

Early follow-up with optical telescopes

Inventory and contribution of fast slewing ground telescopes

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IRAP

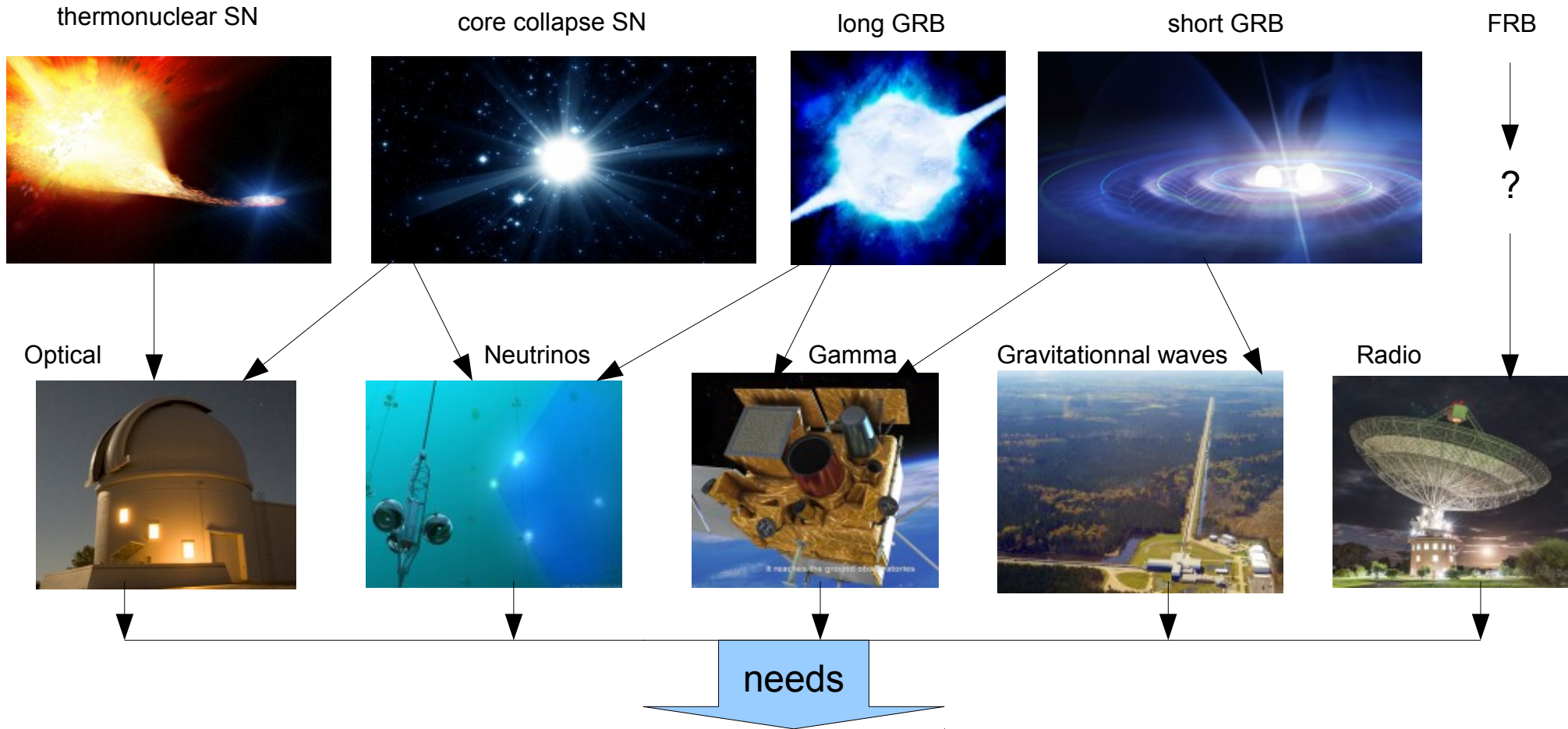


Transient Sky in 2020 workshop :
20 - 22 June 2017

Laboratoire de l'Accélérateur Linéaire , Orsay, France

How to prepare optical observations after 2020 ?

New triggers : Multiwavelength + multimessengers



Short time sampling

=> Fast slewing mounts, disponibility.

Large field of view

=> Small focal length optics
or/and Network of telescopes

High detectivity

=> Large aperture

Complementarity of telescope types

Detectivity

25

20

16

3d

5 min

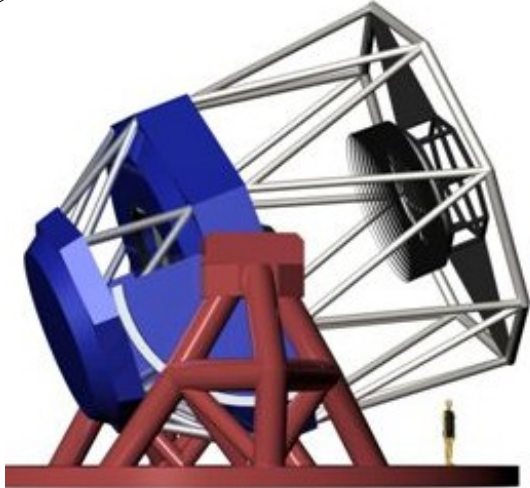
15s

Time sampling

TAROT



LSST



$9^{\circ 2}$

$4^{\circ 2}$

$150^{\circ 2}$

Field of view

GWAC



Optical telescopes for GRBs

Photometry follow-up (light curves)

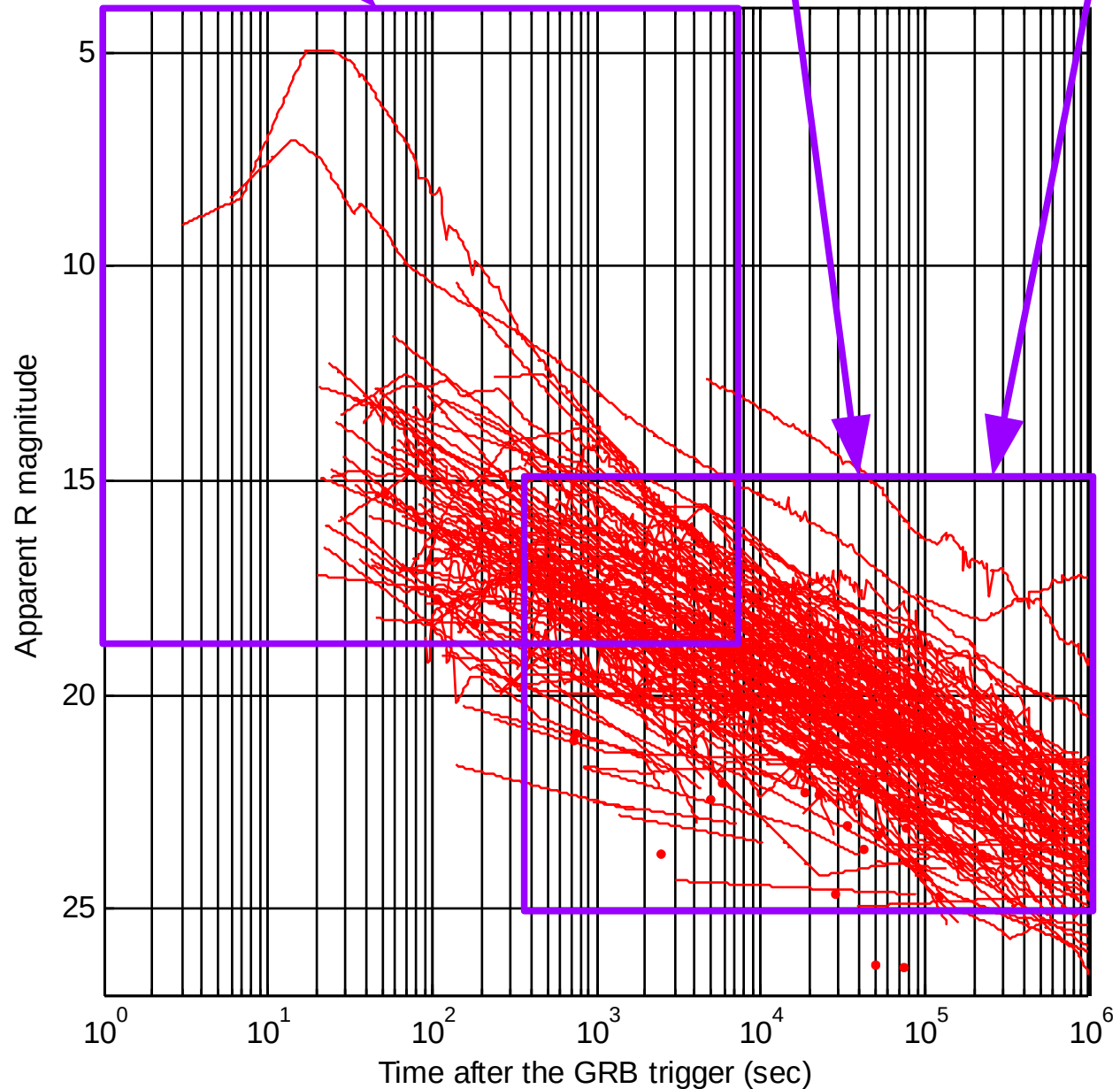
Gamma trigger
 $t_0 : t_0 + 300s$

Swift
INTEGRAL
FERMI

Early photometry

Late photometry

Spectrometry



*Light curves from
GRBase*

Optical telescopes for GRBs

Classification of telescopes

Gamma trigger

$t_0 : t_0+300s$

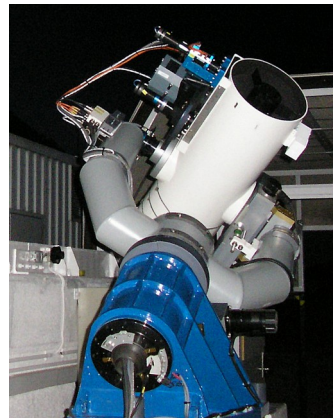
Swift
INTEGRAL
FERMI

Early photometry

$t_0+30s : t_0+2h$

MASTER
MITSuME
Rotse
TAROT
UVOT
TNT
PROMPT
REM

Small diameters
20 cm to 1 meter
Rapid slewing
Autonomous



Late photometry

$t_0+3min : t_0+1week$

GROND
Shajn
NOT
RATIR
P60
Tautenburg
Faulkes
Liverpool
RTT150

Medium diameters
1 to 4 meters
Standard slewing
Human check



Spectrometry

$t_0+1h : t_0+1day$

VLT
Gemini
Keck
Magellan

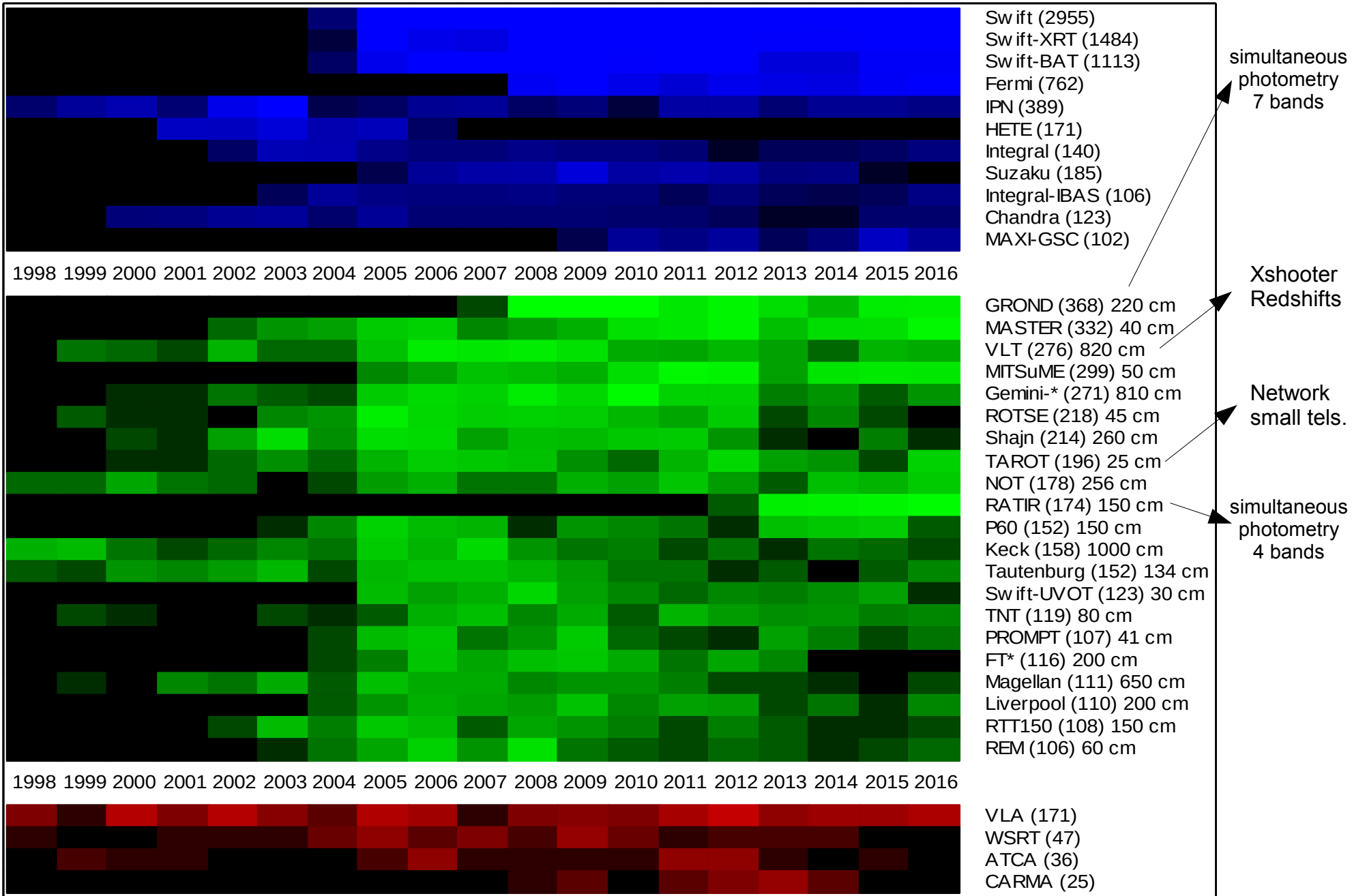
Large diameters
4 to 11 meters
Slow reactivity
Human manual



Optical telescopes for GRBs

Gamma ray burts Coordinate Network Circular production

GCN circular productions



Light curves + images + spectra

How to derive some GRB parameters

T90 : GRB duration

E_{iso} : Isotropic energy

E_{peak} : Peak energy

α, β : Gamma spectrum slopes

R.A, Decl : Accurate position

A_v : Host extinction

NH : Column density of H

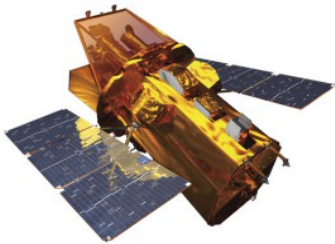
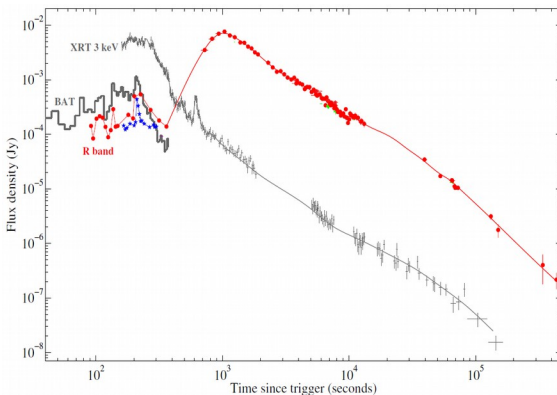
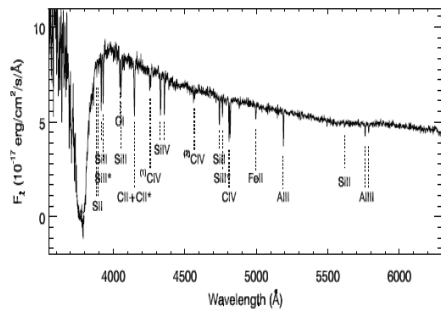
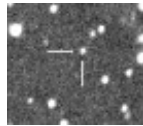
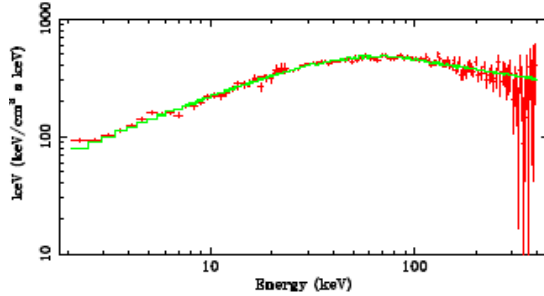
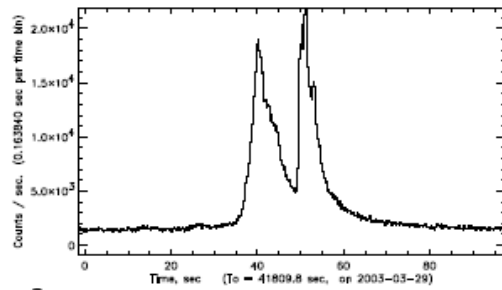
Z : Metallicity

z : Redshift

Inputs parameters

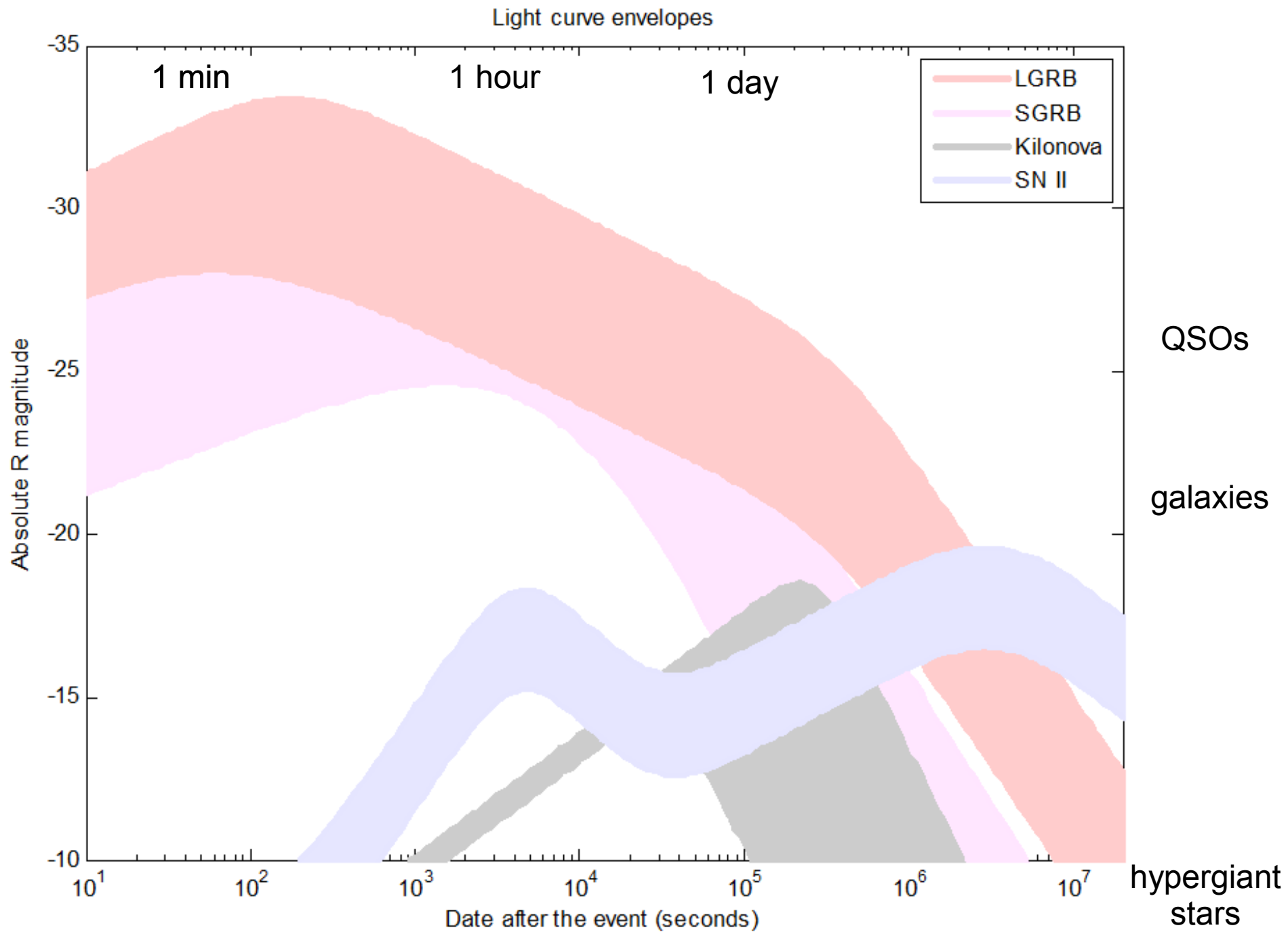
Spectra
Light curves

Science

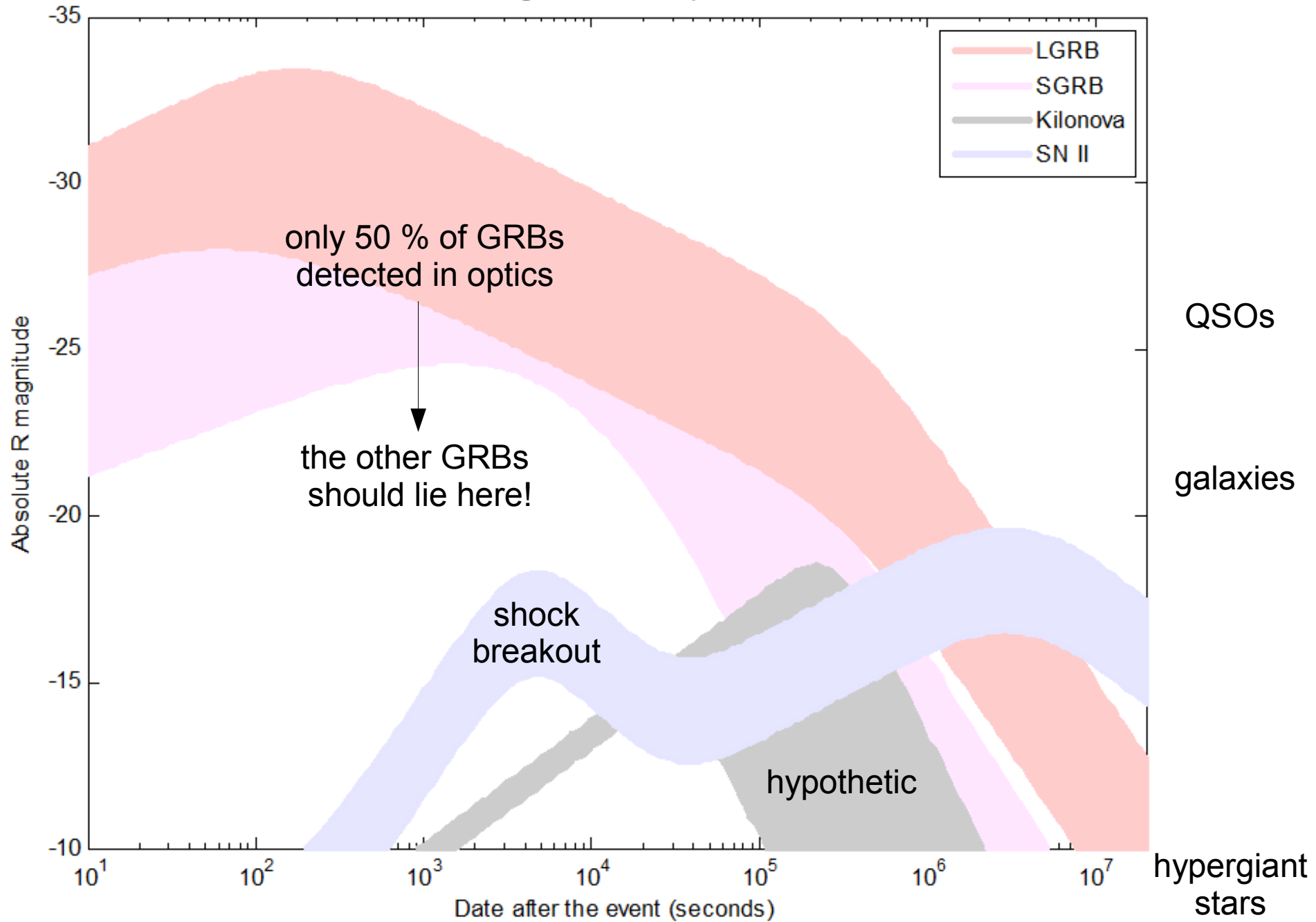


time

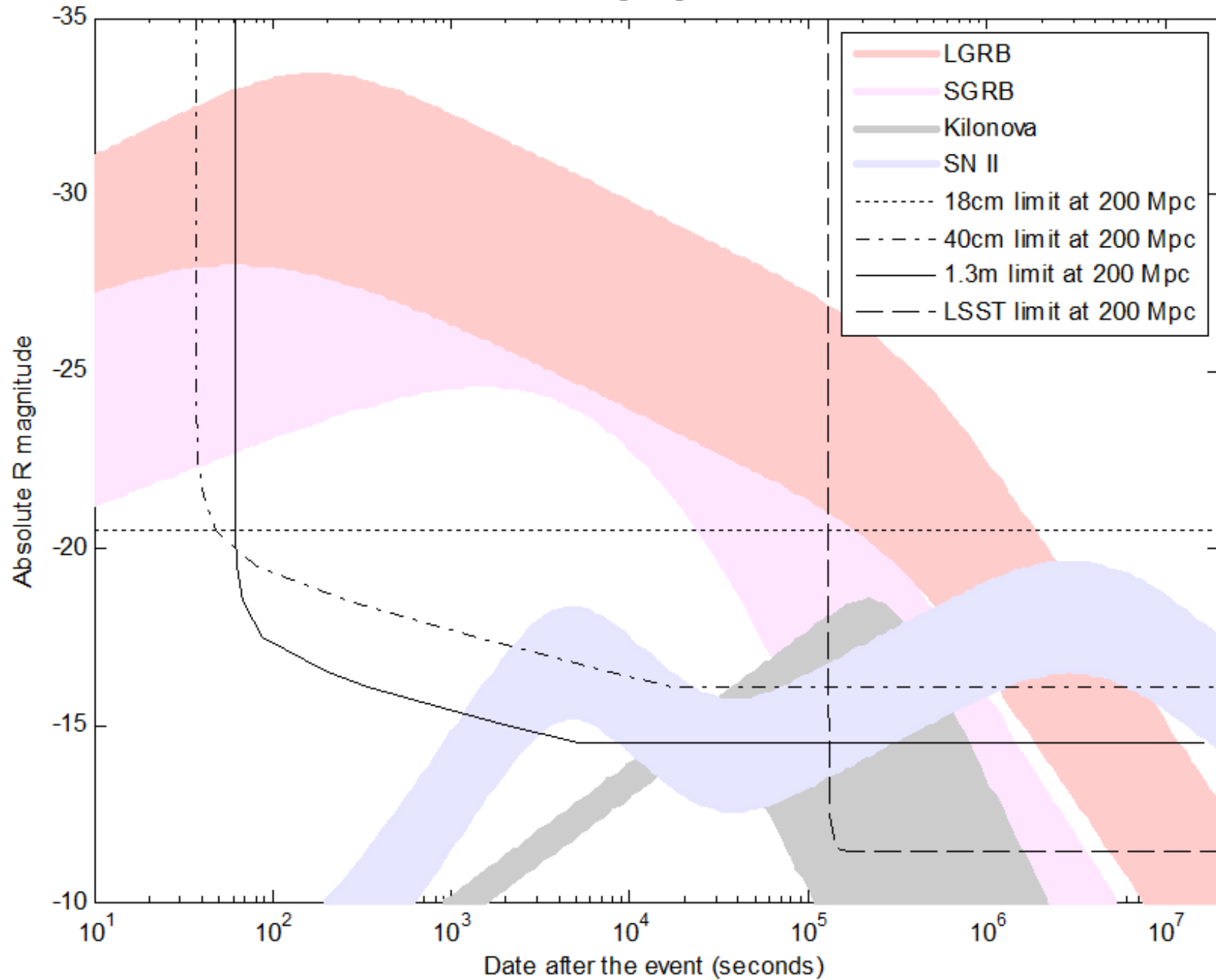
Four cases of "hot topic" cataclysmic events



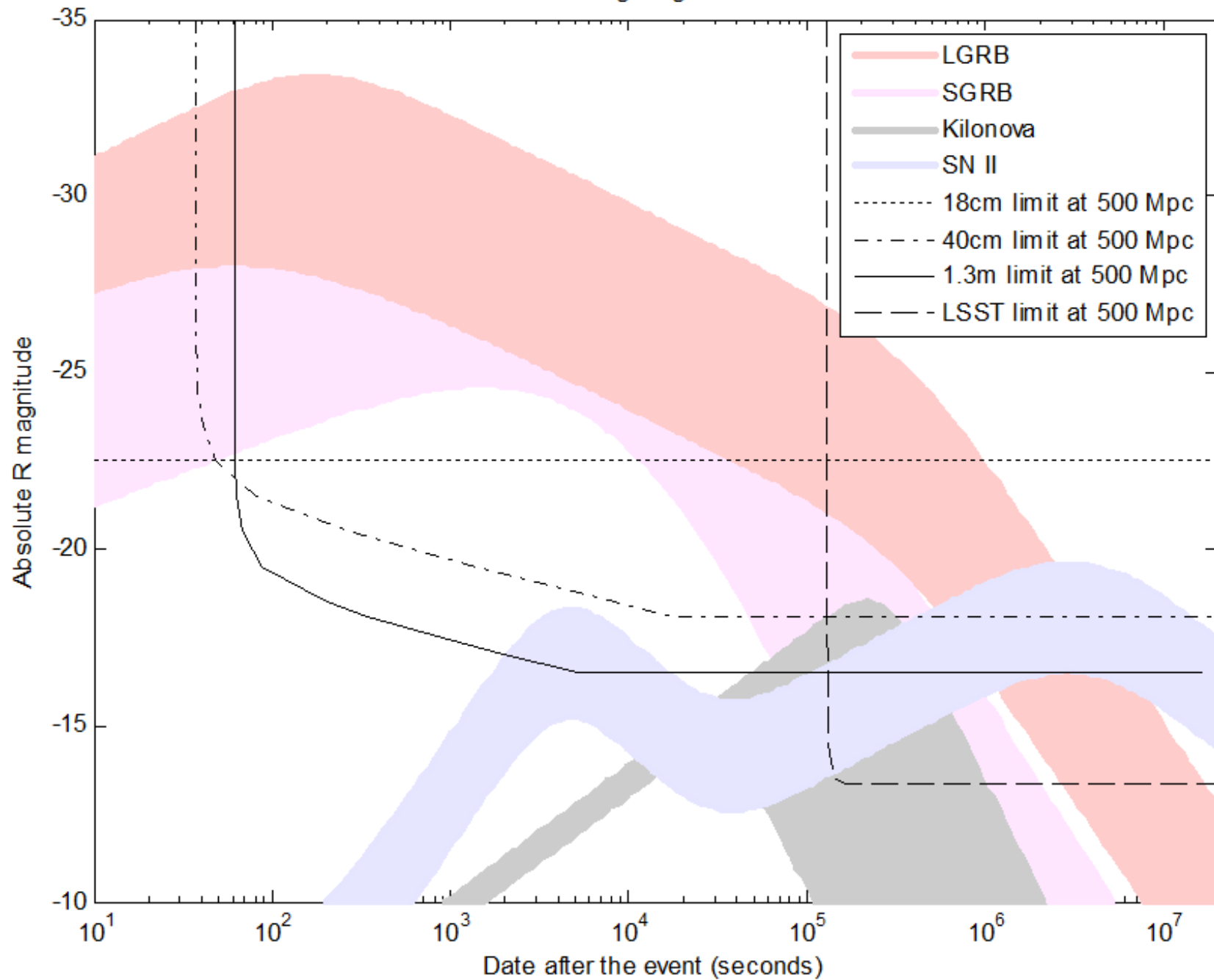
Light curve envelopes



Limiting magnitudes



Limiting magnitudes



How to prepare optical observations after 2020 ?

SVOM F-GFT : A telescope designed for optical follow-up of events

Ground Follow-up Telescope
France + Mexico
@ San Pedro Martir (Mex.)
Expected in 2020

GRBs
FRBs

RATIR, GROND
Large aperture
Detectivity multiband
Near infrared

MASTER, TAROT
Fast slewing



The best
optical telescope
for GRB
photometry

rapid localization
high redshifts
prompt emission
faint emissions

How to prepare optical observations after 2020 ?

TAROT Reunion a prototype of low cost reliable small robotic telescope

Rapid observation
of cataclysmic events

=> Fast slewing mounts

Large fields of view

=> Small focal length optics
Network of telescopes

Neutrinos
Gravitational waves
Supernovae
Early GRBs

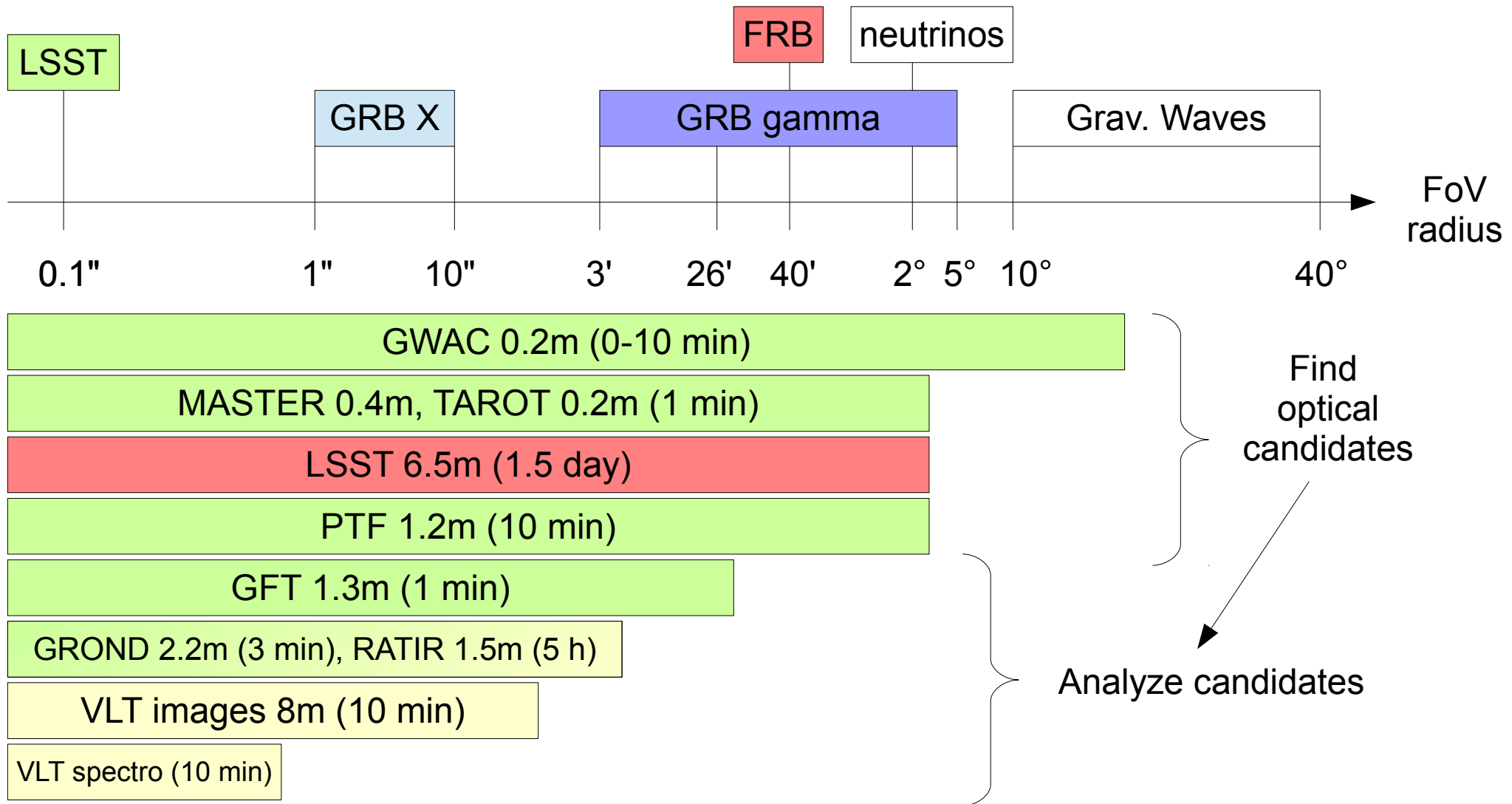


Wide FoV = $4^\circ \times 4^\circ$
Limiting mag. = 17 in 120s
No maintenance
Very high speed mount

Possibility to build a farm of telescopes

From triggers to source identifications

CONCLUSIONS



LSST will give thousands of pure optical candidates. First selection before fine analysis !

How to prepare optical observations after 2020 ?

CONCLUSIONS

The optical telescope strategy

Many small aperture fast slewing telescopes (Farms + Worldwide) => candidates
Some dedicated large aperture telescope for candidate => characterization
LSST + VLT+ELT to perform spectroscopy and late photometry => characterization

The object strategy

Understanding **GRBs** in multiwavelength

- SVOM triggers in 2022 for very high redshifts (infrared)
- Error box of about 0.5 degree when triggered

Participate to research on **GW** optical counterparts

- Scan $>100^{\circ 2}$ + Higher detectivity of Ligo-Virgo network in 2020
- Small focal length telescopes \rightarrow large field of view ($>4^{\circ}$) or telescope network (e.g. GWAC)
- Aperture diameter is limited by the price !

Participate to research on **neutrinos** optical counterparts

- Error box of about 2 degrees.
- New neutrino detector KM3NET \rightarrow search on electronic neutrinos (no Earth noise)

Participate to research on **FRB** optical counterparts

- Error box of about 0.5 degree.
- Follow the Parkes pointings (public in april 2018).