

How SVOM could have observed GW170817 in the Optical band

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Third SVOM Scientific Workshop :
Disentangling the merging universe with SVOM

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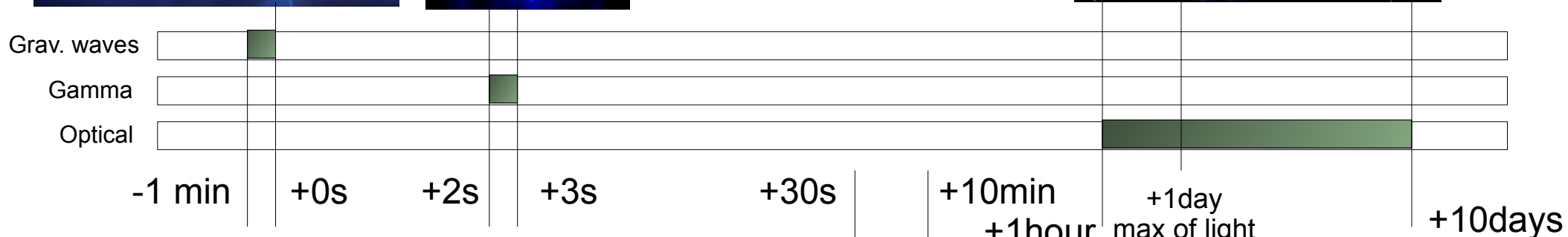
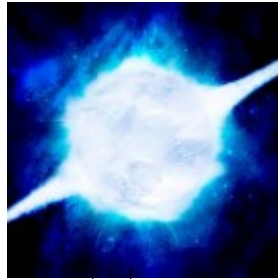
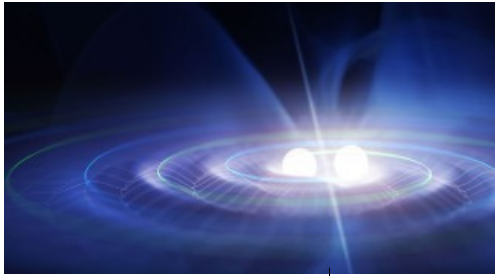
13-18, May 2018

The context of the neutron-star merging in 2022

Neutron star merger

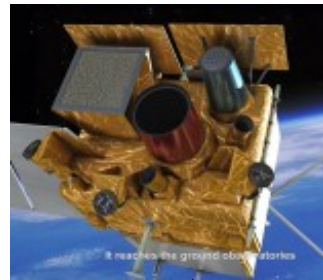
short GRB

kilonova



LIGO + Virgo + Kagra

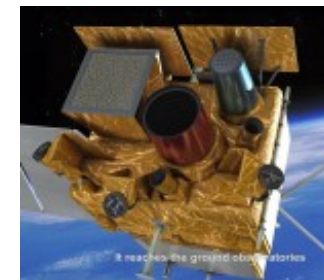
SVOM + Fermi + Integral



ECLAIRs $0.3^{\circ 2}$
GRM $30^{\circ 2}$

3 interferometers triangulation $100^{\circ 2}$
Distance $<200 \text{ Mpc} \pm 20 \%$

SVOM-VT + JWST



GFT Colibri +
Ground telescopes



Goals:
Astrometry $1''$
Photometry **L.C**
Spectroscopy **z, T, Z**

The difficulties to observe from the ground

Visibility depends on:

1. The field must Elev $> 10^\circ$ (proba = 0.43)

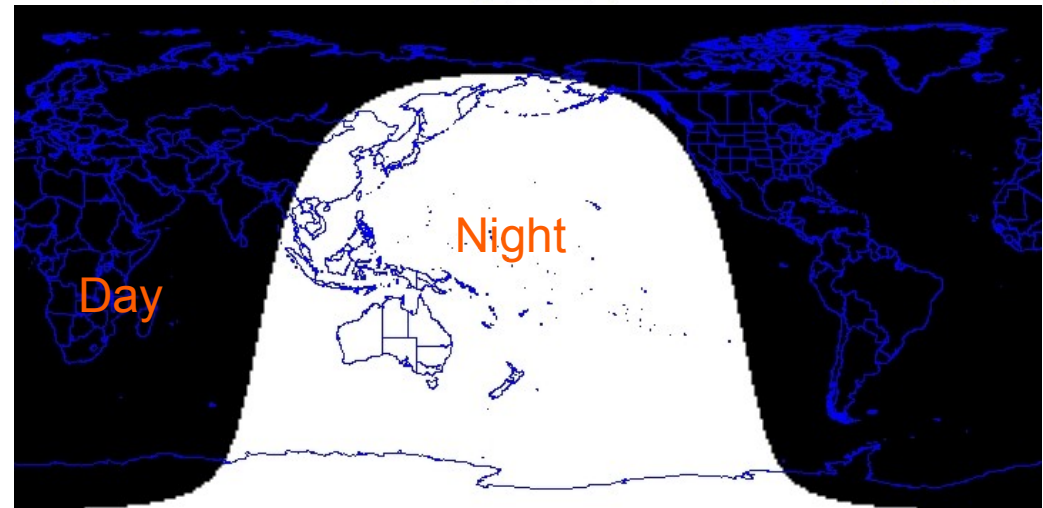
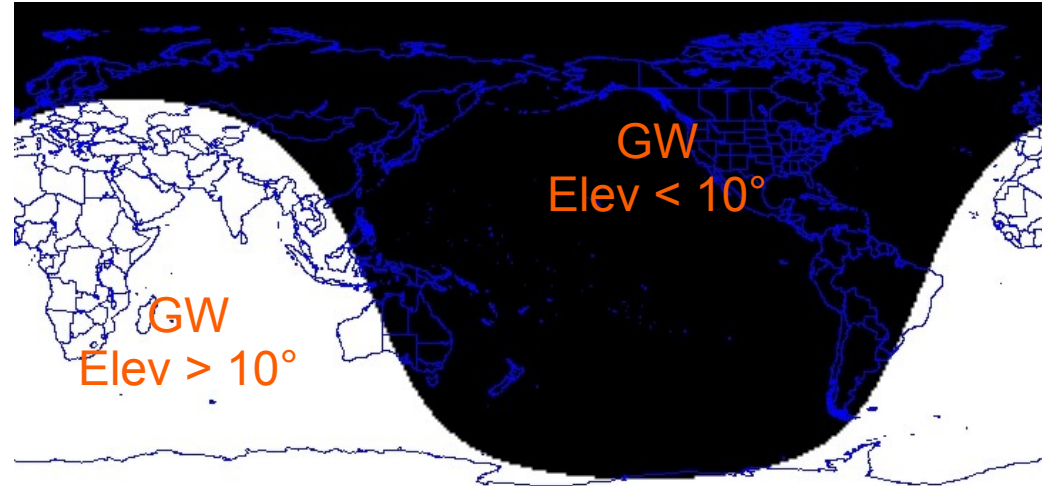
2. The Sun must Elev $< -10^\circ$ (proba = 0.43)

Role of the **Elongation** = angle (Sun, GW)

The most favorable case is Elong = 180°
=> Proba = 0.43 (two cond in the same time)

The worst case is Elong = 0°
=> Proba = 0 (two cond in opposite time)

For **GW170817**, Elong = **61°**

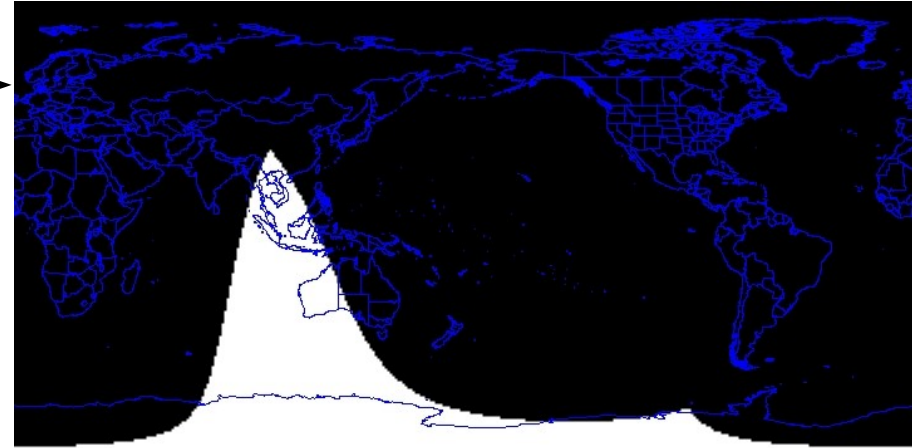


Combine the two white areas
and the winners are...

The difficulties to observe from the ground

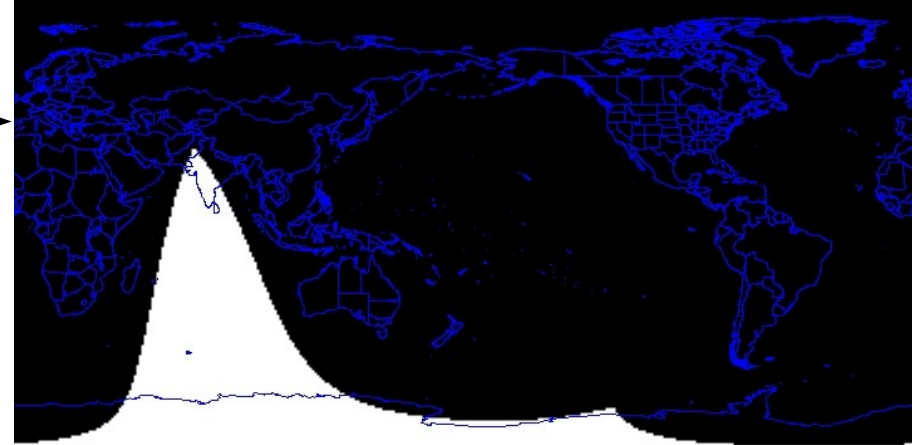
During prompt GW emission:

Western Australia can observe prompt BUT...
the information was not available at this time !



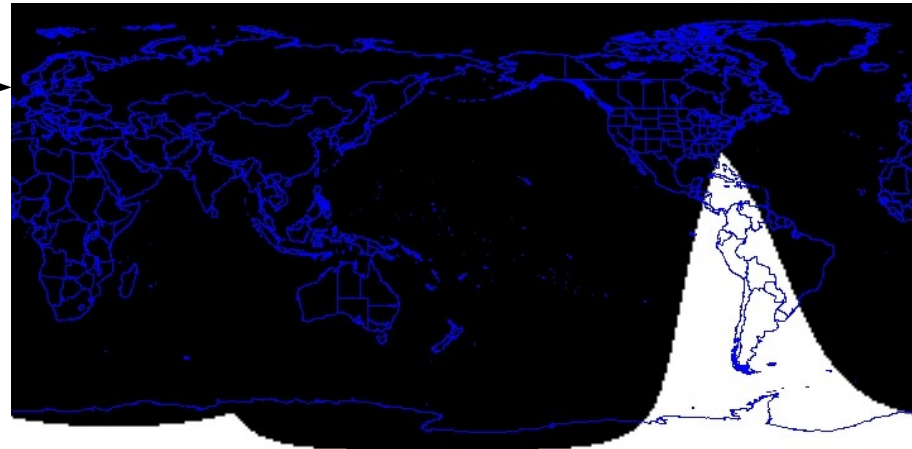
2 hours later :

Indian ocean, then Africa,
then Atlantic Ocean



12 hours later :

South America
but the field of view is visible only 3h/night



Conclusion : Even if VT observes only half of the time due to Earth occultation, it is often better than for ground earth observatories.

The SVOM mission dedicated optical telescopes

SVOM / VT

Outside atmosphere (SVOM orbit)

FoV: 30 x 30 arcmin

Bands: B & R

Chinese GFT

Xinglong

FoV: About 1 x 1 deg

Bands: B to I

Chinese GWAC

Xinglong (+ Chile ?)

40 x FoV: 11 x 11 deg

Bands: Clear

French GFT / Colibri

OAN at San Pedro Martir

FoV : 30 x 30 arcmin

Bands: B to H

Main scenarios during SVOM mission for VT

The best case

1. ECLAIRs or IBIS-Integral trig on SGRB

To do: **One pointing** for VT with a classical SGRB strategy

1.1 If GW information is received after 10 min. to one hour

To do: **Stay** on the field during at less 24h to search the kilonova

The GW170817 case

2. Fermi trig on a SGRB

To do: **Do nothing** with VT

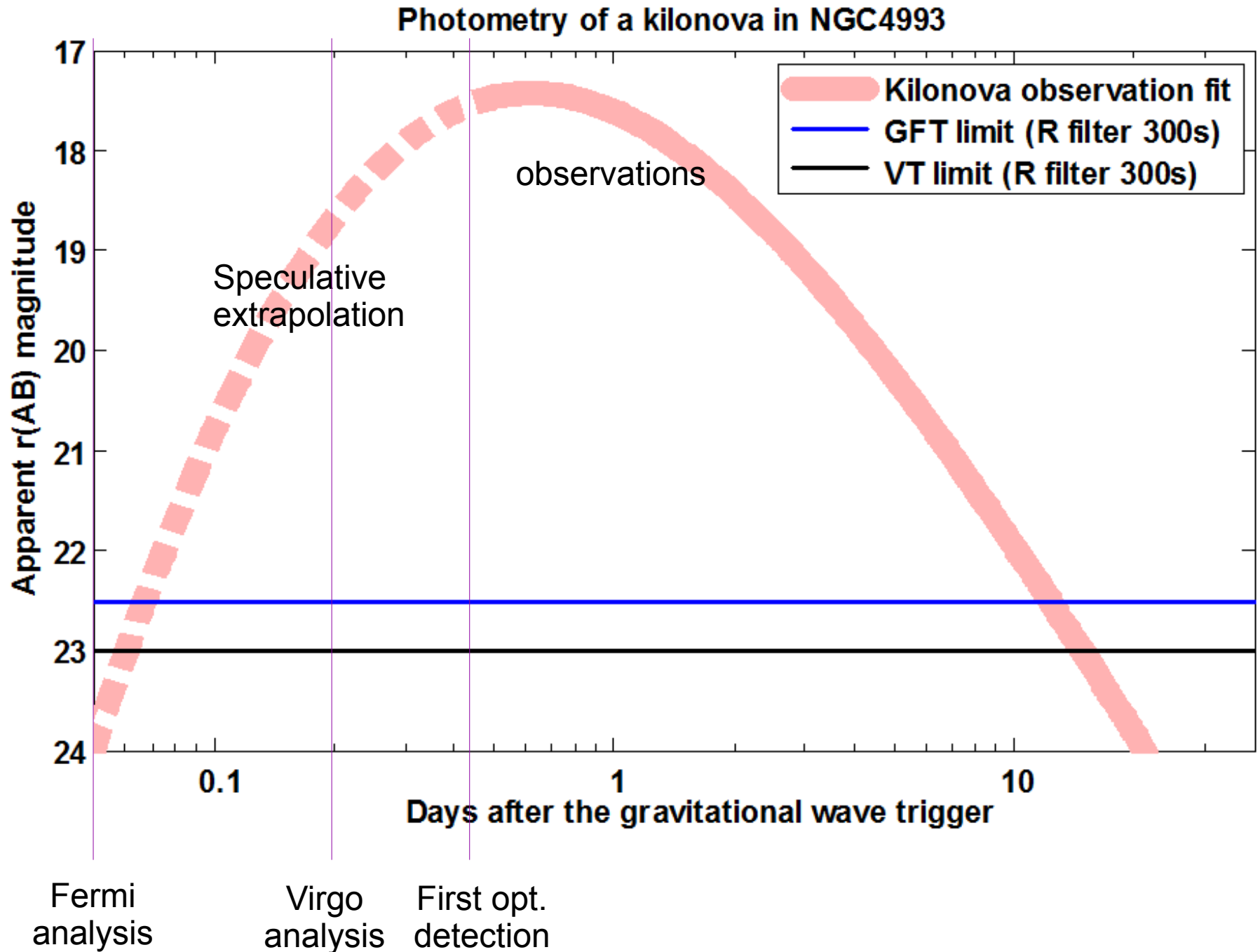
2.1 If GW information is received after 10 min. to one hour

To do: According the uncertainty area **do tiles with VT** (+ MXT)

2.2 If a ground telescope found the kilonova

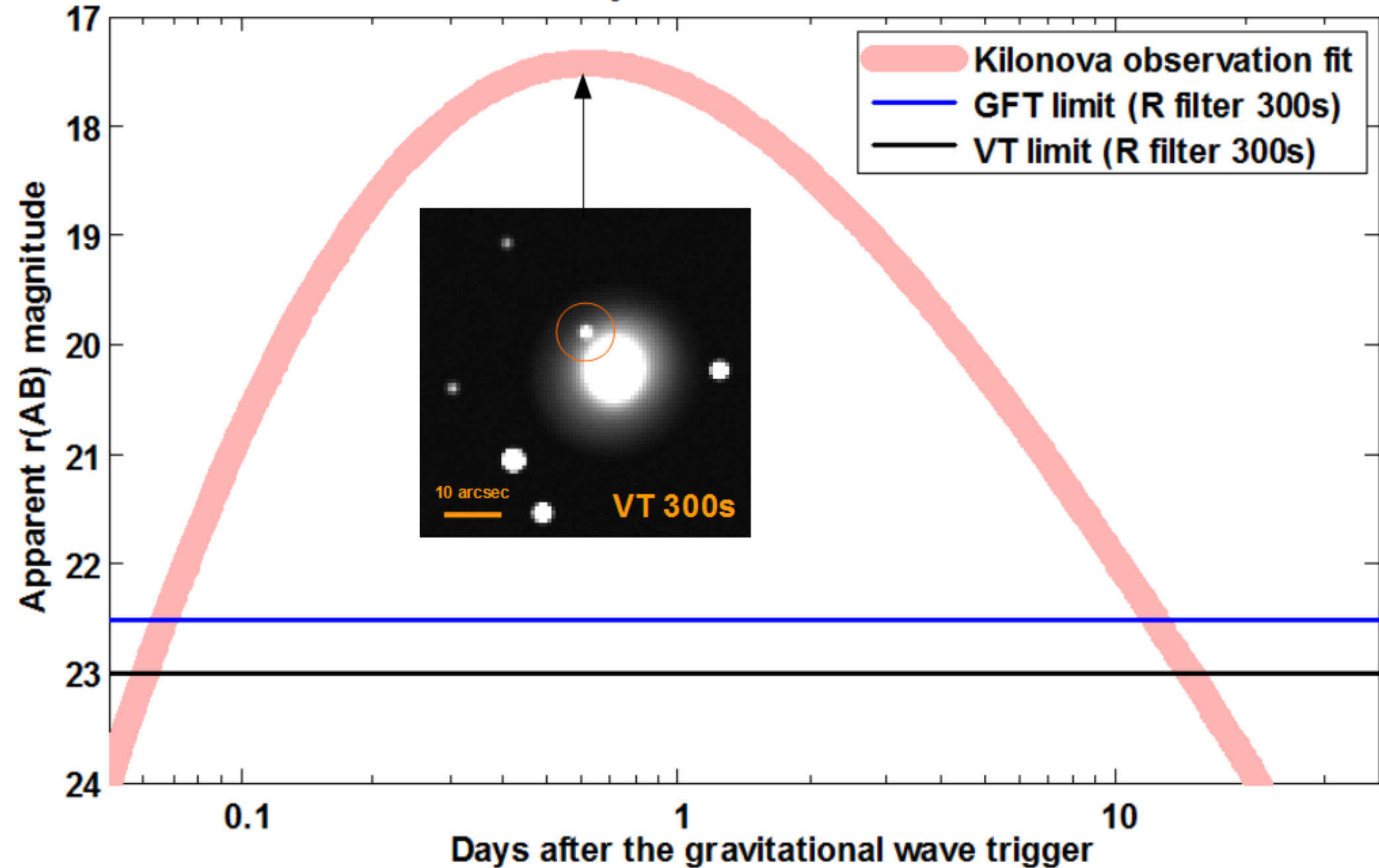
To do: Observe **one pointing** with VT during according the visibility gorund map

Detection of GW 170817 with optical telescopes

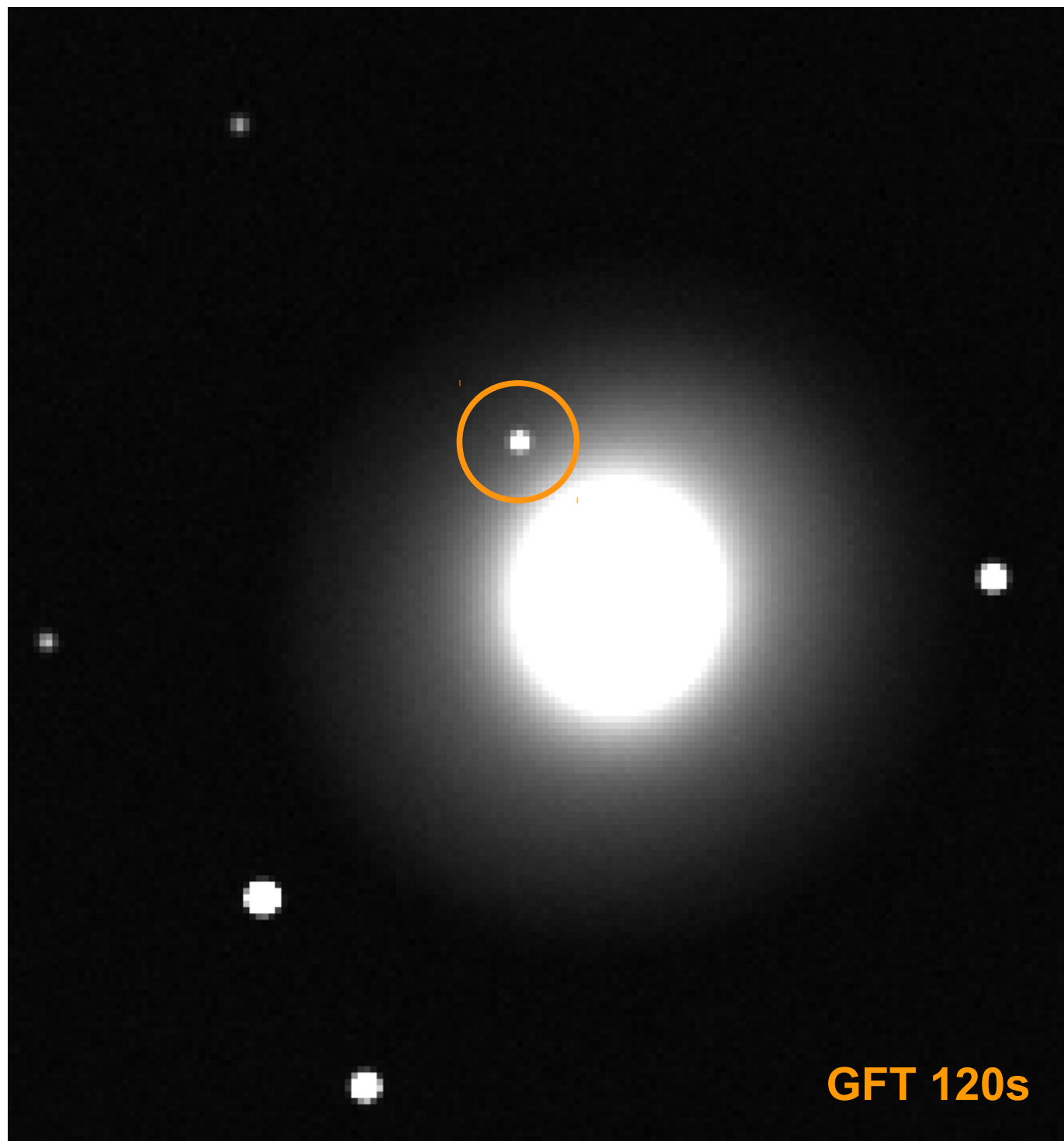
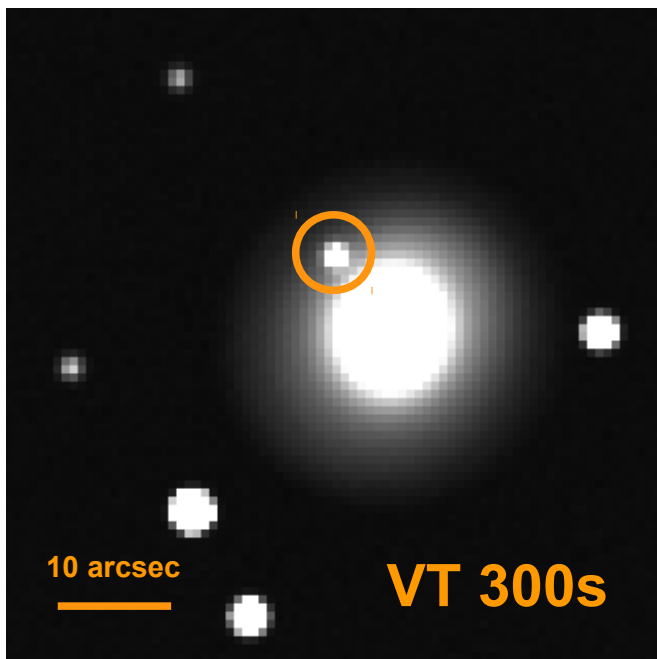


Detection of GW 170817 with SVOM / VT

Photometry of a kilonova in NGC4993



**Image simulation
of a kilonova $r=17.5$
in NGC 4993**



Detection of GW 170817 with SVOM / VT

Simulation movie...