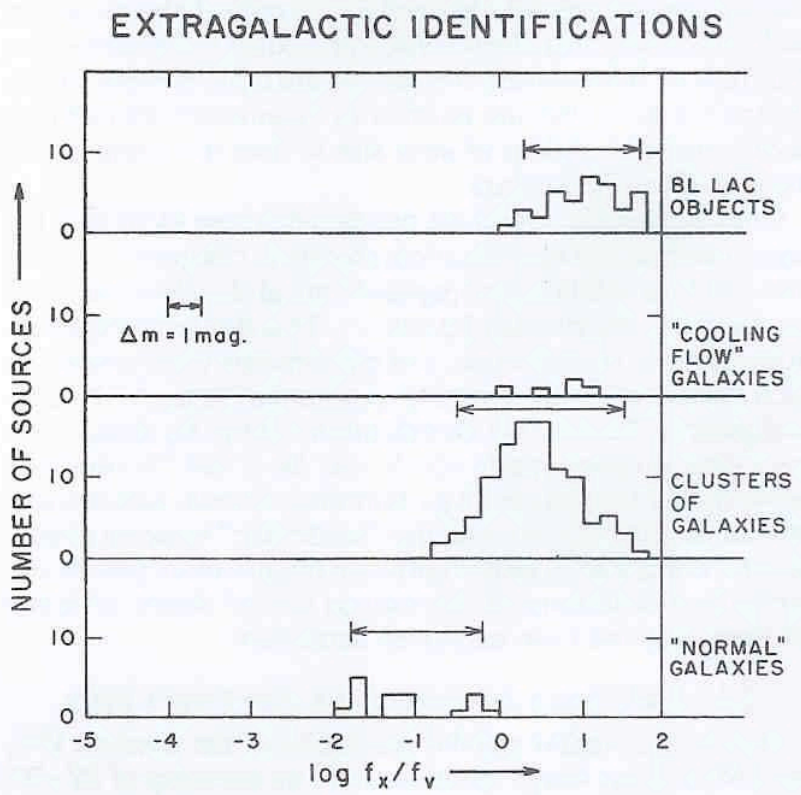
Einstein, …Rosat,… Chandra and XMM-Newton
1978 1999- today

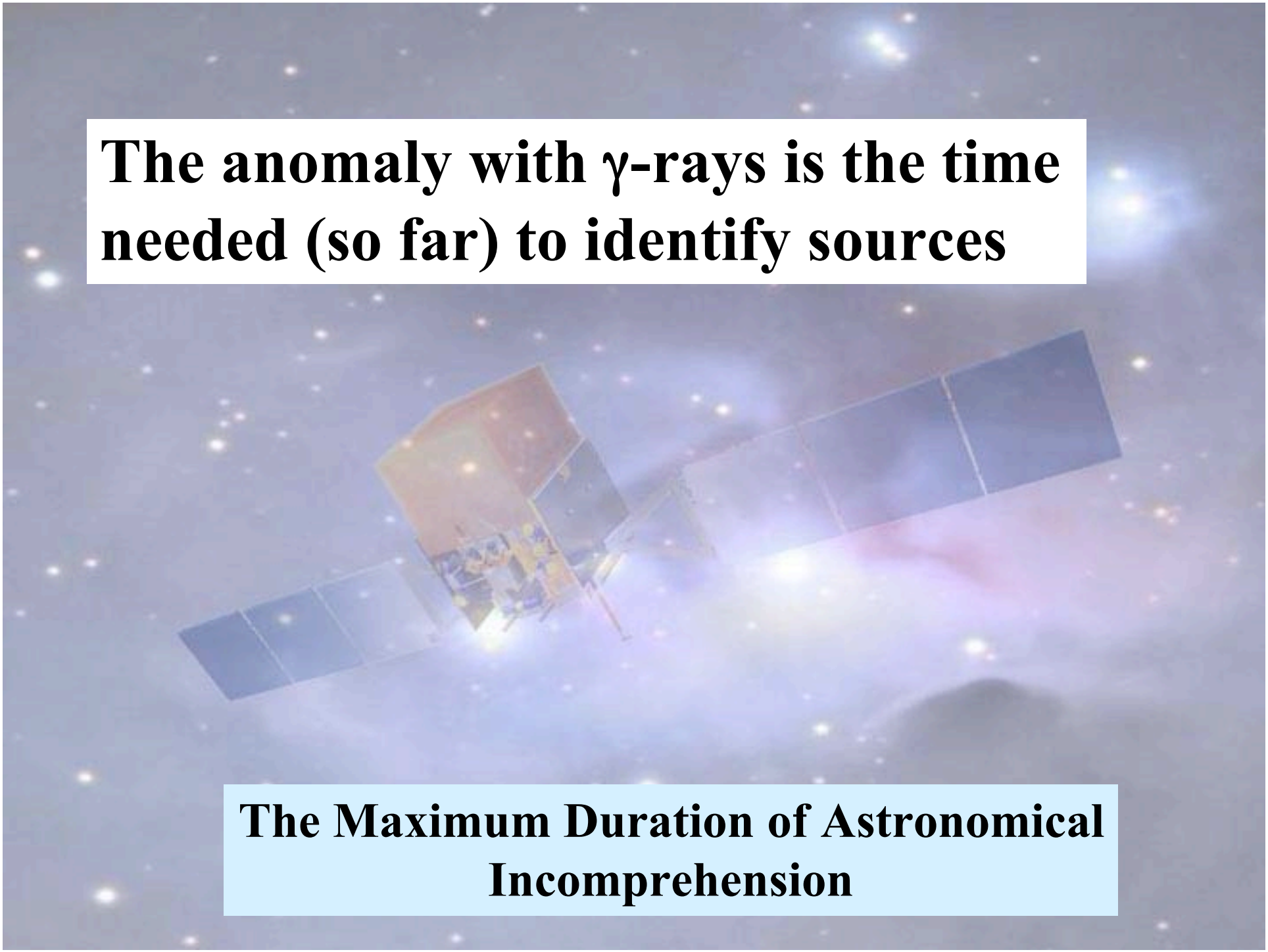
Unidentified X-ray sources are a rare exception

Plentiful individual identifications yielded statistical tools such as the Fx/Fopt parameter.

1991ApJS...76..813S






The anomaly with γ-rays is the time needed (so far) to identify sources
The Maximum Duration of Astronomical Incomprehension

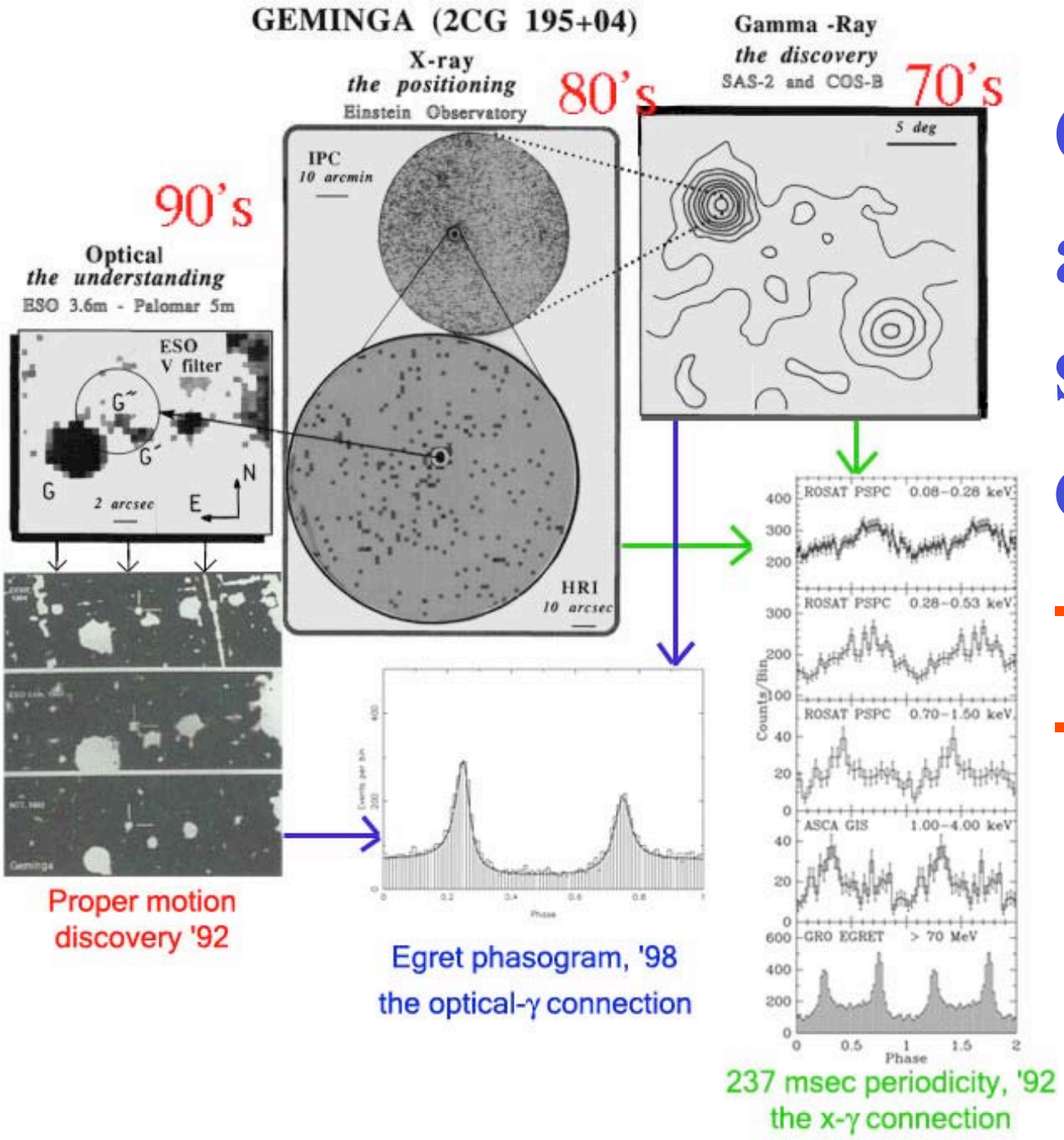
V. Trimble , 2003

- To those of us who lived through the period, the 24 years between the discovery of gamma ray bursts (1973) and their identification with very powerful events at cosmological distances (1997) seemed very long. The case will, however, be made that Mira variables, coronal lines, and others remained puzzling much longer, from the time when they were recognized as requiring an explanation until a successful explanation was found. It is possible that some phenomena now with us (the nature of dark matter, cosmic ray acceleration, etc.) will also exceed the GRB mark and perhaps even the coronal line century.

1CG catalogue has been published in 1977

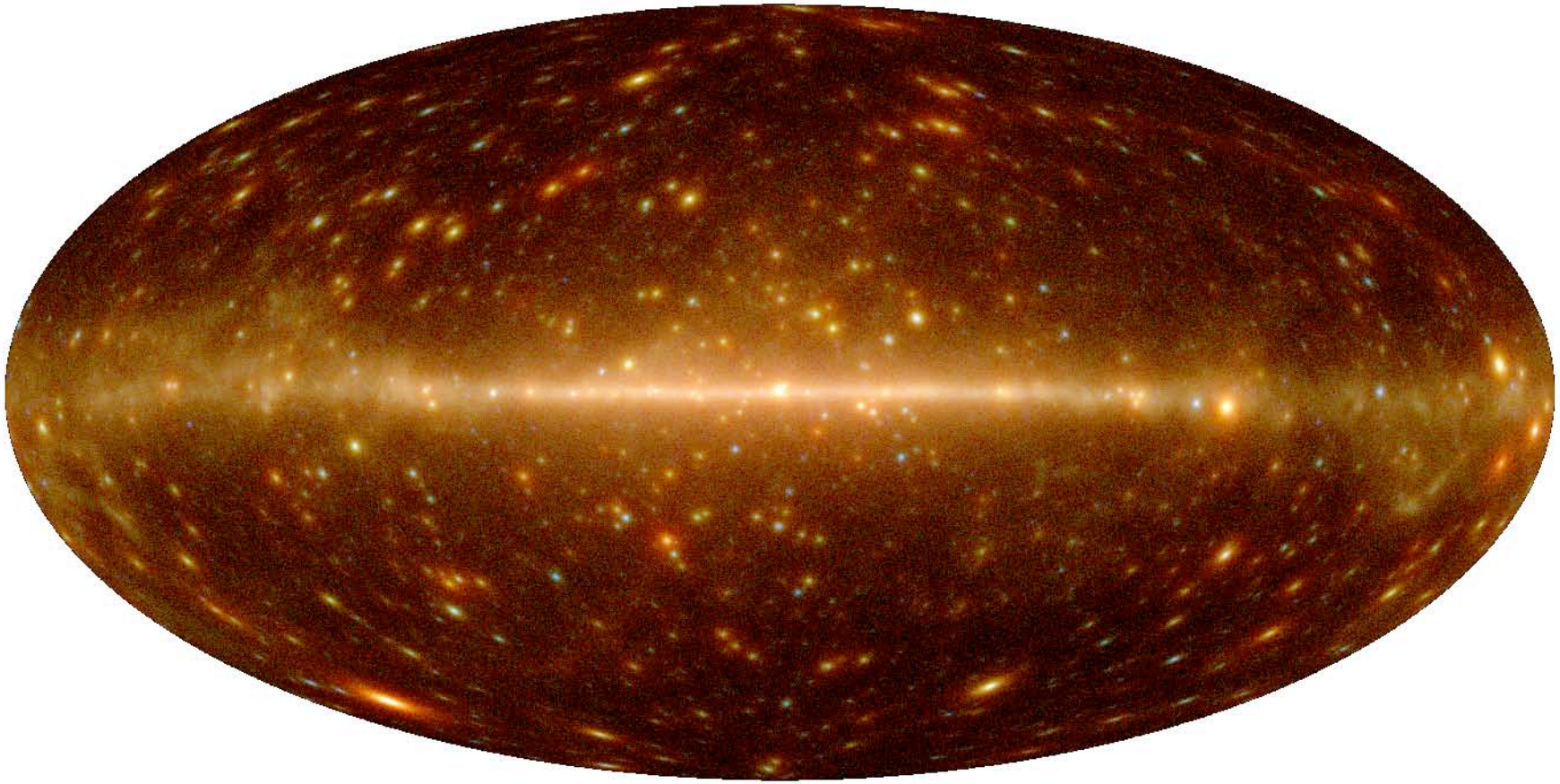
The culprit has been the lack of angular resolution, implying big error boxes

Multiwavelength strategy was devised



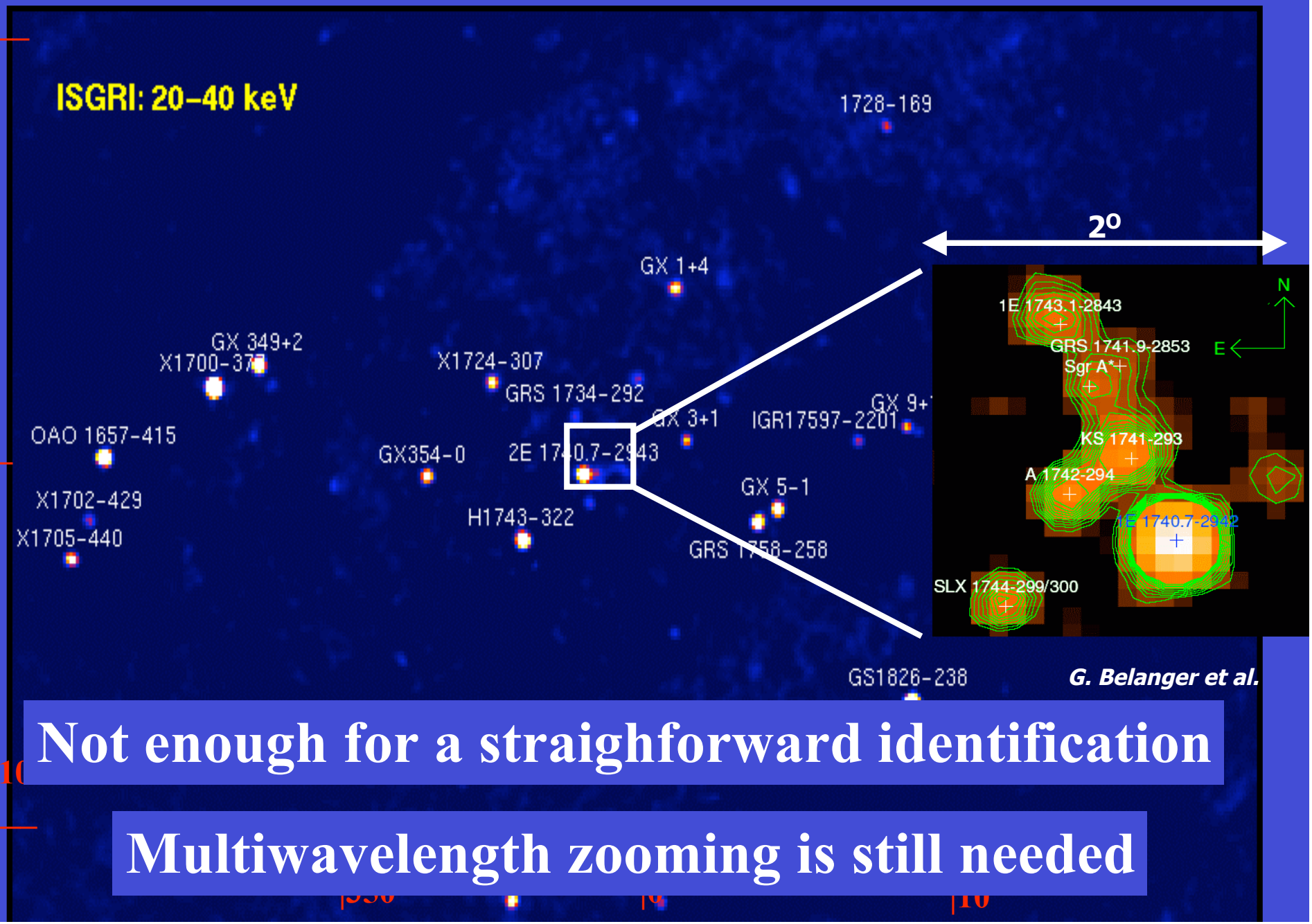
Geminga is a success story based on

- luck
- endurance



Glast will detect hundreds of sources which will be positioned at a 5-10 arcmin level

INTEGRAL Map of the Central Galactic Region



G. Belanger et al.

Not enough for a straighforward identification

Multiwavelength zooming is still needed

a standard multiλλλ approach cannot be applied to hundreds of sources

Observing time (impossibly) intensive

Often not conclusive

Shallow XMM observations (10 ksec) yield 150 sources /sq deg., i.e.:

- **Error radius 10' → 15 sources**
- **Error radius 5' → 4 sources**
- **Error radius 3' → 1-2 sources**

Optical/radio follow-up difficult

Will population studies help?

Yes, to indicate which source populations may hide in the diversity of LAT detections.

EGRET: SNRs!, OB-associations, WRs?, … ?

No, we still have to single out archetypal individuals of new source classes and firmly identify them in λλλ.

There's no way around having a viable Mulitλλλ identification scheme for LAT source identifications!

We propose a 2-step approach

1 -From detection to association

2 -From association to identification

1 -From detection to association

Figure of merit approach

Smart use of catalogues

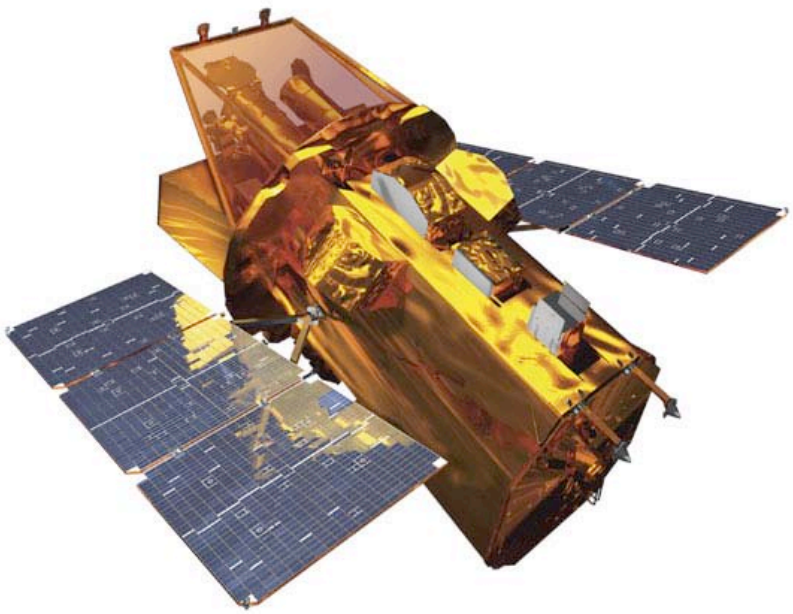
FoM from:
- educated guesses on c.o.p.
- variability,
- energetics

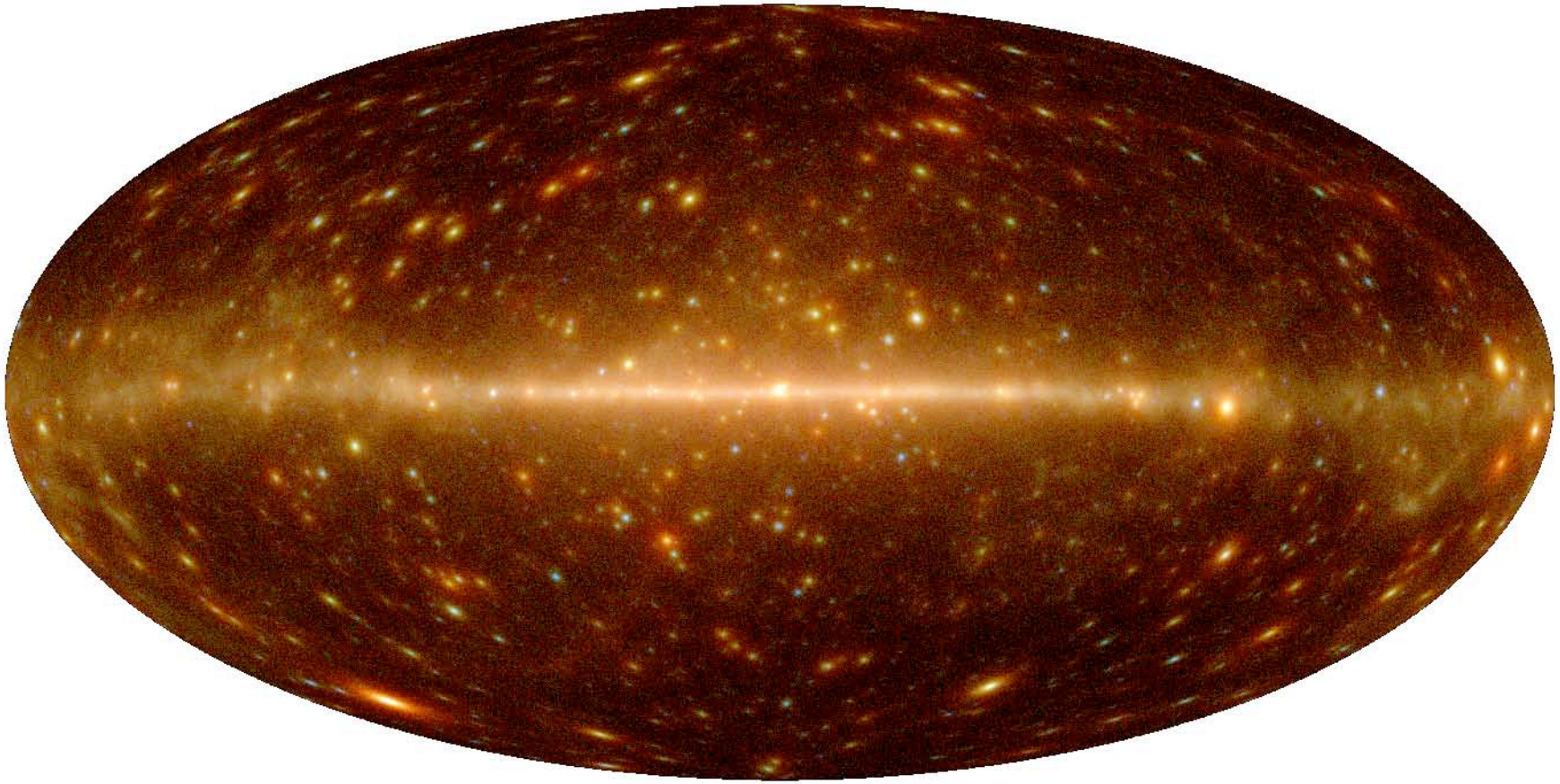
FoM suggests plausible associations

2 -From association to identification

Multiλλλ ob's of high FoM targets can secure identifications

e.g.:Swift filler obs time





Individual identifications will provide statistical tools, such as Fγ/Fx or Fγ /Fradio or Fγ/Fopt …