GOTO - CTA-LST Activities on La Palma

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CTA-Oz | 16 April 2020

Co-located at ORM in La Palma

GOTO

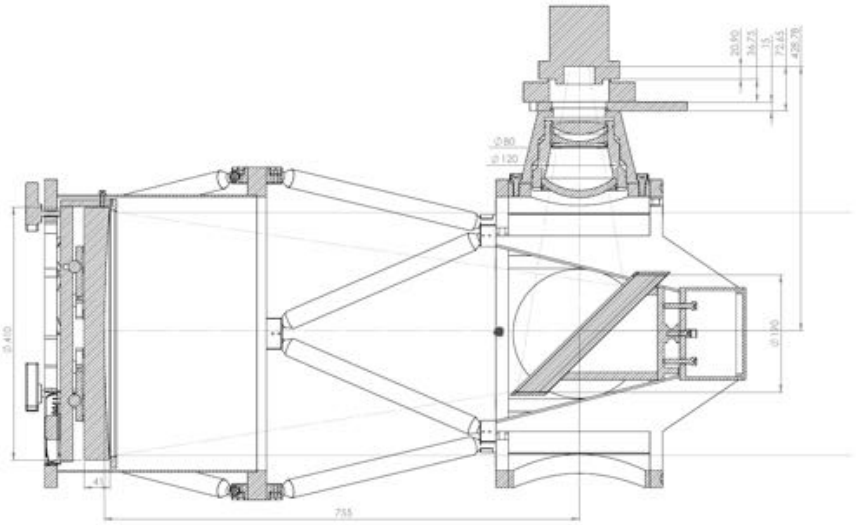
GRAVITATIONAL-WAVE OPTICAL TRANSIENT OBSERVER

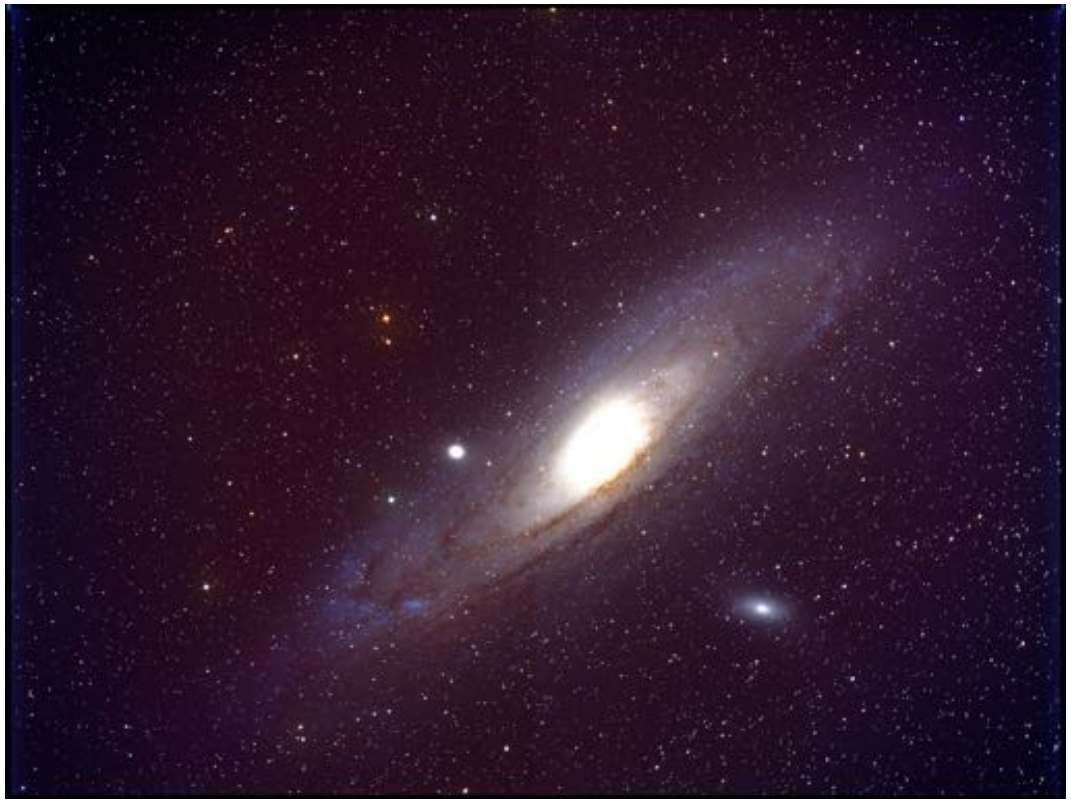
- *Specifically designed and optimised* for rapid response GW-EM searches
- Wide area capability to sufficient depth
- Aim to catch counterparts early to allow follow-up with other facilities

GOTO

GRAVITATIONAL-WAVE OPTICAL TRANSIENT OBSERVER

- Cost-effective and scalable
- Survey speed, depth and filter coverage can be adapted to changing needs
- Operates in *sky survey mode* most of the time to have recent reference images of the visible sky
- **(also means lots of secondary science)**
  - **luminous transients (TDE, AGN)**
  - **CTA, Fermi, Swift, IceCube triggered searches**



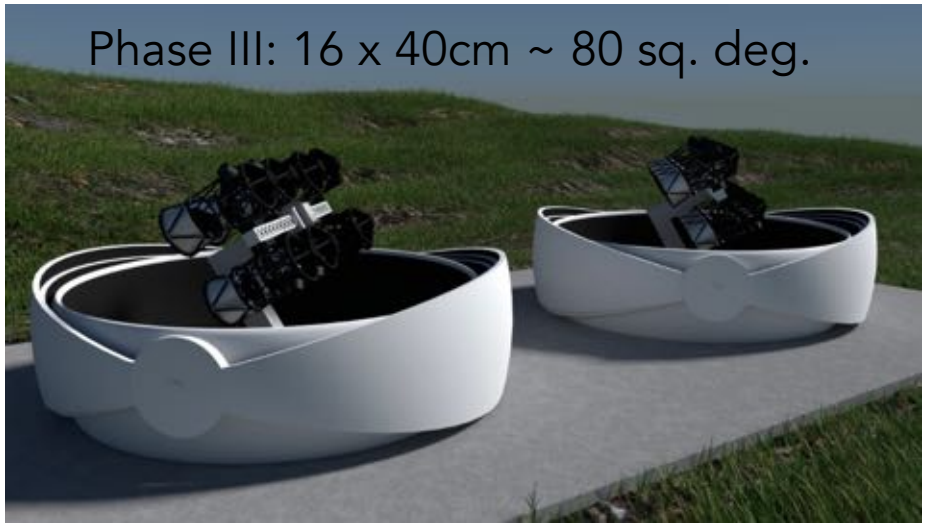


Specifications

- Quick-slewing robotic mount
- Independent 40cm f/2.5 Newtonian Wynne-Riccardo OTAs
- 1 telescope = 2.85 x 2.114 degrees , 1.25”/pixel
- FLI MicroLine 50 Mpixel CCD) ~ 5 sq. deg
- 5-slot filterwheel (currently LRGBC)

Site Updates

- GOTO recently upgraded to 8-UT configuration ~ Oct 2019
  - Provides ~50 sq. deg. field of view in single 60s exposure down to limiting mag R~19.5
- **Recently awarded UK - STFC PPRP funding to build GOTO-South and second 8-UT instrument at La Palma**
- Will begin commissioning of Australian site on Siding Springs ~August 2020
- During Phase III: can survey visible-sky every 2-3 days

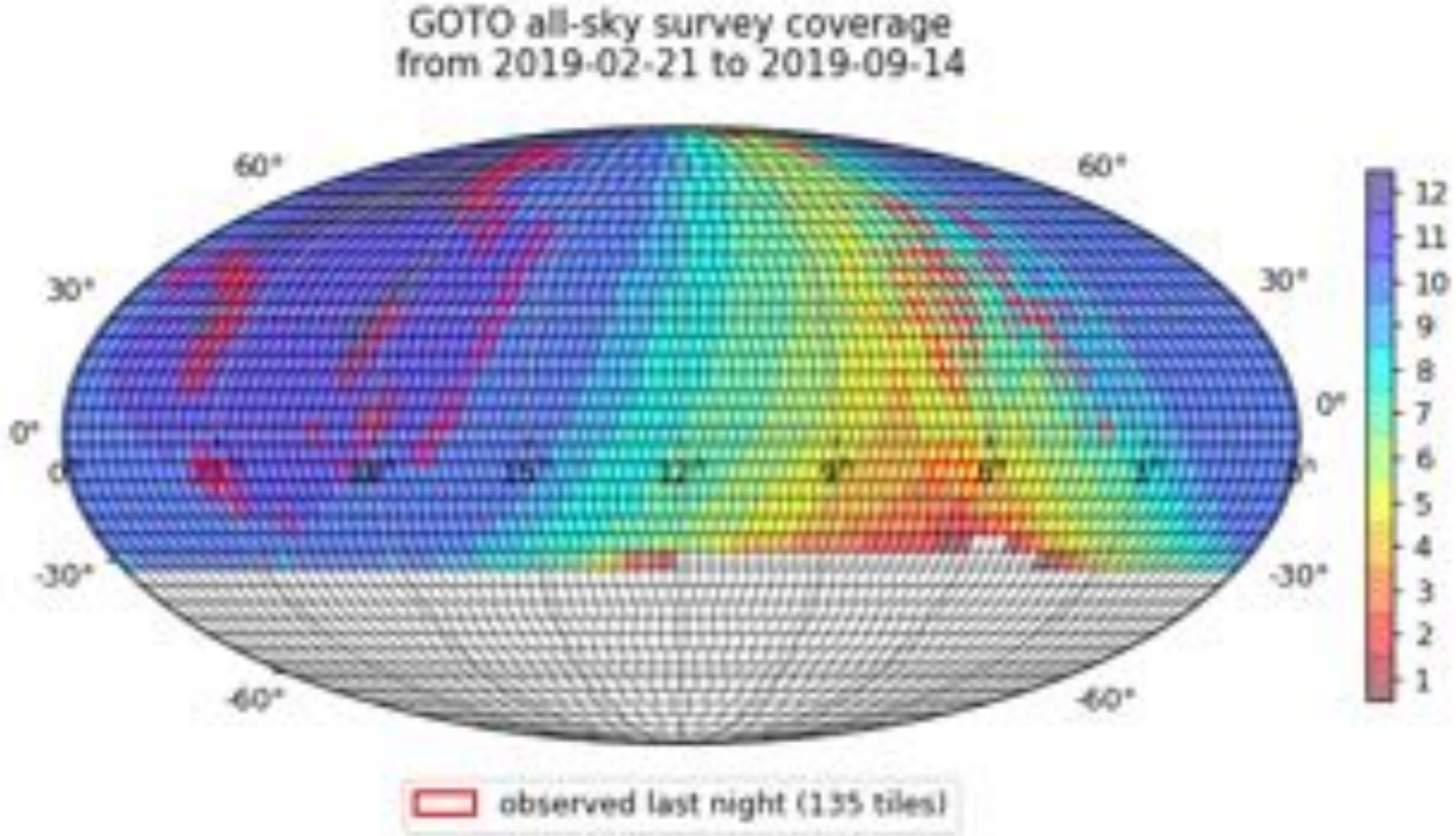


site: Siding Springs Observatory

Key Areas for cooperative observing (CTA KSPs)

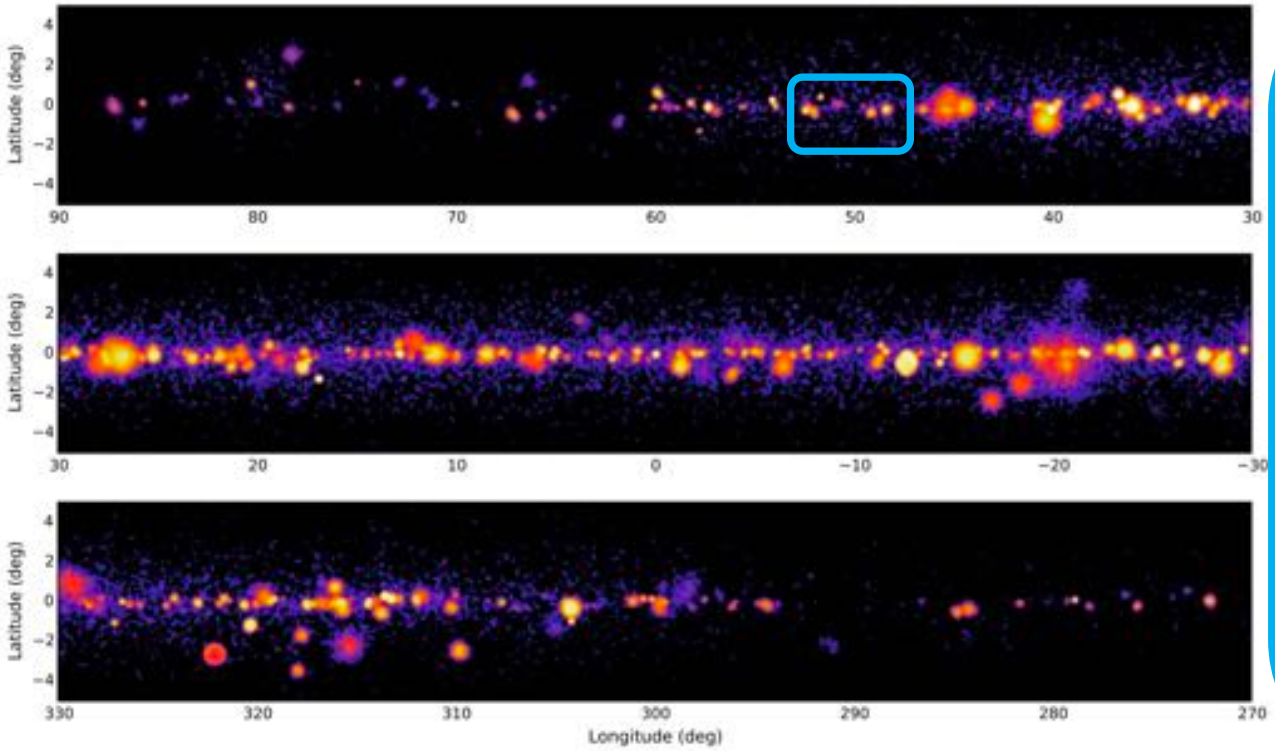
- Science-Targeted (co-monitoring or simply providing data)
  - Fermi-LAT triggered
  - Transient Phenomena
  - AGN Monitoring
- Galactic Plane survey
  - 1) Monitoring optical properties of Galactic very-high energy (VHE) gamma-ray source populations, namely supernova remnants (SNRs), pulsar wind nebulae (PWNe) and binary systems
  - 2) monitoring optical properties of identified targets for follow-up observations, such as new gamma-ray binaries and PeVatron candidates
  - 5) discovering new and unexpected phenomena in the Galaxy, such as new source classes and new types of transient and variable behaviour.
- Extragalactic survey
  - serendipitous detection of fast flaring sources, not detectable in short observation time (hours) by lower sensitivity observatories like Fermi-LAT and HAWC

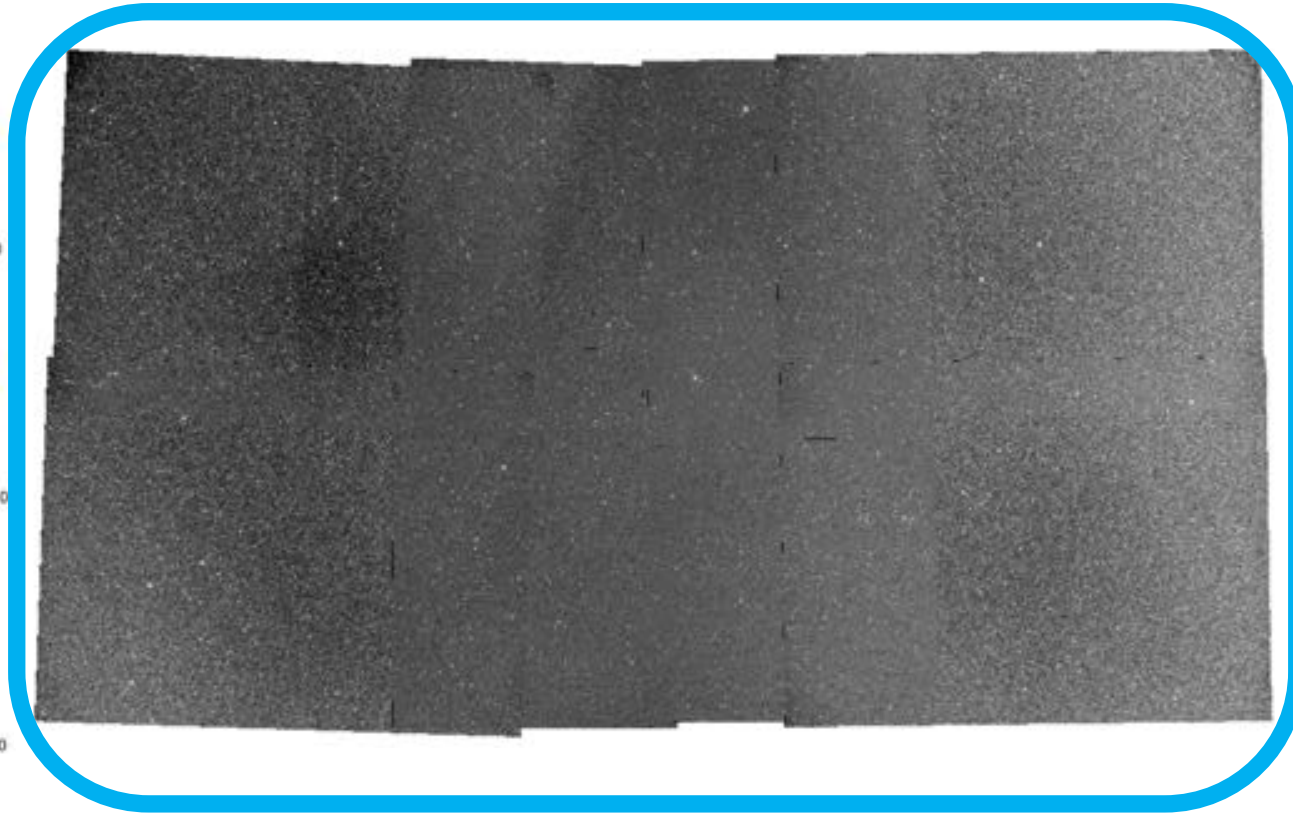
GOTO survey mode and synergies with CTA-LST



GOTO survey mode and synergies with CTA-LST

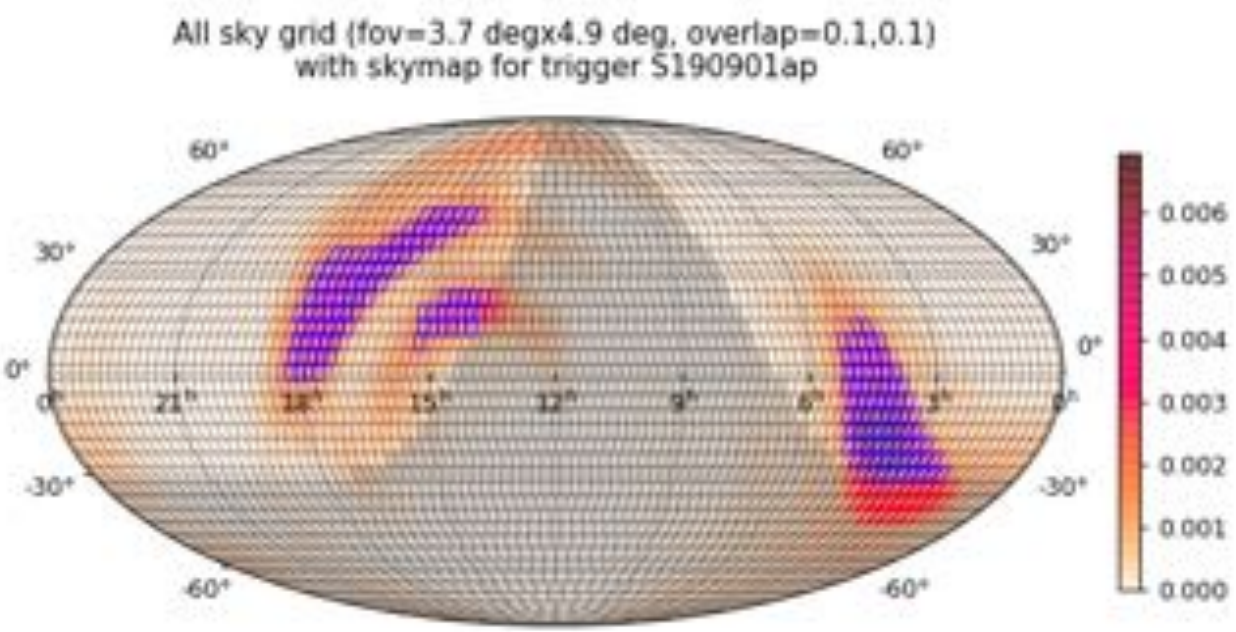
- Galactic Plane study
- Previous M31 nova study with GOTO – parallels to targeted searches over weeks-long timescales





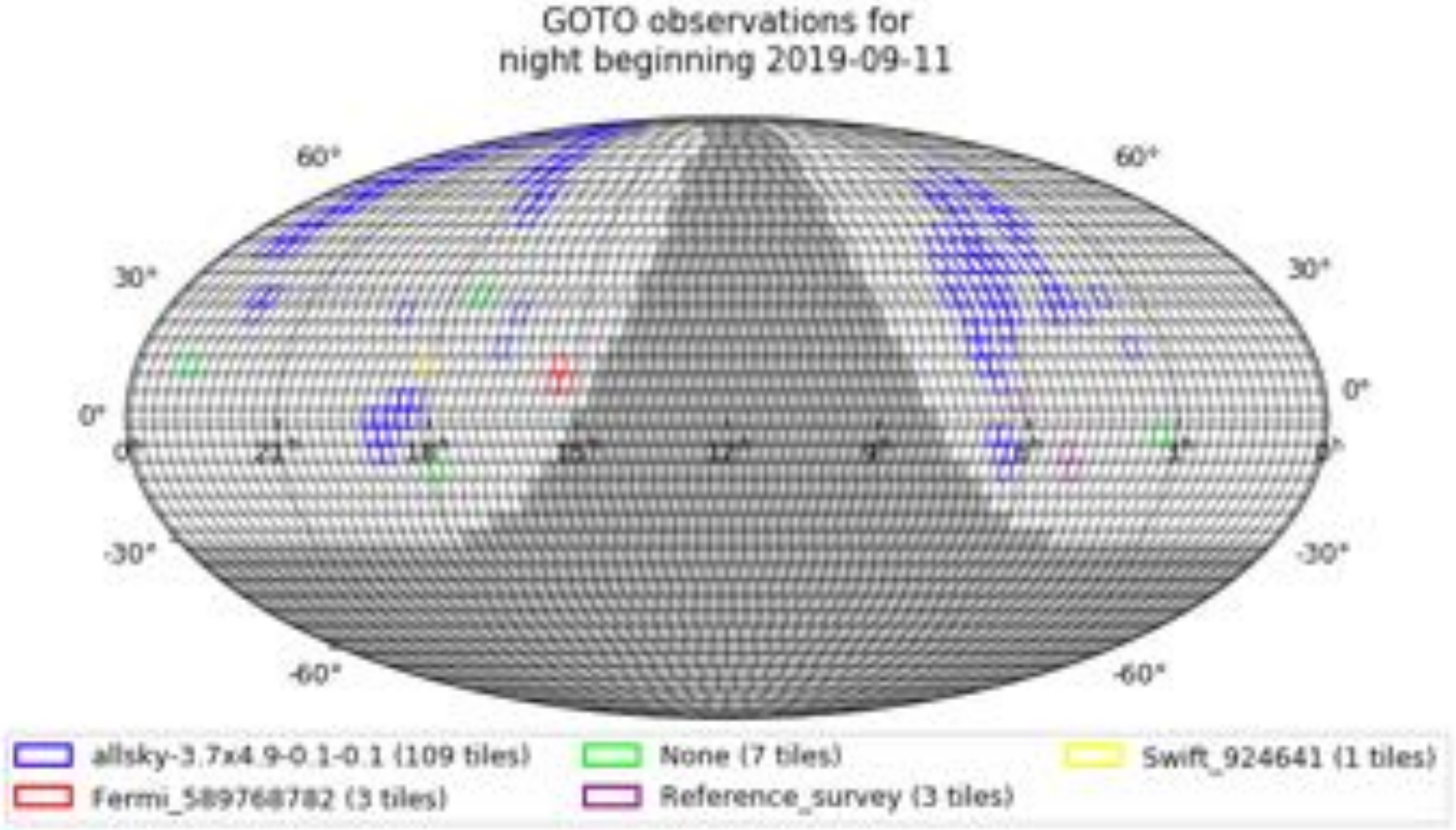
GOTO Automated Tiling + Reference

- Divides the sky into fixed grid of overlapping tiles
- Most nights: all-sky survey over tiles
- GW/Fermi skymaps are mapped onto grid, each tile containing a fraction of the probability
- When a tile is observed we use previous observations for difference imaging



GOTO-tile S190901ap
4-UT configuration

Observing on the Grid



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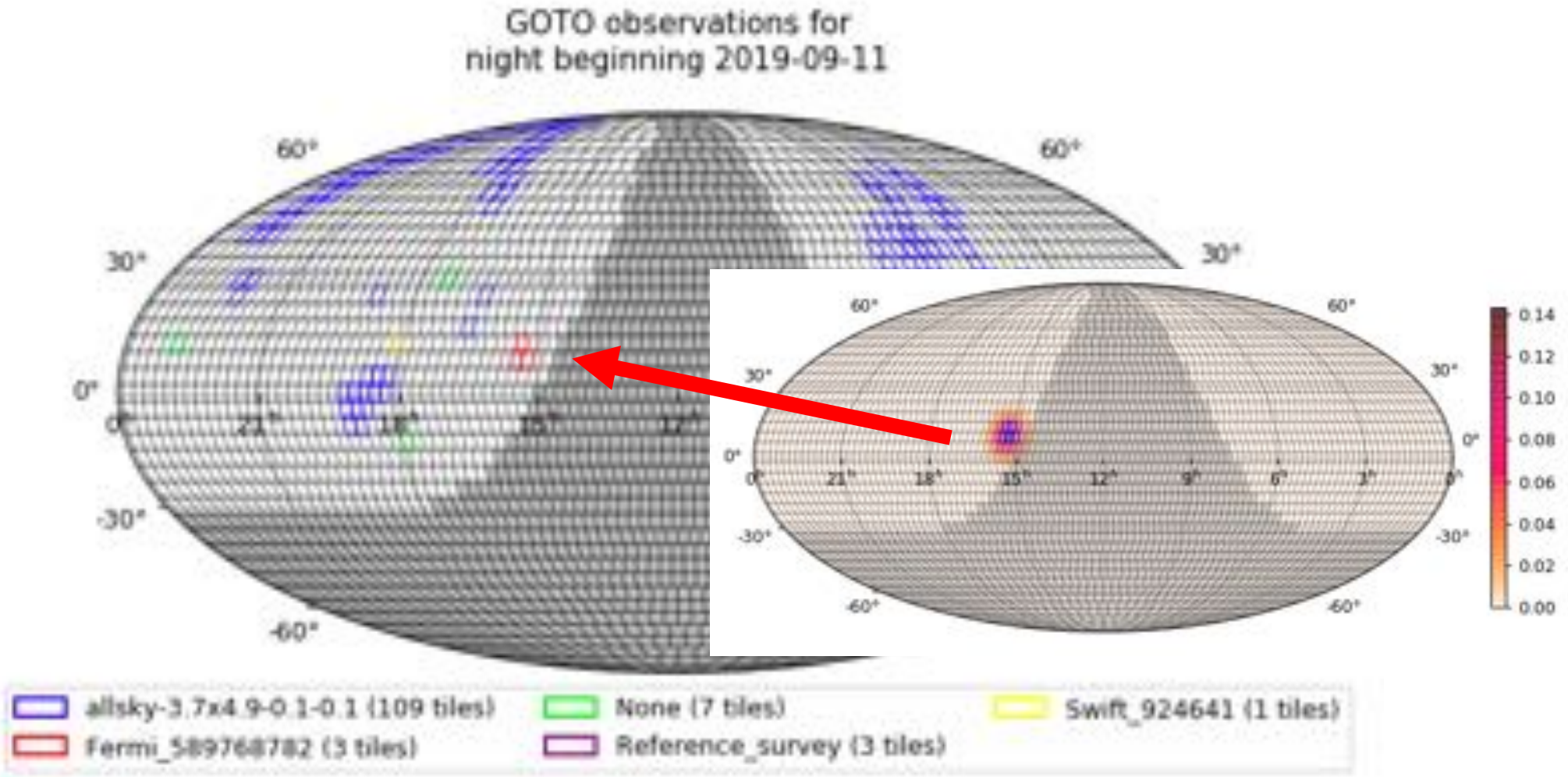
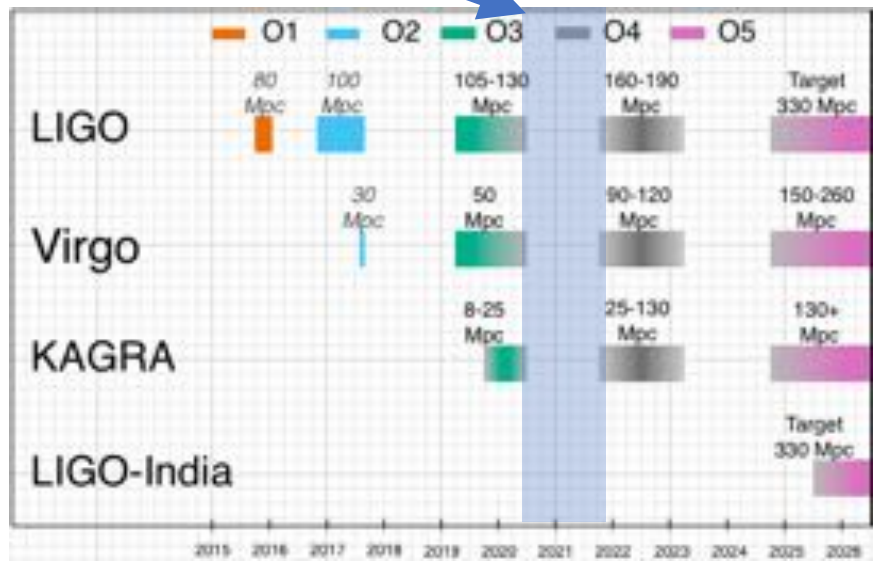


Potential Collaboration Timescales

- GOTO closed observatory on 19 March on direction of IAC. The IAC will reassess on 26 April – most likely pushed to reopening in May+ 2020.

- LIGO-Virgo O3b Run suspended on 24 March; O4 expected in ~2022.
  - Great time to progress on secondary science cases

- Working with GOTO Collaboration (K. Ackley, Danny Steeghs, Duncan Galloway) and CTA members (Daniel Mazin, Juan Cortina, Masahiro Teshima) to work out key science areas to explore and to work out timeframes for the upcoming year+



Summary

- GOTO is optimized for and primarily dedicated to GW-EM searches (even poorly localized/lower FAR events). The robotic capability, speed and flexibility of the instrument is great for collaboration with external groups (CTA, …)

- Early identification of candidates (GW counterpart & other notable/fast transient) – have a recent comparison image available

- All 8UTs installed in North giving >50 sq. deg
- Complements longitude/latitude and strategy of other facilities

- Feeder facility for follow-up

- Future: Instruments in the North (~80 sq. deg) and South (~50 sq. deg) for complementary science cases.

www.goto-observatory.org