



# GW170817

## ESO Observations

Operations Perspective

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# ESO's sites



**Paranal**

**Chajnantor**

**Santiago**

**La Silla**

**Garching bei München**

## ■ Observing Modes

- Visiting Mode (VM)
  - Only supported mode for La Silla
  - Designated Visitor Mode, Eavesdropping
- Service Mode (SM)
  - Paranal ~ 60-65% of the time on VLT
  - Only mode for Survey Telescopes VISTA, VST

## ■ Observing programme types

- Normal – high priority vs filler type
- **Target of Opportunity**, Rapid Response Mode
- Large Programmes and **Public Surveys**
- Monitoring Programme – relatively small but over long time
- Calibration Programme





# Observatory Schedule

Dynamic schedule: enabling rapid response to unexpected events

| La Silla Paranal Observatory Schedule P99v1.3 (5/7/17) |                |                |                |
|--|----------------|----------------|----------------|
| Period 99  |                | August 17      |                |
| UT   | UTd            | UT             | UTd            |
| UT1  | Period Change  | Period Change  | Period Change  |
|  | Technical time | Technical time | Technical time |
|  | Service        | Service        | Service        |
|  | Service        | Service        | Service        |
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| Service  | Service        | Service        |                |
| UT2  | Period Change  | Period Change  | Period Change  |
|  | Technical time | Technical time | Technical time |
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| UT3  | Period Change  | Period Change  | Period Change  |
|  | Technical time | Technical time | Technical time |
|  | Service        | Service        | Service        |
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|  | Service        | Service        | Service        |
| UT4  | Period Change  | Period Change  | Period Change  |
|  | Technical time | Technical time | Technical time |
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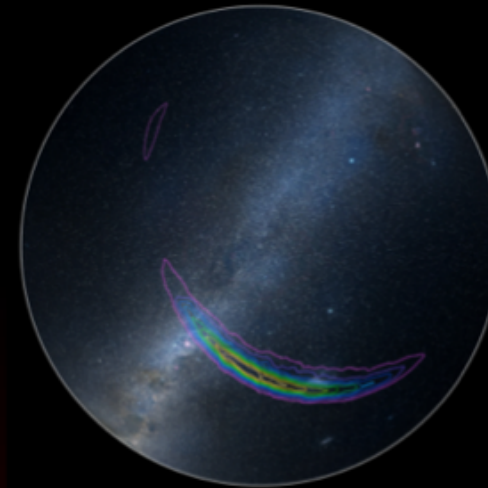


# VLT/VLTI Science Policy & ToO

- Target of Opportunity (ToO) requests for *unpredictable* sudden astronomical events
- ToO programmes submitted via OPC
  - Observations of transient phenomena or their follow-up
  - Observation strategy defined in the proposal and prepared in advance
  - Priority over scheduled Service Mode observations
  - Exceptionally: current programmes could be interrupted
- Rapid Response Mode – automatic observations upon receiving encoded alerts from satellites or robotic telescopes

- **VINROUGE** - VISTA Near-infraRed Observations  
Unveiling Gravitational wave Events (PI: N. Tanvir)
  - Lol Oct 2015 & full proposal Mar 2016

VINROUGE is an ESO public survey which aims to use the VISTA telescope to map error regions of gravitational wave events. The particular goal is to search for near-infrared "kilonova" transients which are created by material ejected during compact binary mergers in which at least one component is a neutron star.







17 Aug 2017 evening – notification for a new Target of Opportunity trigger on VISTA  
VISTA field of view is 1.5 sq. deg

18 Aug 2017 morning – accurate position next to NGC 4993 known  
follow-up triggered on many other telescopes and instruments



# First couple of nights...

- 17 August: VISTA/VIRCAM & target location
  - observations also with VST, UT3, UT4 in the same direction, but not wide enough fields...
  
- 18 August:
  - FORS2 (Covino) – imaging polarimetry
  - GROND (Rau) – broad band imaging
  - EFOSC (Smartt) – spectroscopy & imaging
  - X-SHOOTER (Pian) – imaging and spectroscopy
  - VIRCAM (Tanvir) – near-IR imaging (Ks, J, Y)
  - MUSE (Levan) – IFU



# Continuous campaign@LPO: August 17 – September 13

## OPTICAL

- FORS2 IPOL (Covino), 600RI LSS and BVRIz imaging (D'Avanzo)
- EFOSC LSS and imaging (Smartt)
- MUSE (Levan)
- VIMOS URz imaging (Levan)
- OmegaCAM griz imaging (Cappellaro, Grado)

## NEAR-IR

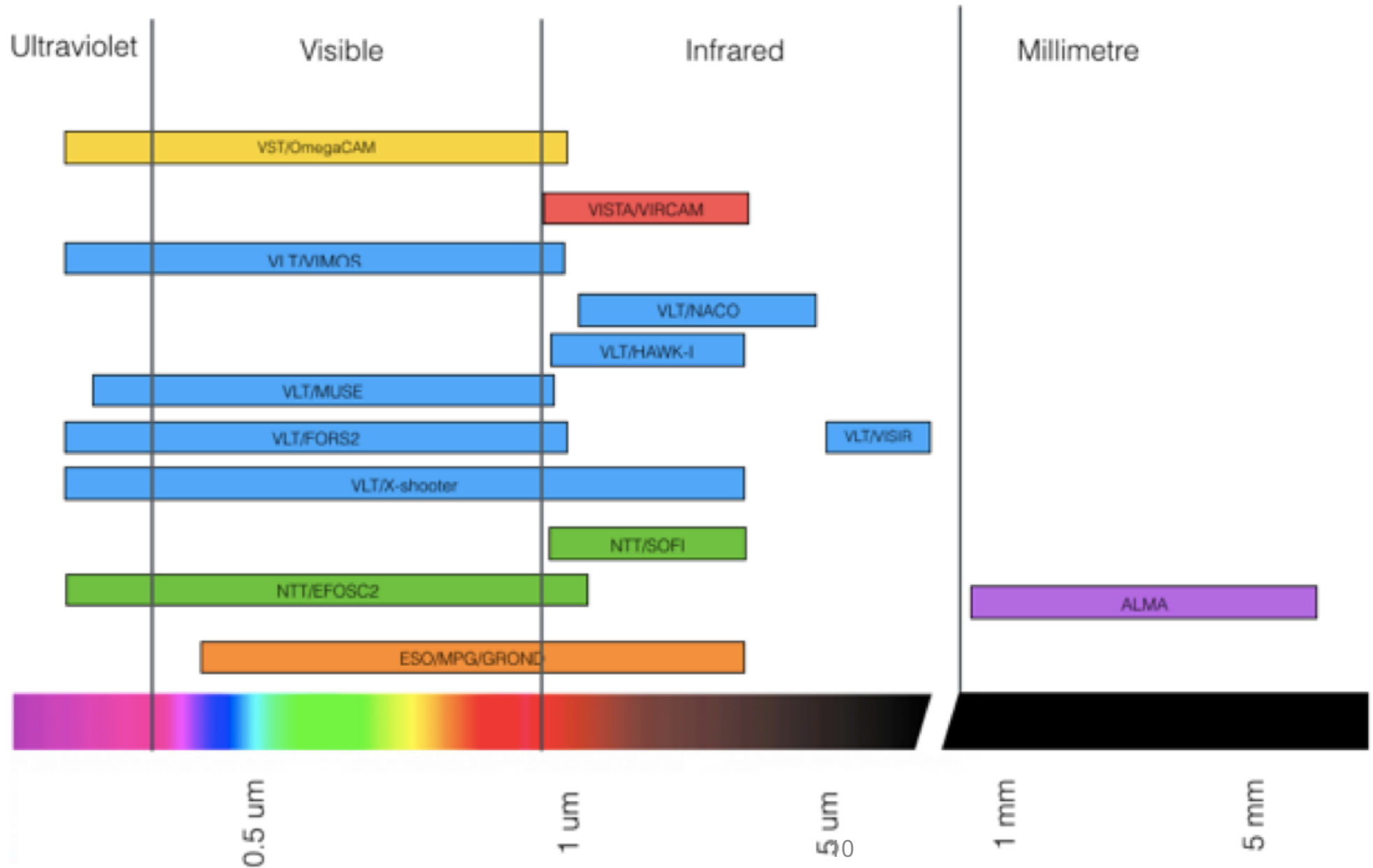
- VIRCAM YJKs (Tanvir)
- SOFI JHK (Smartt)
- HAWK-I HKs (Levan, D'Avanzo)

## NON- OPTICAL DETECTION + NIR

- X-SHOOTER ToO programmes: Pian, Smartt, D'Avanzo
- GROND (Rau)
- NACO L' and VISIR 8.9 $\mu$  N-band (ESO)
- ALMA band 7 ToO trigger (Europe/Chile) and band 3 (NA project)



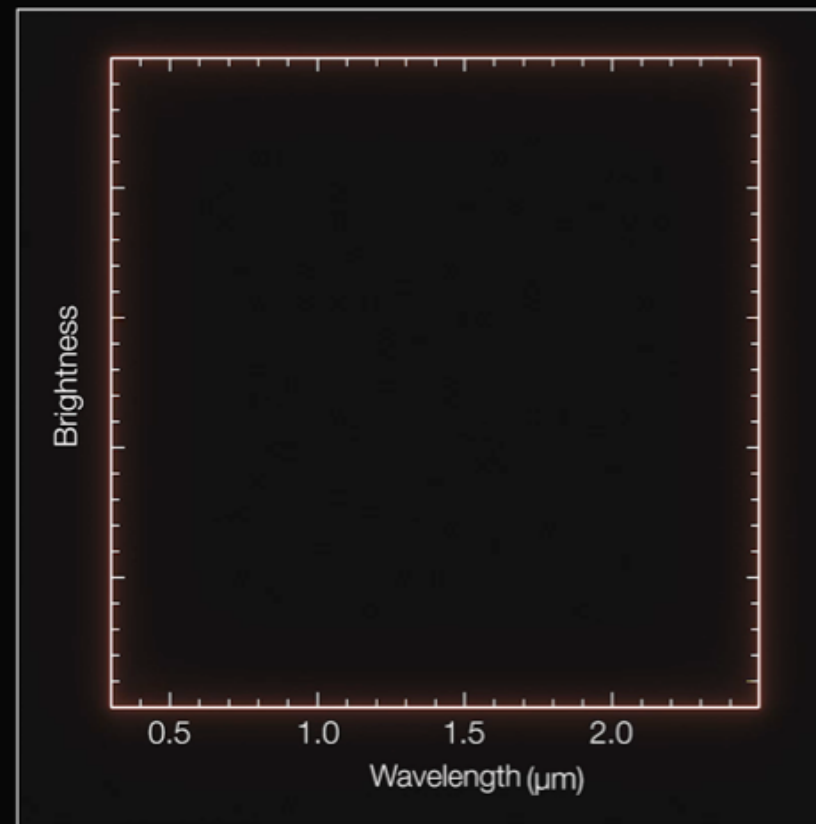
# Simultaneous observations over the entire wavelength range







# GW170817: VIRCAM & X-SHOOTER



Time: -1225 days

<https://www.eso.org/public/videos/eso1733e/>

ESO PR **Credit:**ESO/E. Pian/S. Smartt & ePESSTO/N. Tanvir/VINROUGE

# Lessons learned: what worked well

- The largest ToO observing campaign
  - 12 instruments, 9 telescopes
  - More than 120h and over 5150 science files
- ToO observing mode
  - Readiness and well established procedures
- Coordination with approved ToO programme PIs
  - Communication between teams and the mountain
  - Flexibility and adapting schedule/instruments/time
- Simultaneous observations
  - Different telescopes/instruments/wavelengths
  - Imaging/spectroscopy/polarimetry





# Paranal: 12 August 2017, 9am







# Lessons learned: improvements

- ESO observations with NACO, VISIR
  - Readiness to take up active role vs support role
  - Scientific coordination & immediate follow-up with data analysis
  - Data access politics
  
- Coordination between teams – data releases
  - Public Surveys – ePESSTO, VINROUGE
  - Imaging data – public release October 16<sup>th</sup> (press conf)
  - Majority of spectra – proprietary

# And that's life...

- Most time critical events happen during holiday season!
  - Ability to react and availability of expertise
  
- There will be a planned technical intervention (UT4)
  - Flexibility and re-scheduling