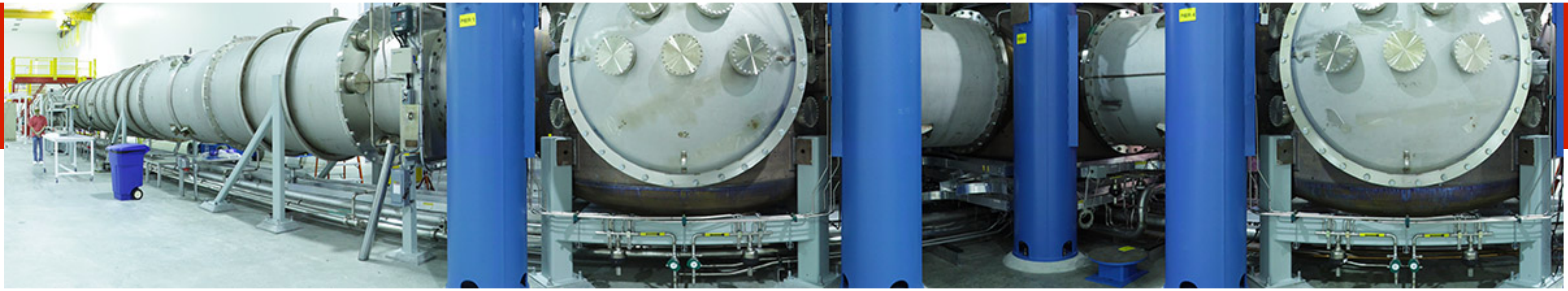
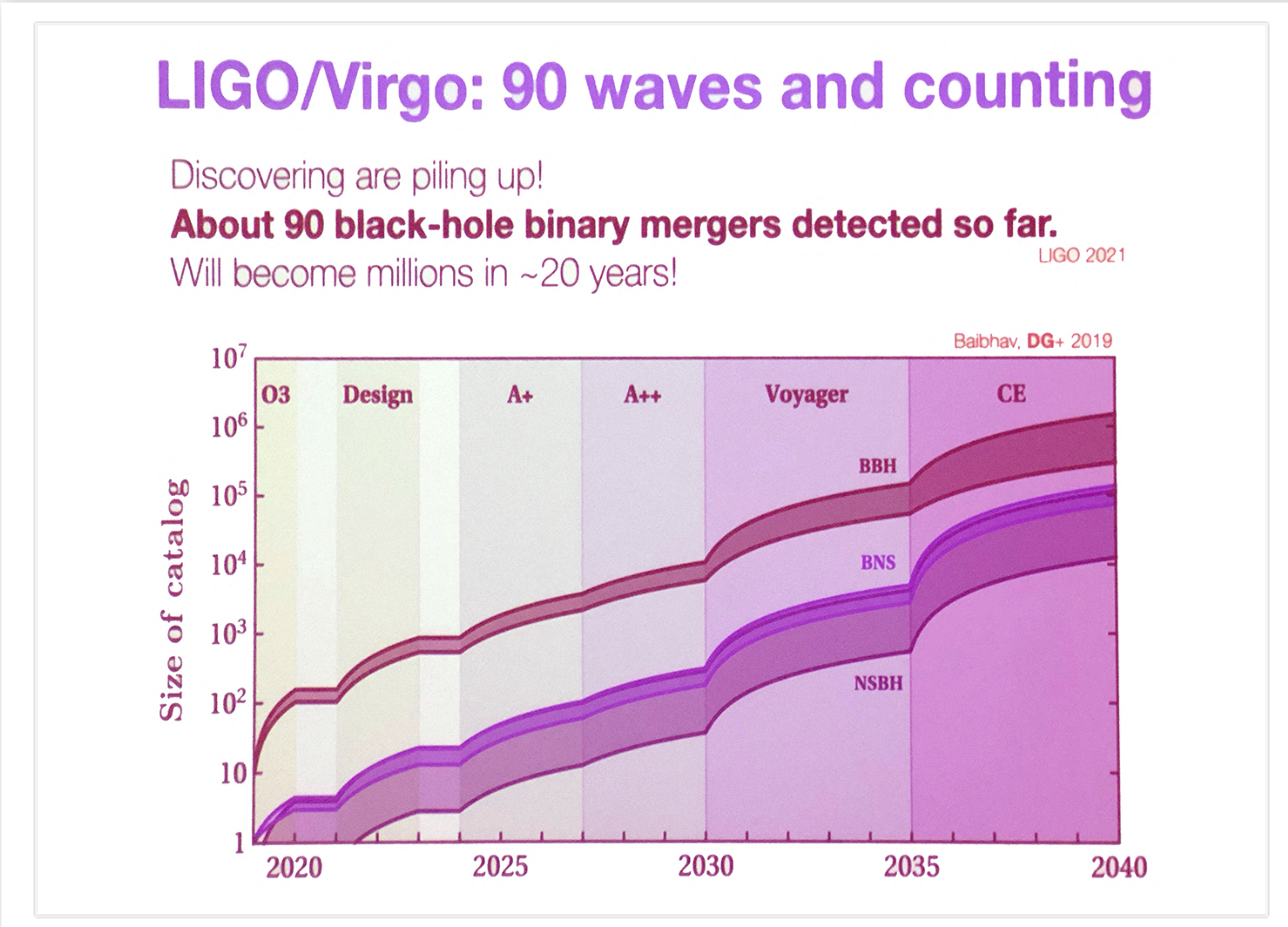


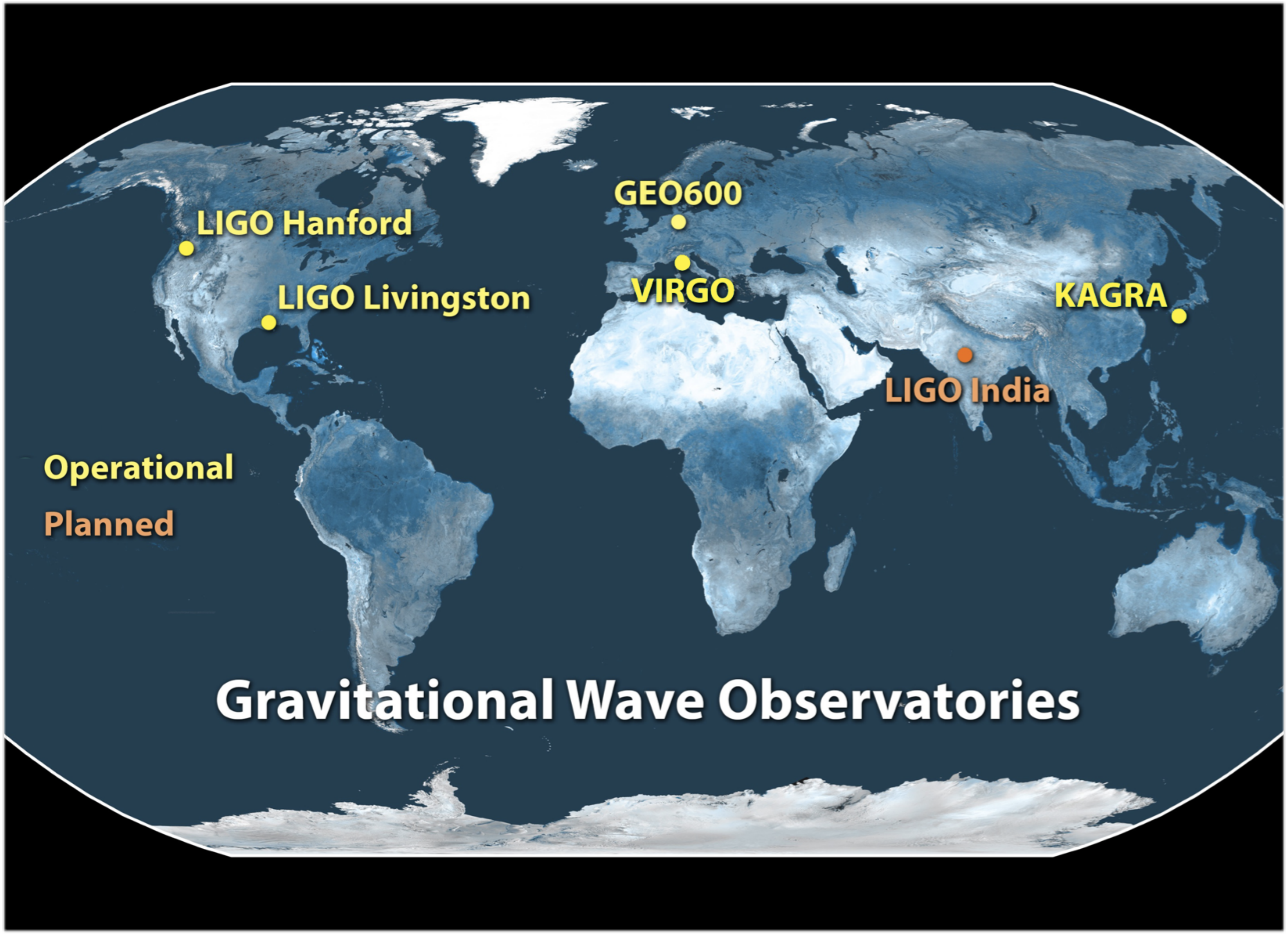
Localizing GW sources to aid EM follow-up observations

Zsolt Frei, Eötvös University, Budapest
December 6, 2022, Jerusalem

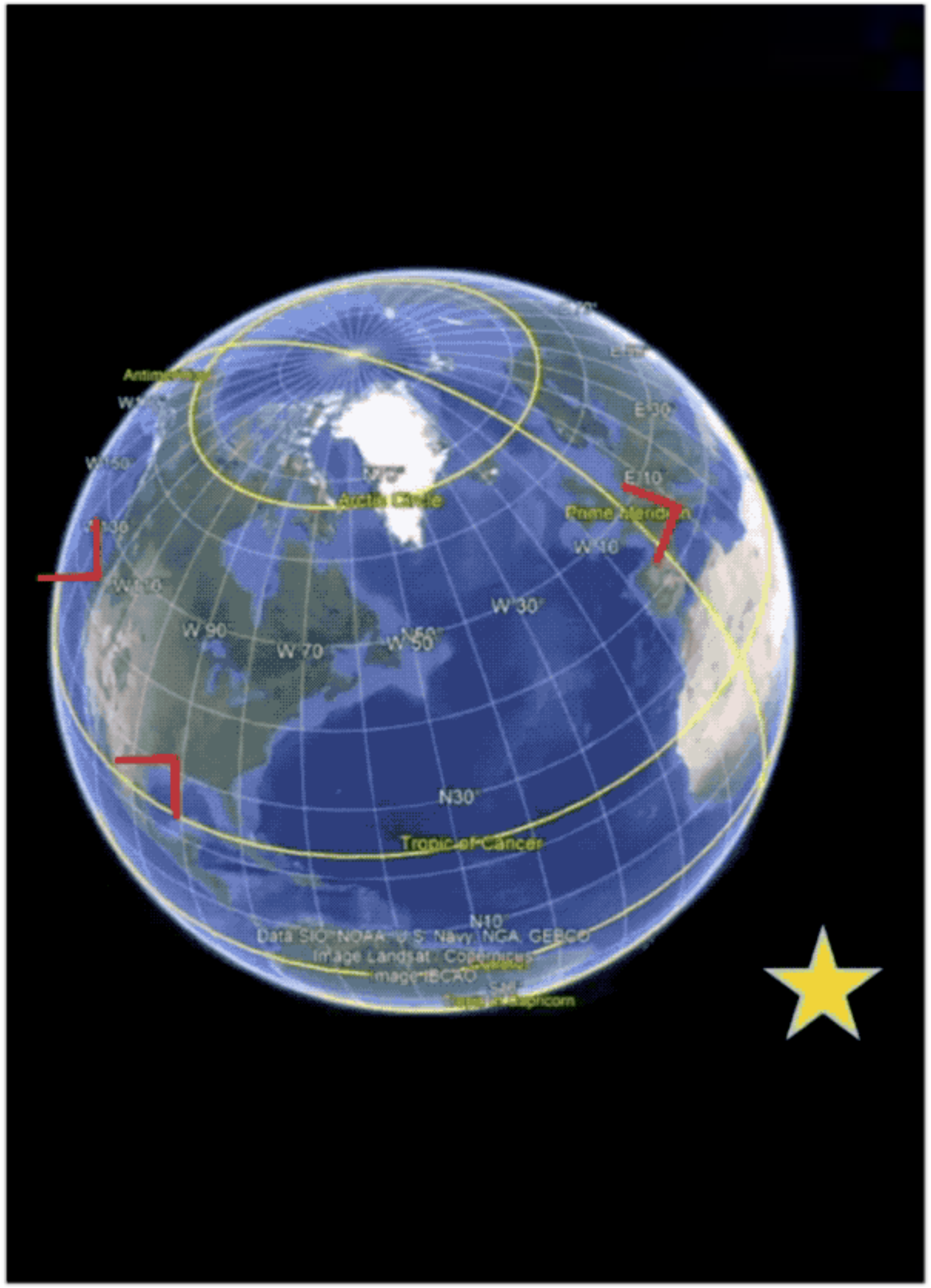
Budapest in December…

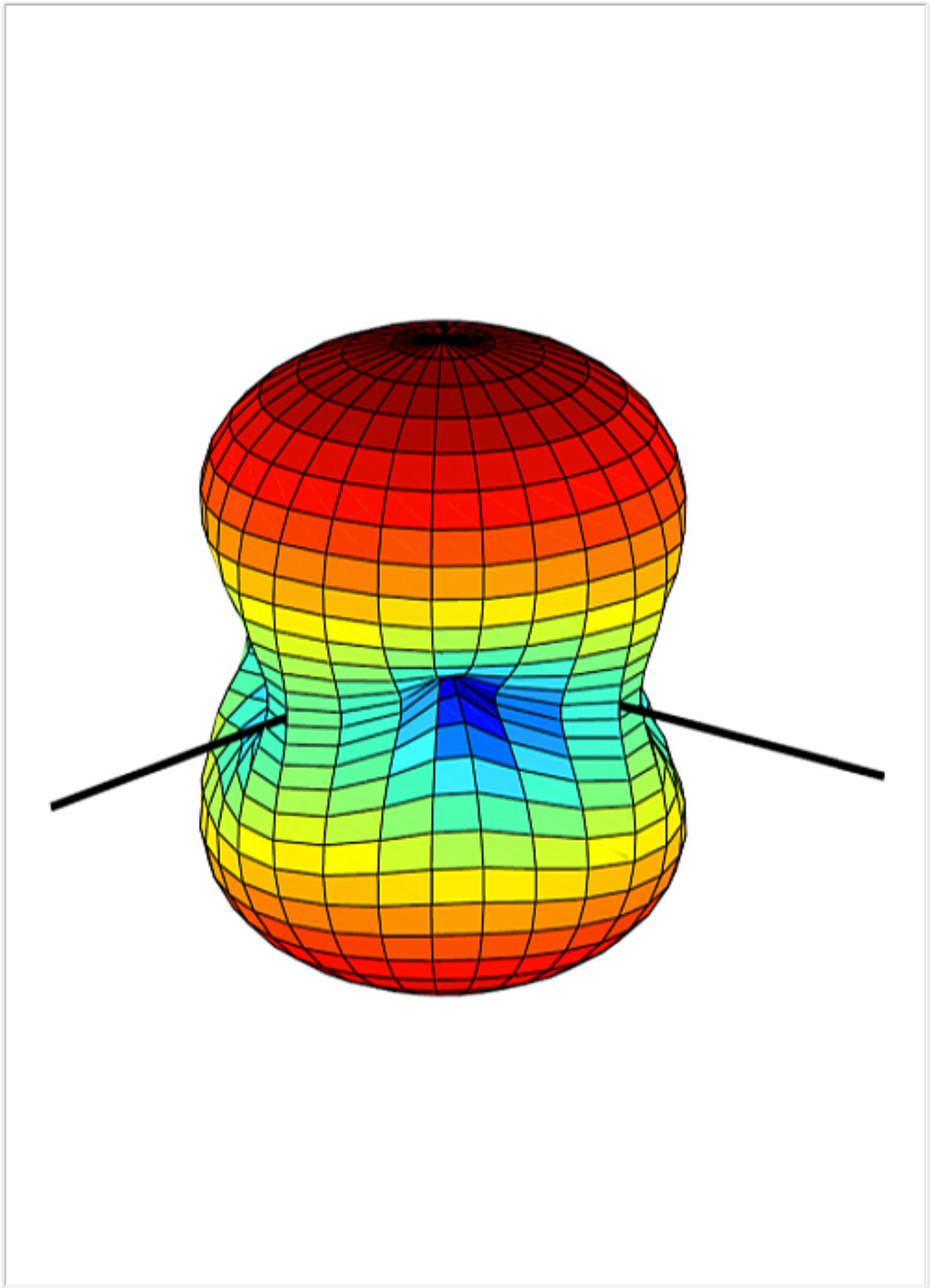


Stolen from Davide yesterday….



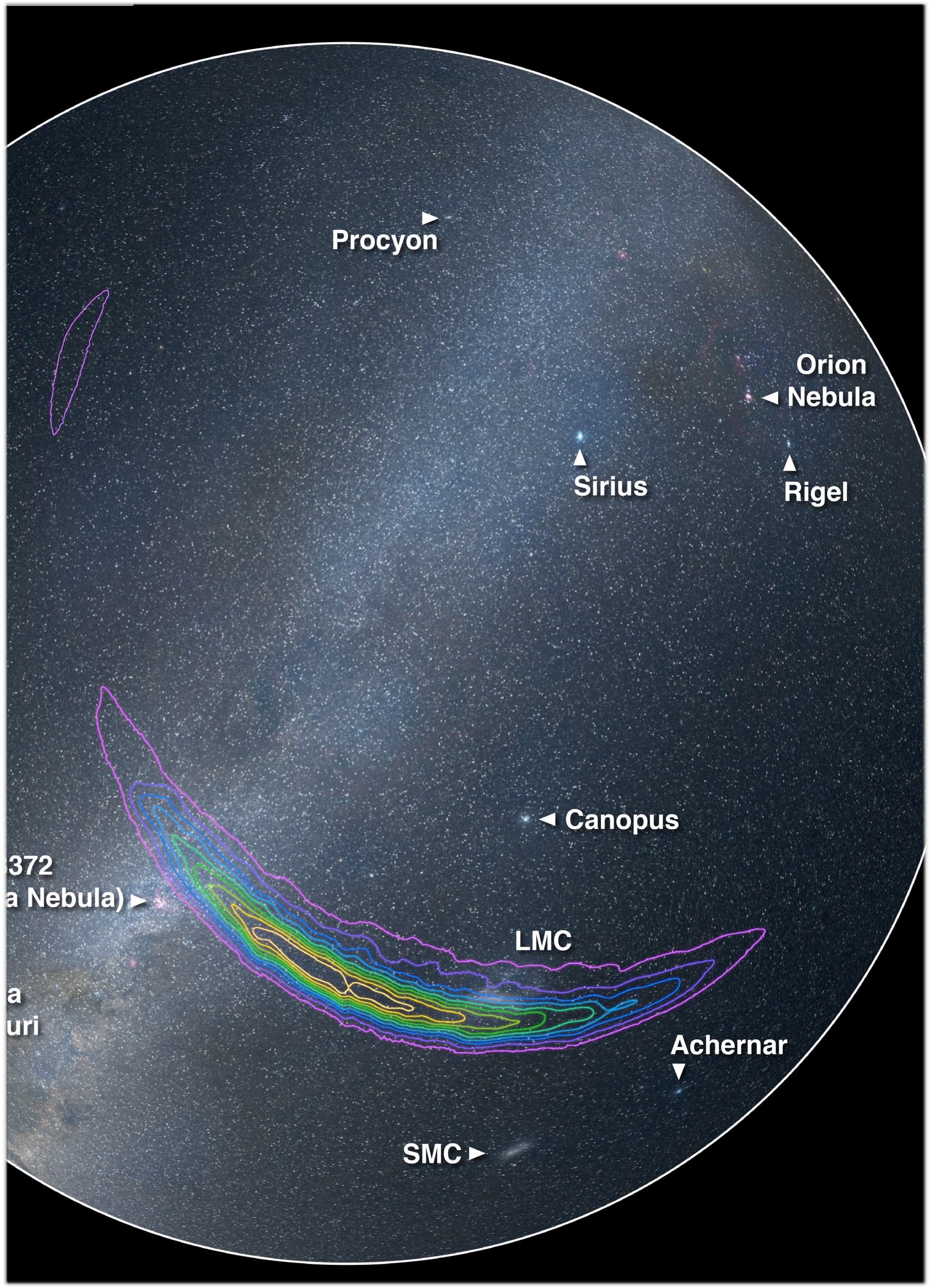
Laser Interferometers around the world

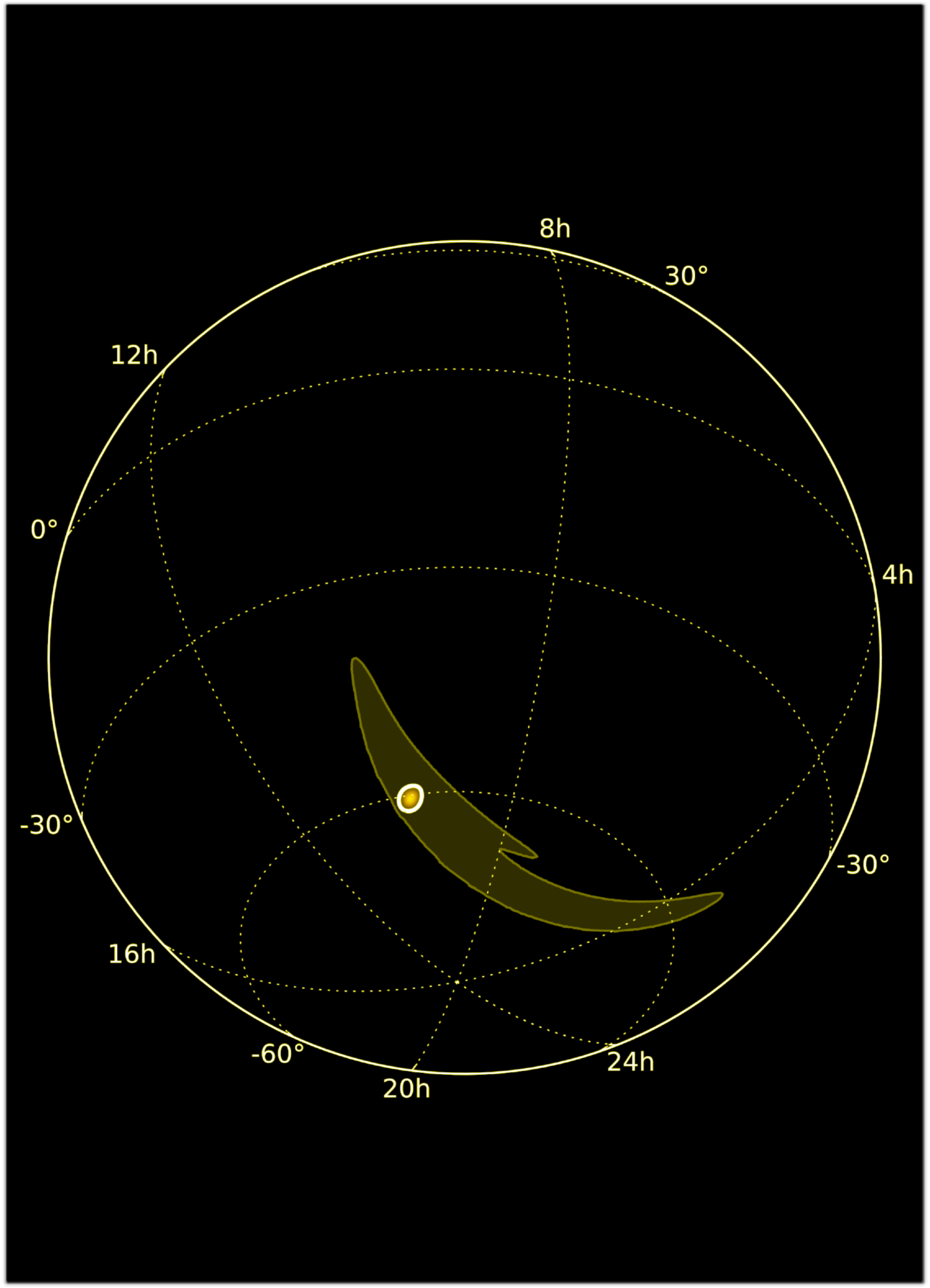




Not GW170817, just an example…

How to localise GW sources





Localization “precision”

aquarius.elte.hu/glade/

Eötvös Gravity Research Group

EGRG

- Description
- Download the catalog
- Previous versions
- Documentation
- Gamma-ray bursts

GLADE (Galaxy List for the Advanced Detector Era)

Description

We are introducing a value-added full-sky galaxy catalog with high completeness for identifying gravitational wave (GW) sources in order to support future electromagnetic (EM) follow-up projects of the LIGO/Virgo Collaboration. The catalog has been constructed (combined and matched) from four existing galaxy catalogs: **GWGC**, **2MPZ**, **2MASS XSC** and **HyperLEDA**. Additionally, we have extended GLADE with the **SDSS-DR12 quasar catalog**. GLADE contains 3,262,883 objects, which is two orders of magnitude greater than the number of galaxies in the GWGC catalog alone (53,312). Naturally, GLADE could be used in a broad range of various astrophysical projects besides EM follow-up efforts.

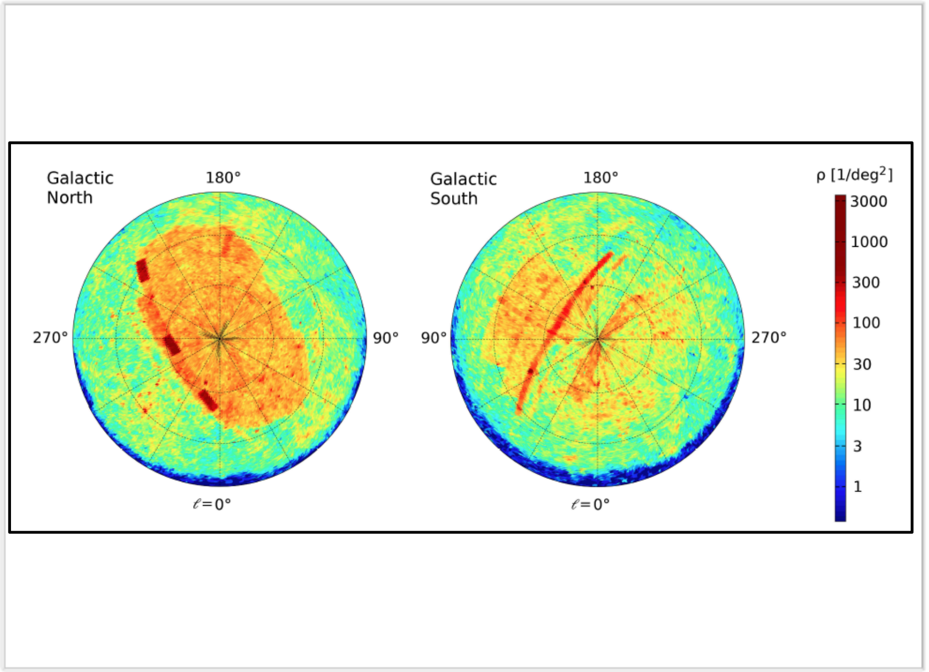
For a brief overview of the GLADE project, check out the **talk slides** presented at the 2015 September LIGO-Virgo Collaboration Meeting in Budapest, Hungary.

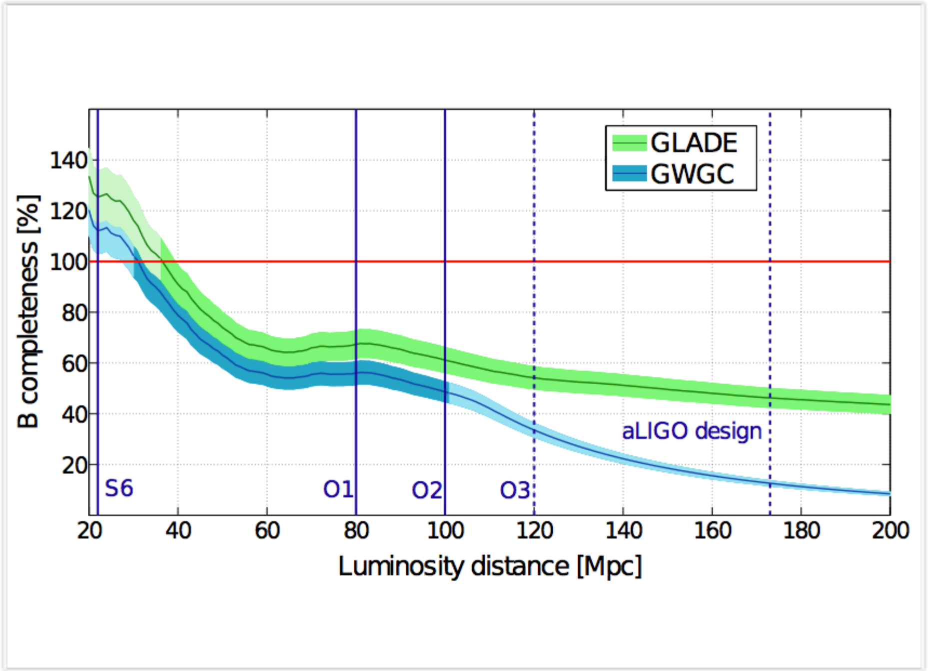
Acknowledgments

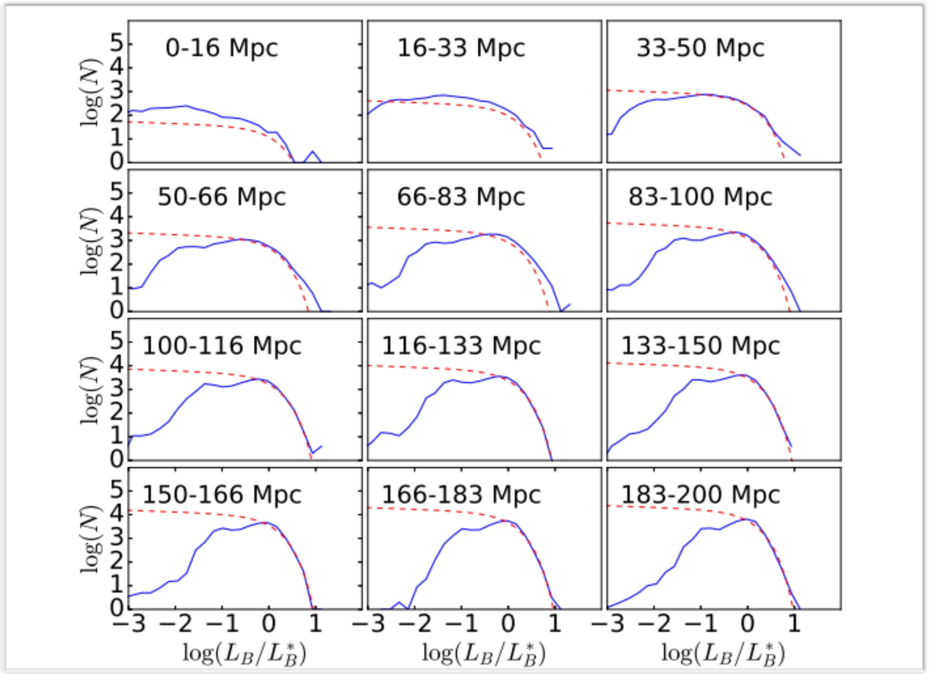
We are very grateful for the Wide Field Astronomy Unit (WFAU) for providing the 2MPZ data used in creating GLADE.

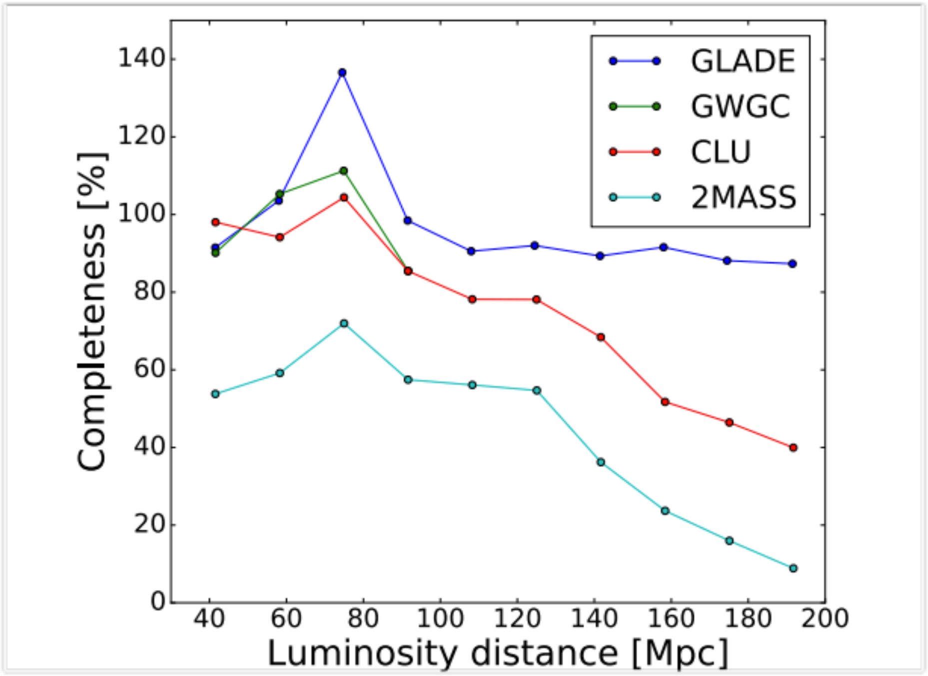
If you have any questions or suggestions about the catalog, please send us an email: dalyag@caesar.elte.hu

Our new galaxy catalog: GLADE (Galaxy List for the Advanced Detector Era)



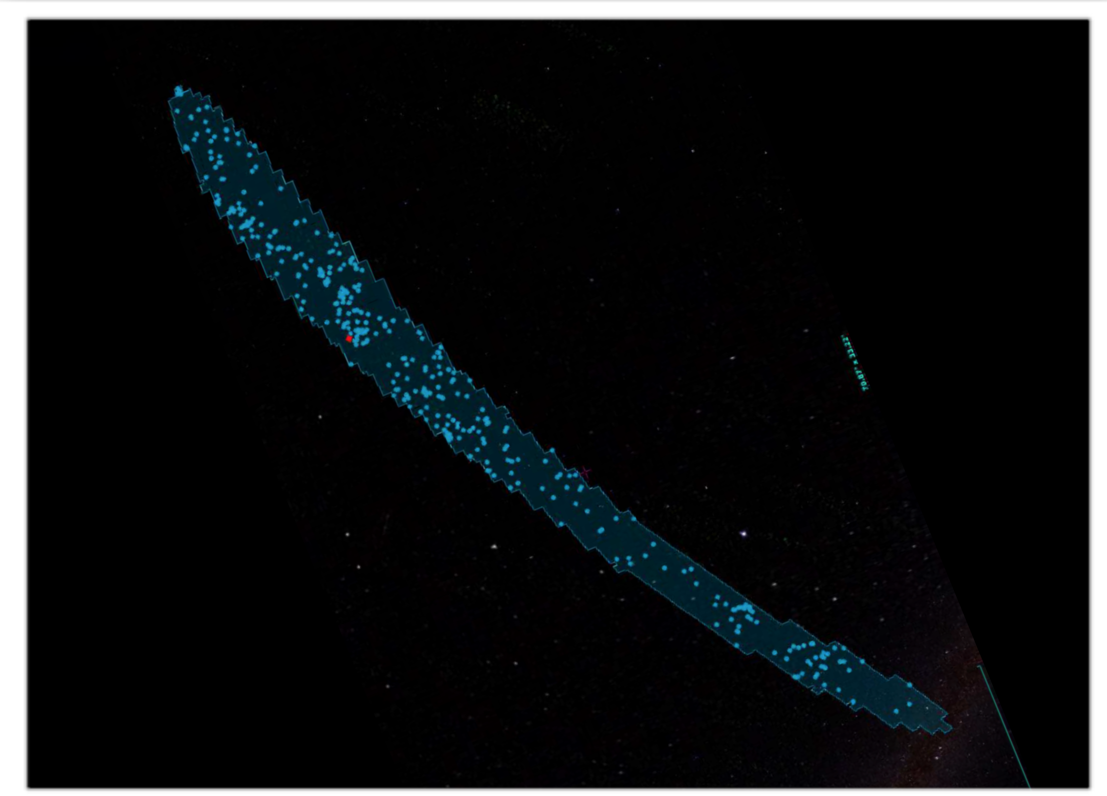


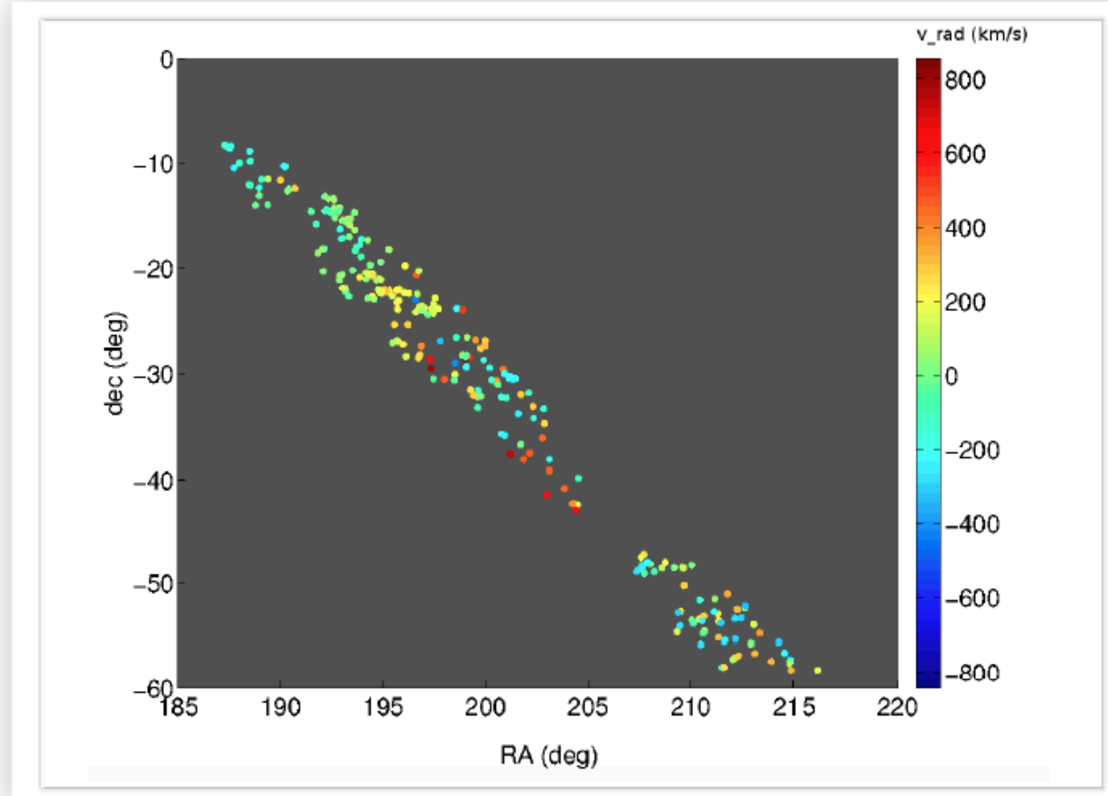




Technical details

Assembled from: GWGC (50k), 2MPZ (2MASS with photo-z, 930k), 2MASS XSC (Extended Source Catalog, 1.65m), HyperLEDA (2.6m), SDSS-DR12 QSOs (300k)

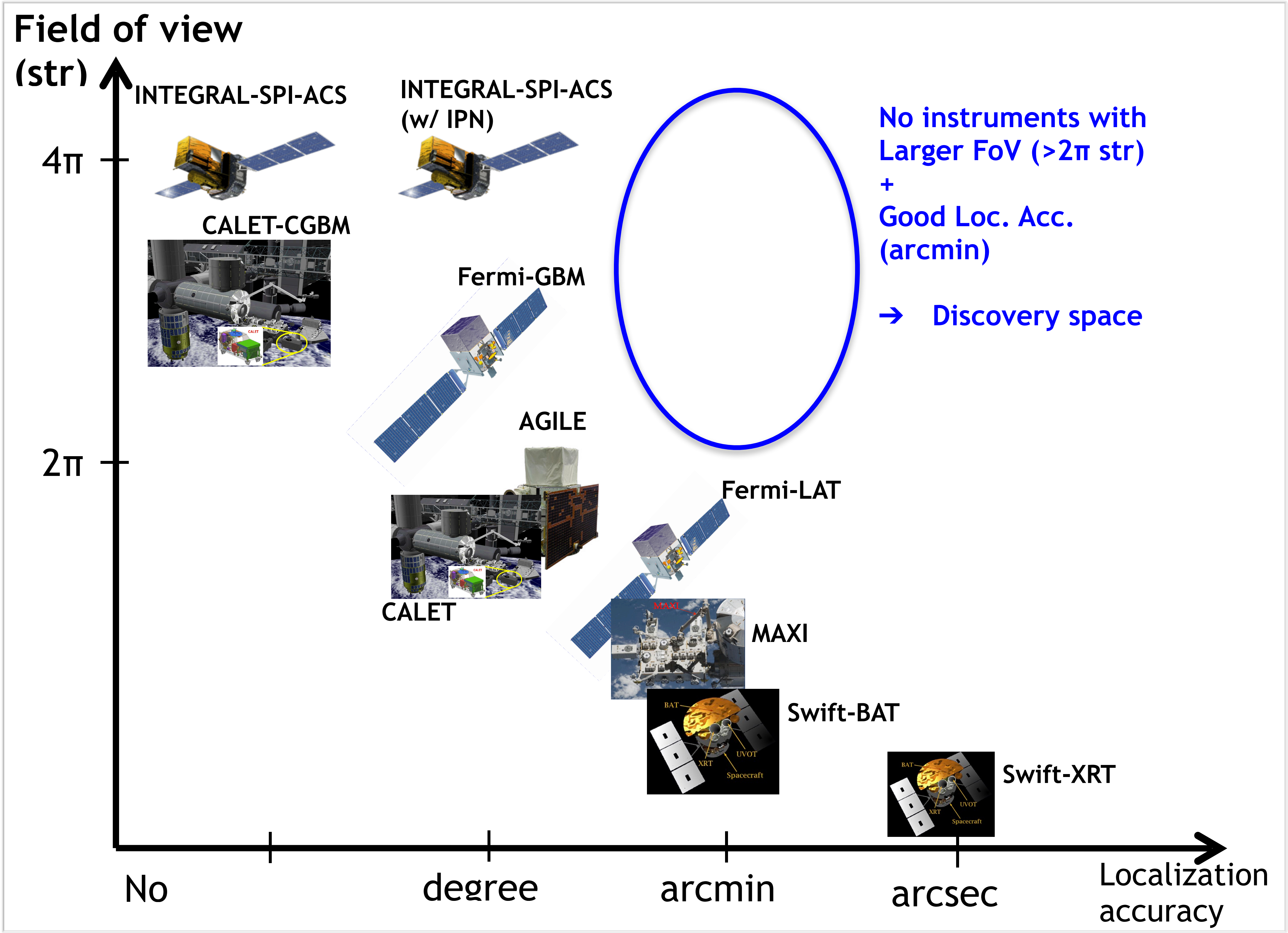




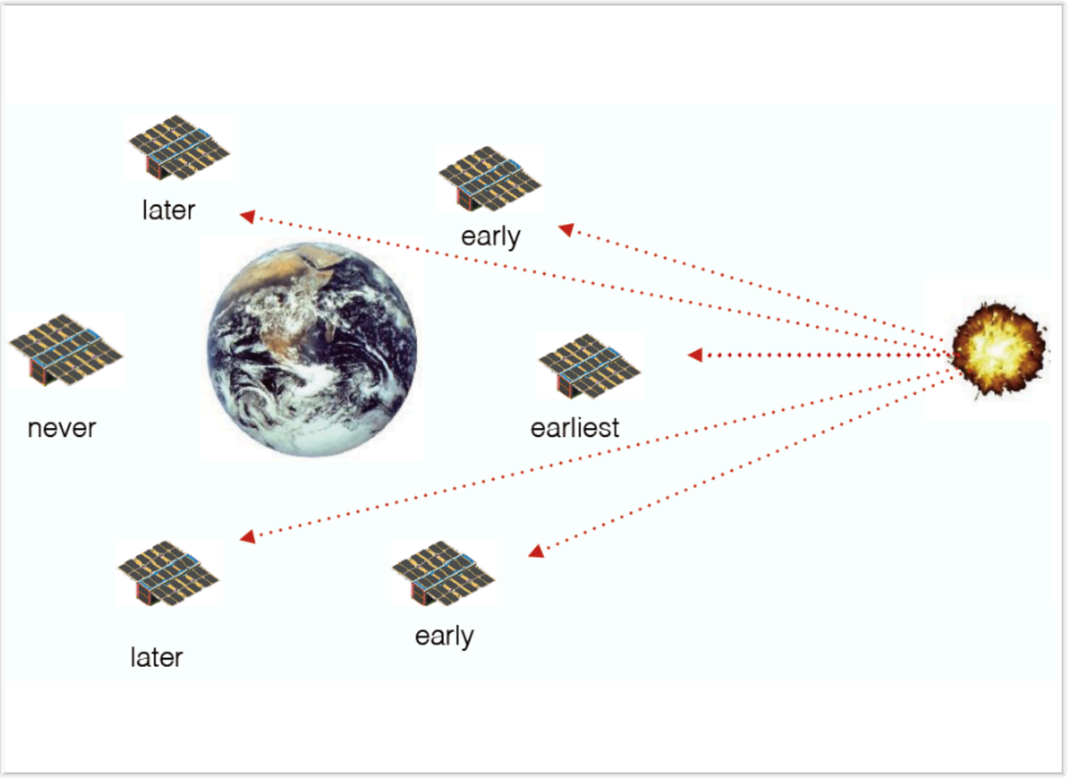
Galaxies from GLADE in the error box, and required radial velocity corrections

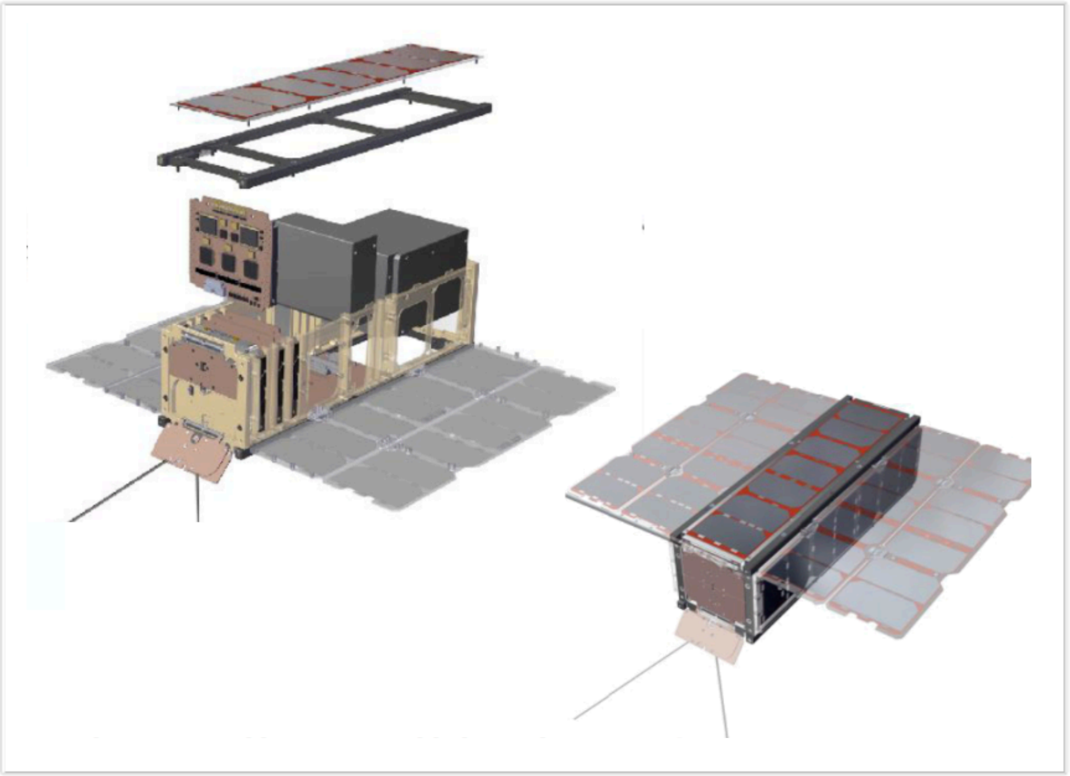
- Precise radial velocity information is required for the estimation of the Hubble constant

- Information comes from the model of the local (“Virgo-centric”) flow



Slide from Norbert Werner, thanks!!!!





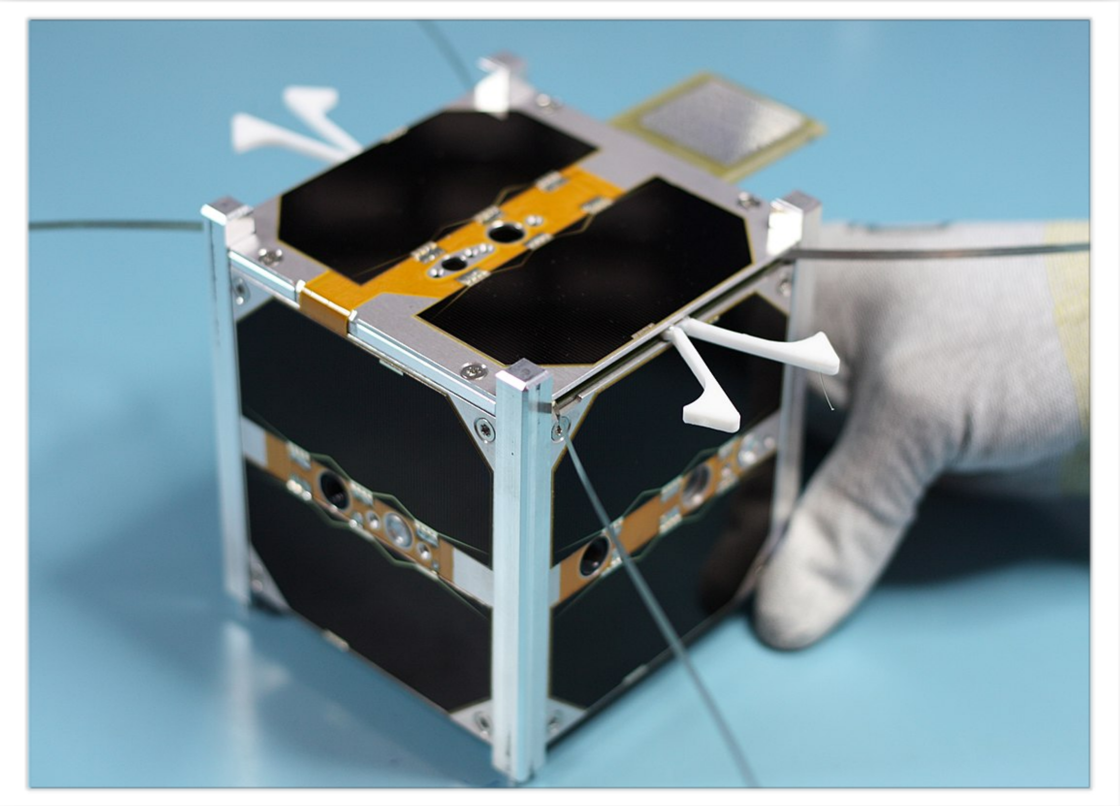
CAMELOT:
Cubesat Array for MEasuring and LOcalizing Transients

A constellation of at least **9 satellites** can provide:

- **all sky coverage** with a large effective area
- Better than 0.1 millisecond timing accuracy
- **~10 arcmin localisation accuracy** using triangulation

Each satellite will use a standard **3U cubesat** platform developed by C3S LLC for the ESA sponsored RadCube mission.

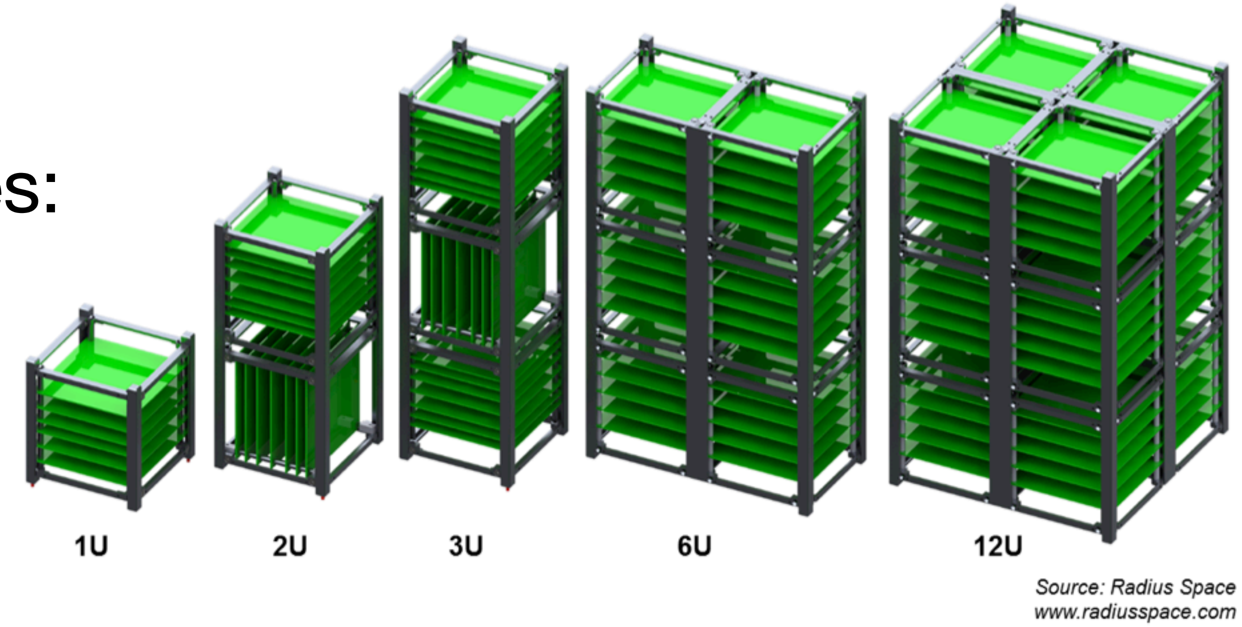
The cubsesats will be equipped with a *GPS receiver for precise time synchronisation* and *inter-satellite* (Iridium NEXT) *communication* equipment for *rapid data download*

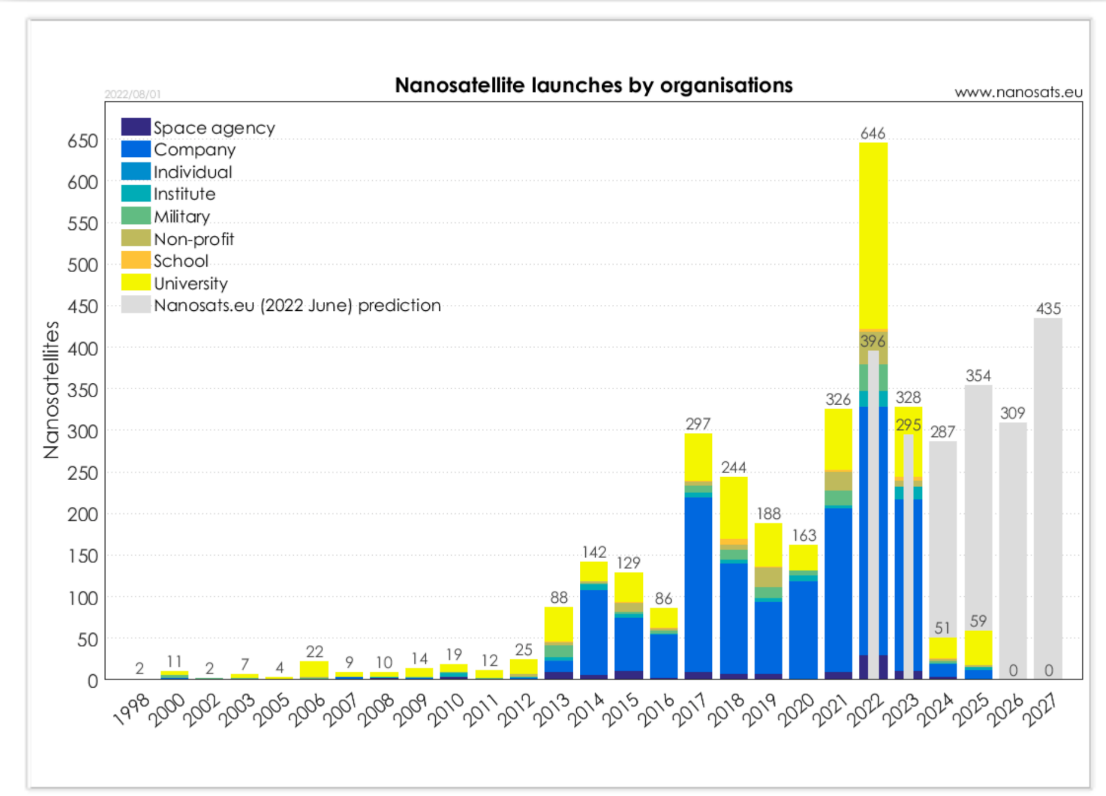


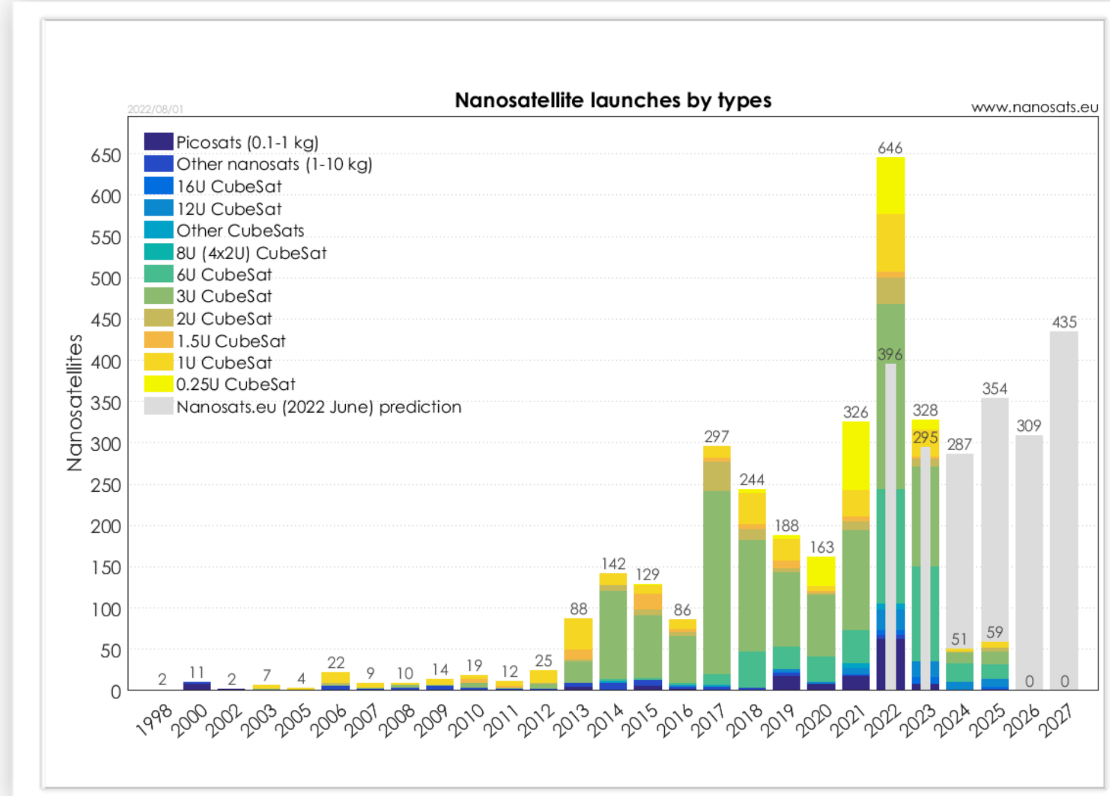
Cubesats deployed from the Space Station

The new era of nanosatellites (cubesats)

Standard cubesat sizes:



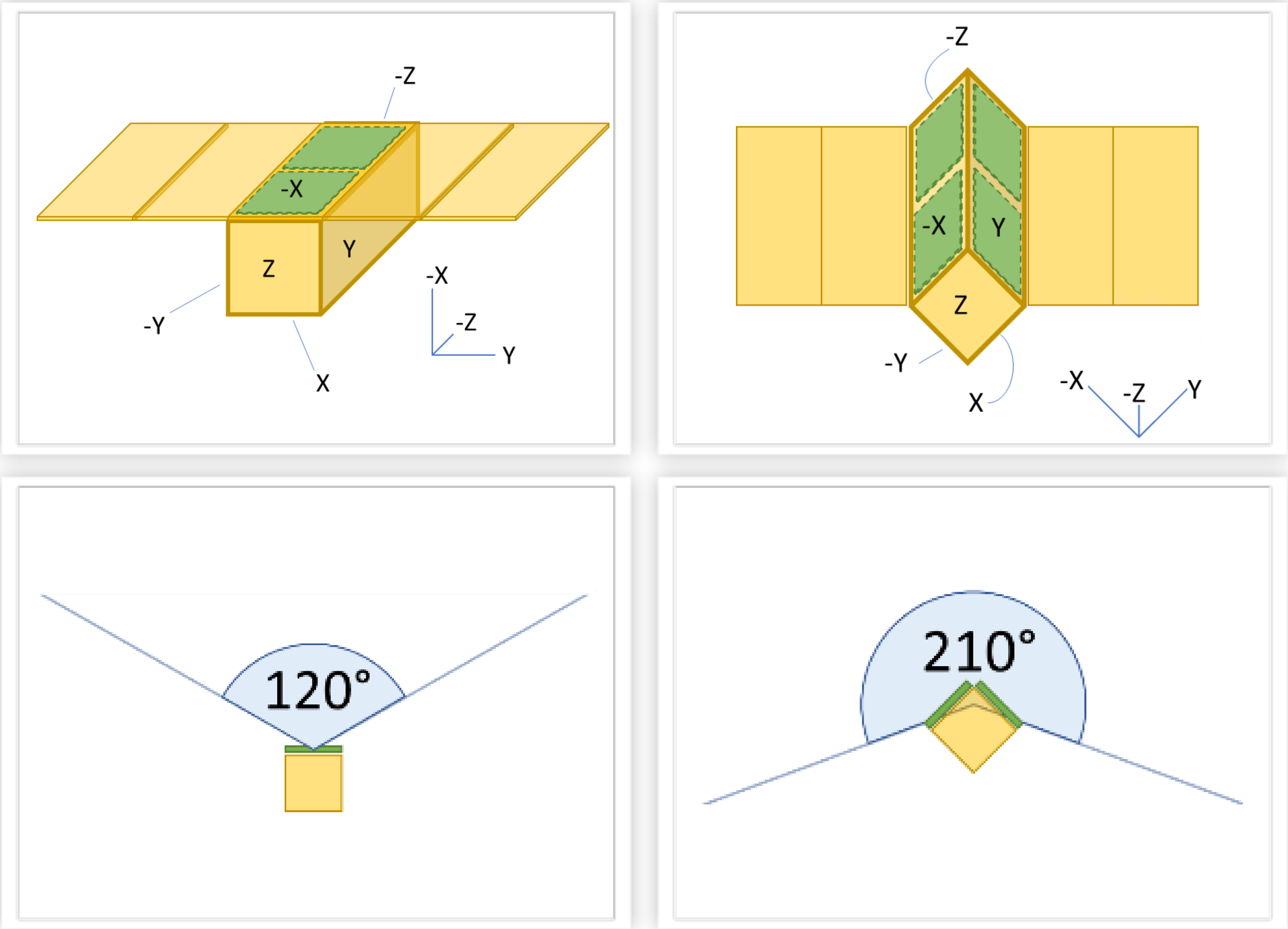




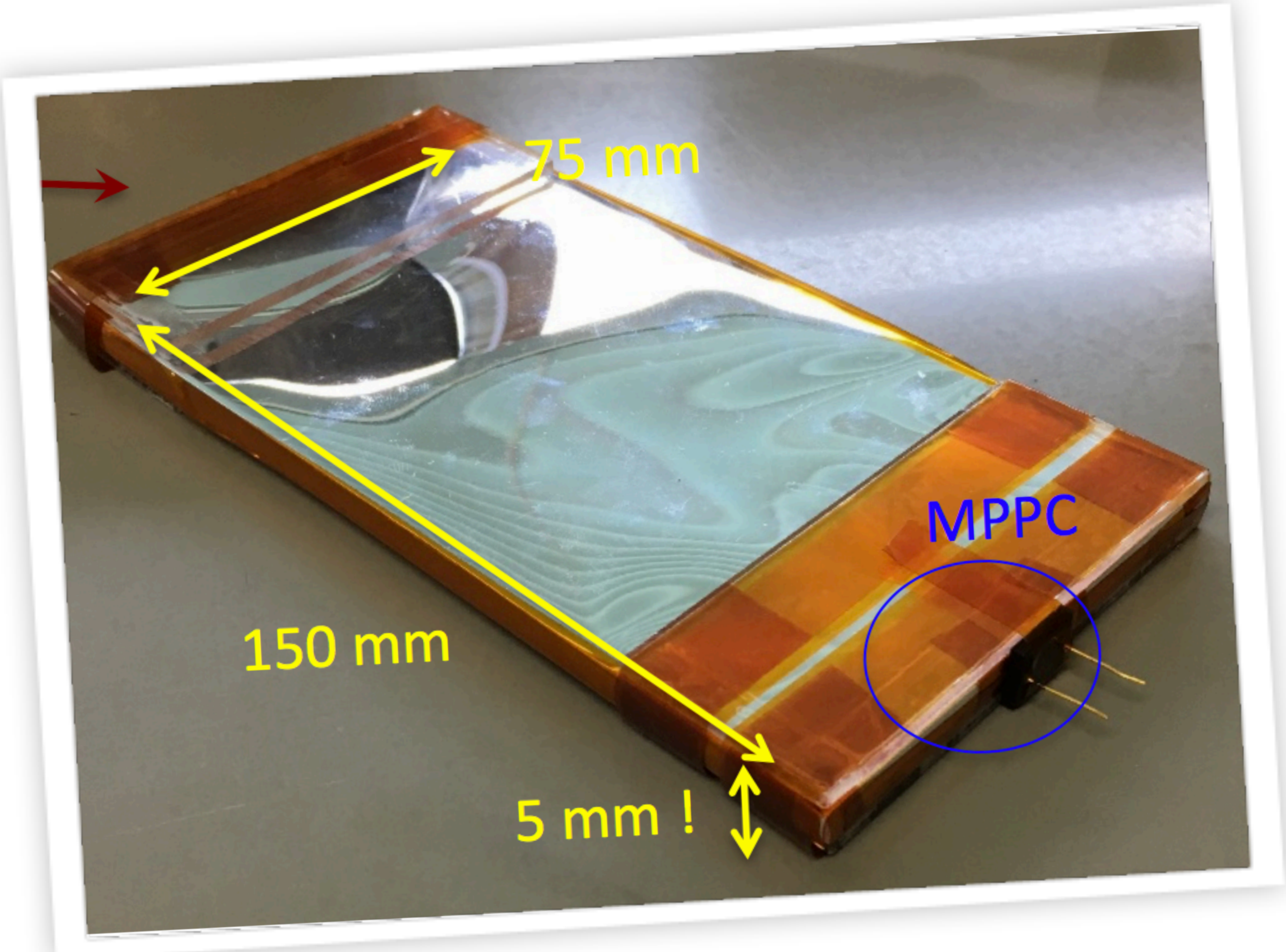
Three epochs of cubesat development:

1) Small projects by students and enthusiasts
2) **Demonstration of new technology for space applications**
3) Breakthrough science and full scale commercial use

Most cubesats built by <u>private companies</u> and <u>universities</u>, not space agencies



Two possible detector configurations

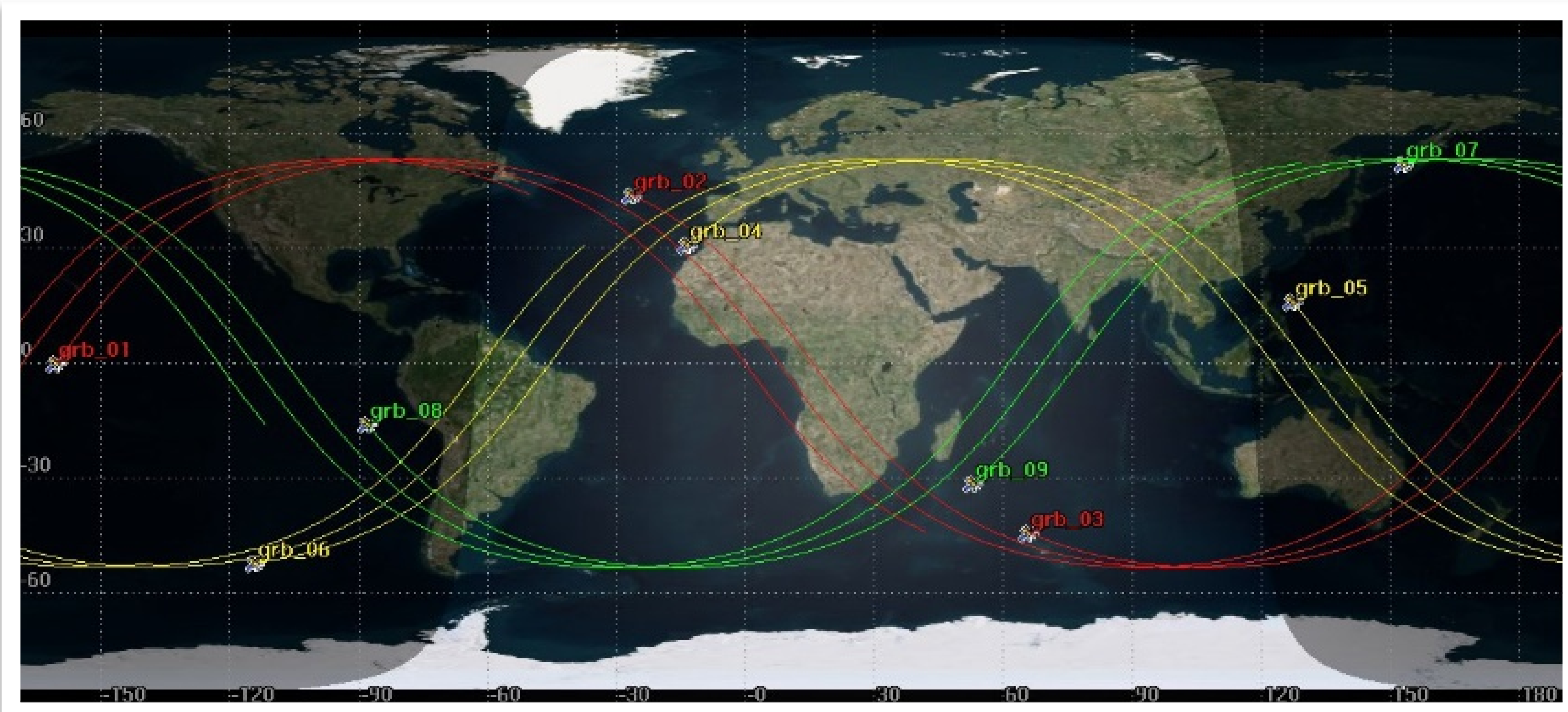


The detector design

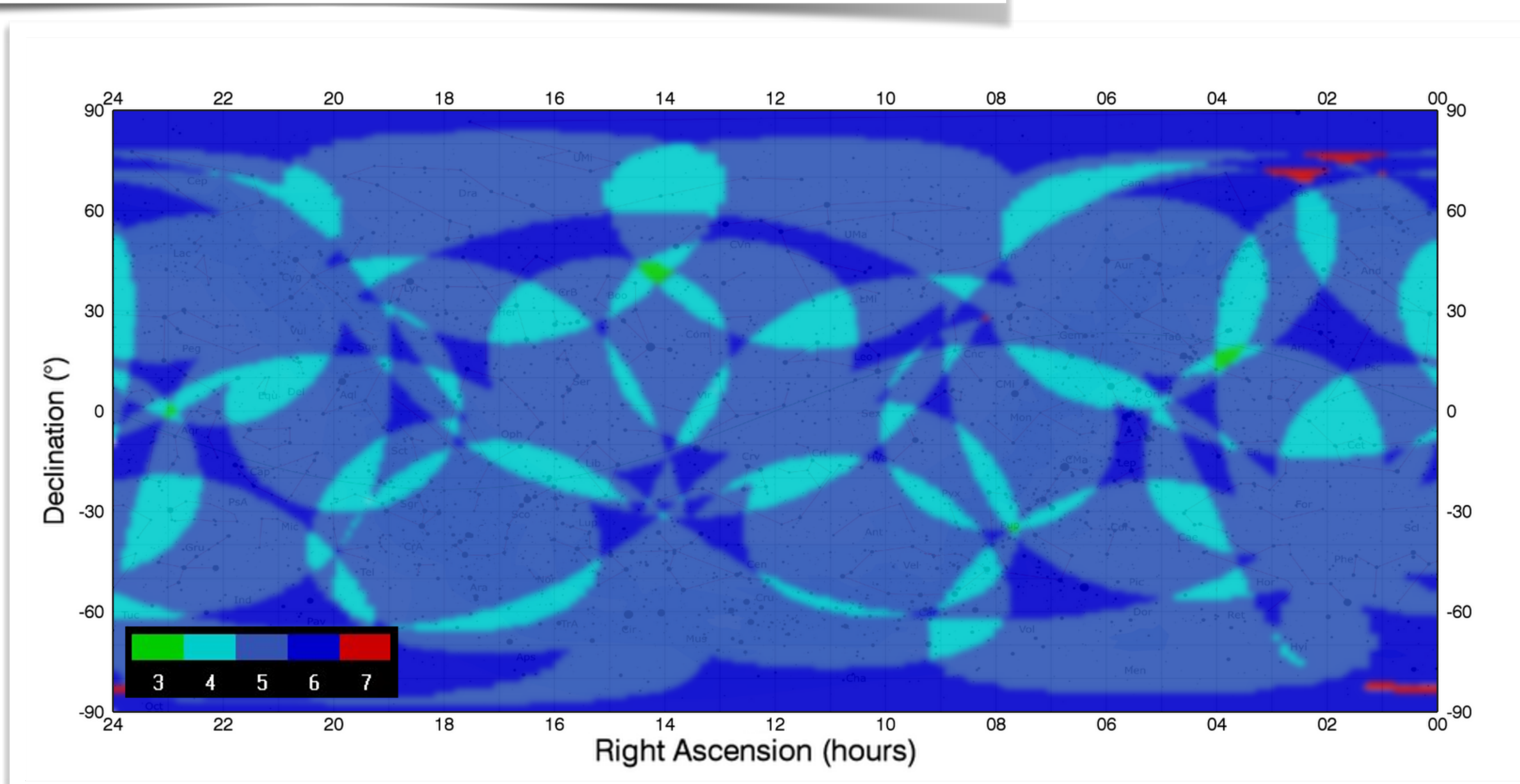
Large and thin detectors with small readout area are challenging.

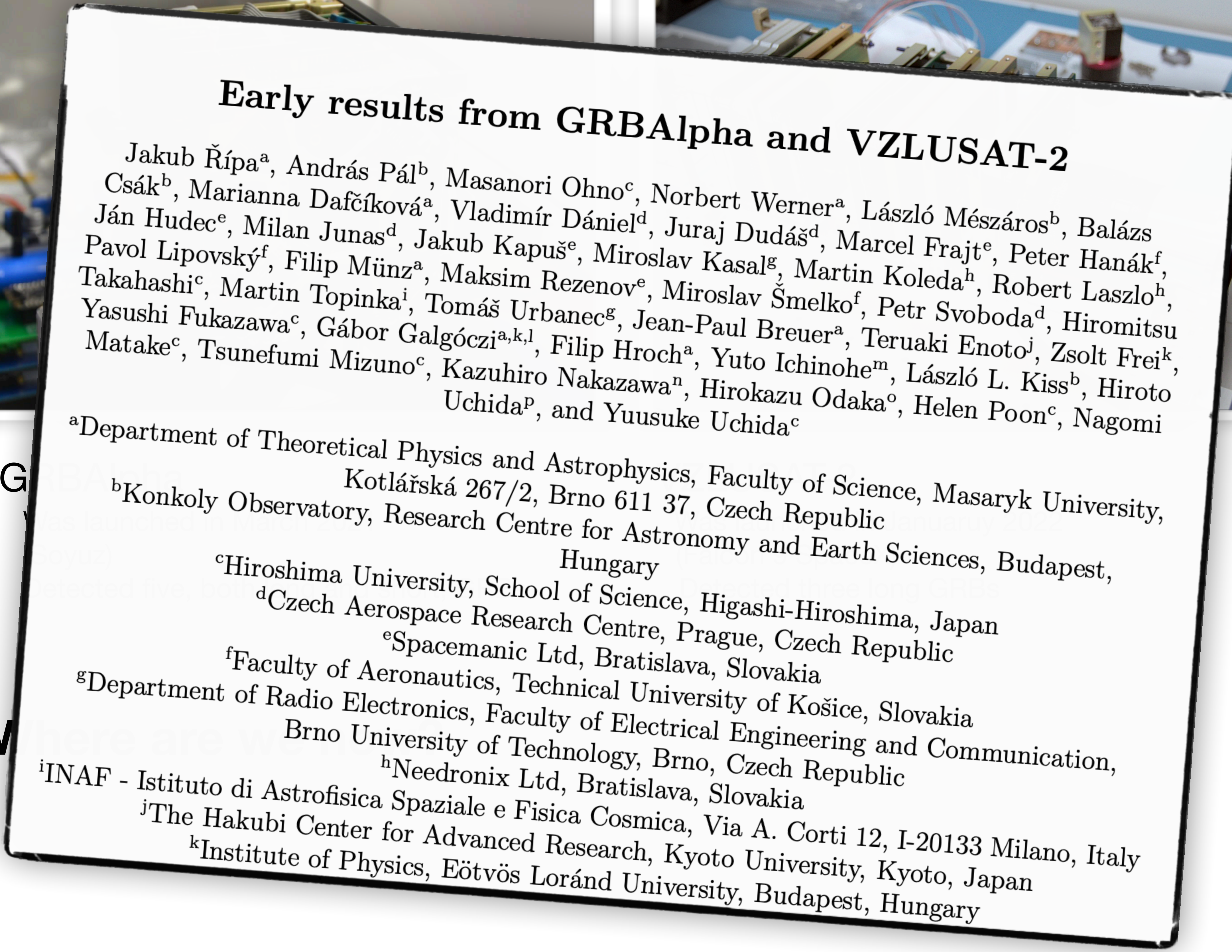
The read out of the CsI detectors with Multi-Pixel Photon Counter)MPPC is currently being evaluated in the lab as part of our feasibility study. The system provides a large light yield, compact readout area and relatively low operational voltage.

To maximize the effective area, the detectors based on Cesium Iodide scintillators and **Multi-Pixel Photon Counters (MPPC)** will occupy two lateral extensions (8.3cm x 15 cm x 0.9cm x 4)



Sky visibility
on 53 deg Orbits





Early results from GRBAlpha and VZLUSAT-2

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