



KILONOVA CATCHER

WP-G : Towards the scientific exploitation of the Kilonova-Catcher citizen science program

Damien Turpin,

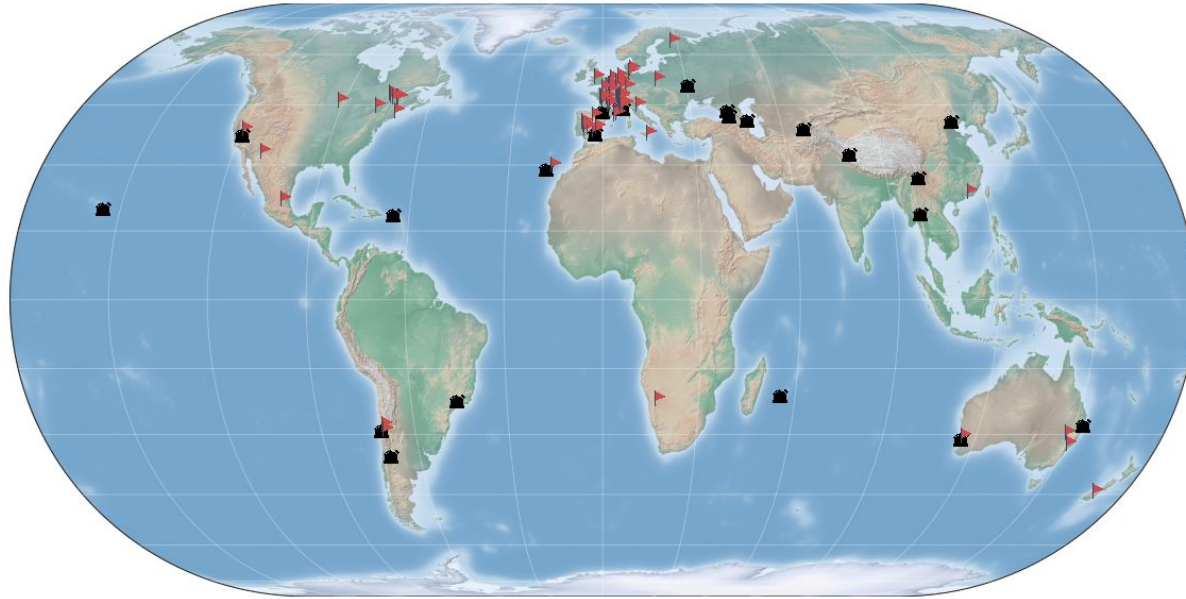
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Kilonova-Catcher in a nutshell

The GRANDMA + KNC networks



Towards the largest astronomical community devoted to the optical follow-up of the MM transient sky

The KNC community



114 people



KILONOVACATCHER



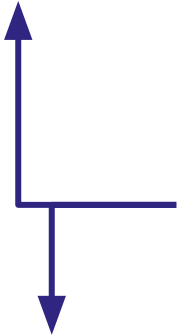
<http://kilonovacatcher.in2p3.fr/>

62 people



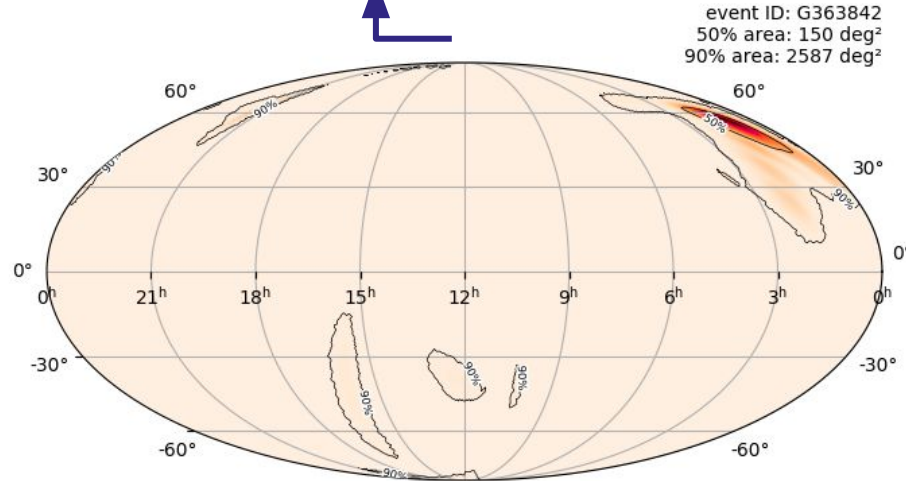
The complexity of the GW optical follow-up

Non-Standard shape for the localization regions



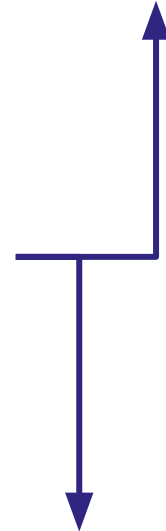
large localization regions
($> 1000 \text{ sq.deg}$)
and
partitioned in the two celestial
hemispheres

Significance of detection sometimes
unclear



Alert at any time
(time-domain astronomy, welcome !)

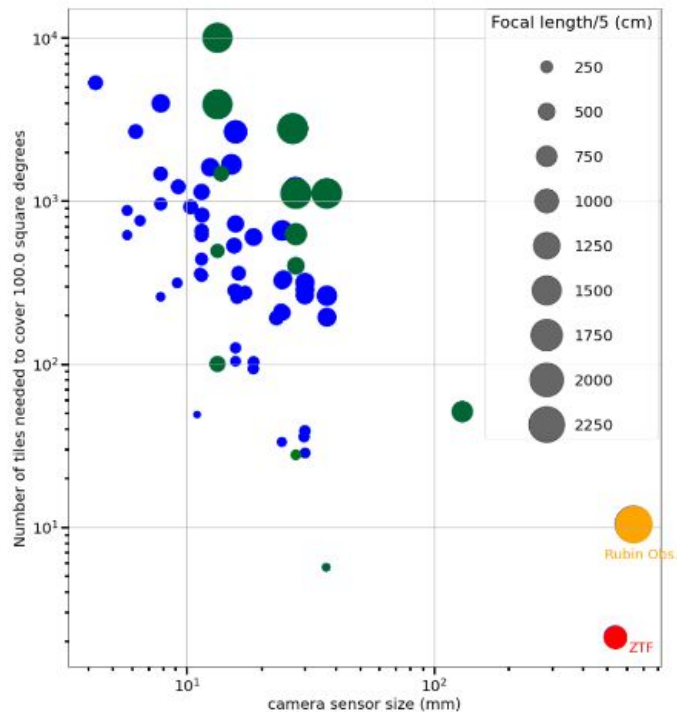
Significant updates on the
localization region by the GW low
latency pipelines



Cosmological distances = large
volume of Universe to cover

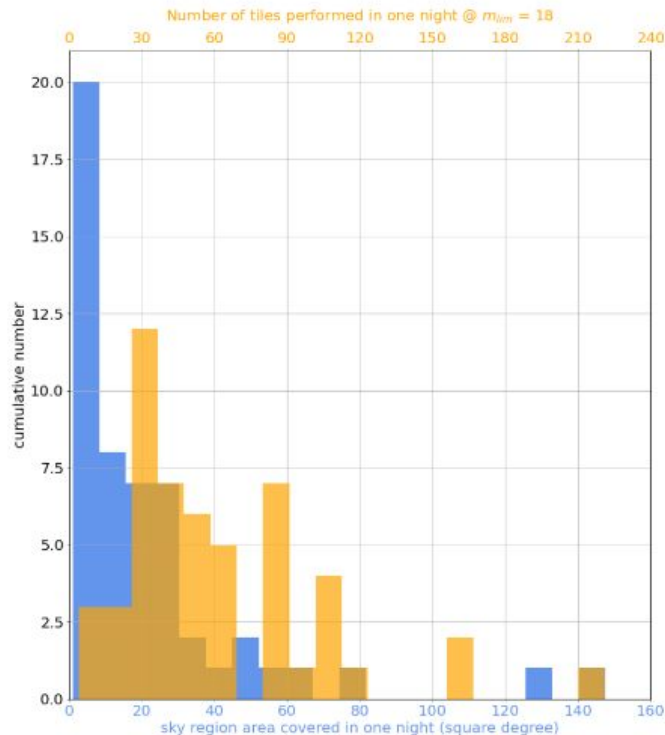
Kilonova-Catcher astronomers: Their telescope properties

At first glance, the Kilonova-Catcher astronomers don't have telescopes optimized for GW follow-up....



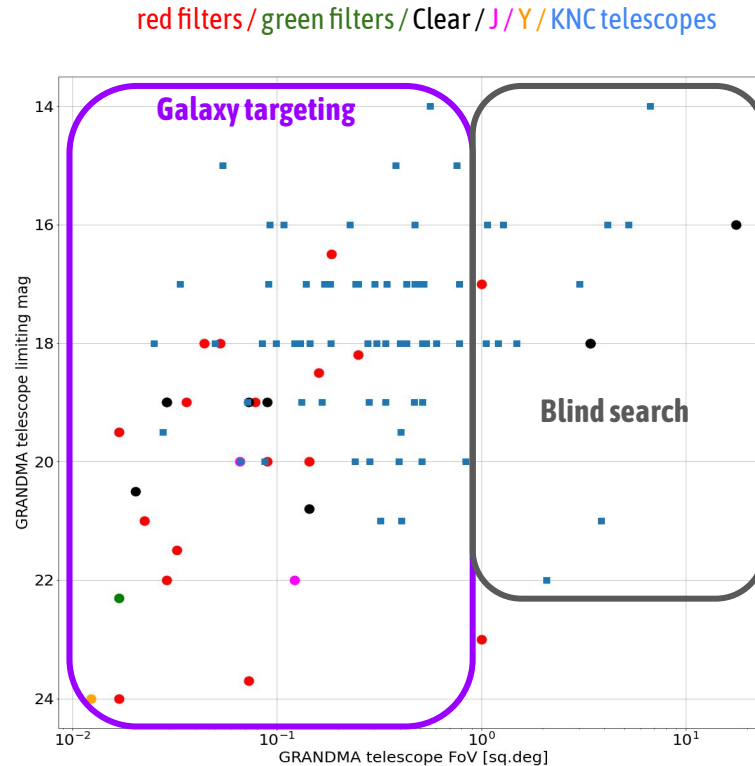
KN-Catcher
GRANDMA
ZTF
Rubin Obs

...But they are numerous (>100)
average unfiltered lim. mag = 18 +/- 0.5 (exp ~ 10 min)



Kilonova-Catcher observing modes

The GRANDMA +KNC telescope obs. mode for EM/MM searches



The KNC astronomers will mainly focus on **galaxy targeting searches** and **transient characterisations**



Kilonova-Catcher: the science goals

1. Build a large community of amateur astronomers devoted to the optical follow-up of MM transient sources
2. Provide tools to efficiently schedule follow-up observations based on a network strategy (**ICARE, Skyportal ?**)
3. Provide tools to send and visualize (in real-time) alert & follow-up data to the amateur community (**KNCatcher web site**)
4. Provide tools to quickly analyze the data sent by the KNC astronomers for scientific purposes (transient detection, light curve characterization, transient identification, model fitting, etc.) (**STDPipe, Skyportal?, etc.**)
5. Provide educational contents about the MM time-domain astronomy to prepare the future of the MM astronomy with the amateur communities (**KNCatcher web site**)



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Kilonova-Catcher: the status



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Kilonova-Catcher: Build a large community of amateur astronomers

This year, we will pursue:

1. our communication actions about the project
 - ✓ A Ciel & Espace article (french popular science journal) about KNC will be published soon
 - ✓ SF2A 4th Atelier Pro-Am in June
 - ✓ Applying for the SF2A Award Gemini
 - ✗ Creation of a dedicated KNC YouTube channel
 - ✗ Pedagogical guide for the observer of the MM sky (**Summer 2022**)
 - ✗ Video presentation of the project with the participation of some KNC astronomers (**Summer 2022**)
2. our actions to strengthen the current links with the KNC community
 - ✓ Need to restart the bi-monthly meetings
 - ✓ Make the KNC astronomers participating to the GRB follow-up campaign (best-effort basis):

I would like them to continue the follow-up of Swift and Fermi GRBs!





Kilonova-Catcher:

Provide tools to efficiently schedule follow-up observations

Ready

- ✓ alert generator (manual)
- ✓ KNC database
- ✓ KNC web site (still some debugs....)
- ✓ manual obs plan generator for follow-up type alerts (not GW blind search obs. plan -> galaxy targeting + tiles)

Last developments (by order of priority)

1. connect the GRANDMA alert system to the KNC database (**real-time!**)
2. Send **automatically** the observation plans (list of pointings) to the KNC users in the database
3. Send emails and slack notifications to the KNC users **automatically**



Kilonova-Catcher:

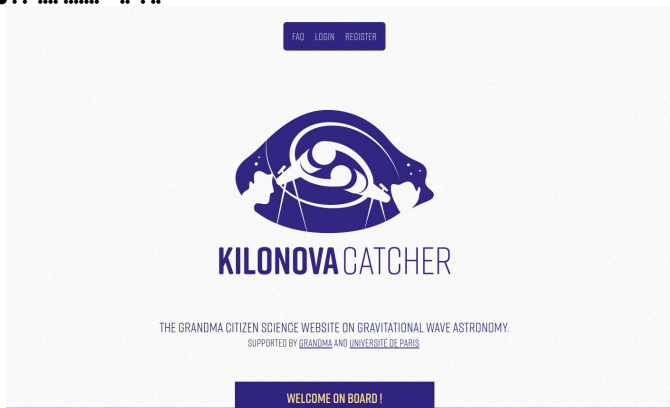
Provide tools to efficiently schedule follow-up observations

AUTOMATISATION!



Kilonova-Catcher: Provide tools to send and visualize (in real-time) alert & follow-up data

Official release of the KNC web site
<http://kilonovacatcher.in2p3.fr/>



DAMIEN
WELCOME ON YOUR KILONOVA CATCHER DASHBOARD !

Select an observation plan for a telescope [Show All](#) [Telescope myTelescope](#) [Telescope T8 Telescope](#)

[Telescope T11 Telescope](#) [Telescope T30 Telescope](#)

3
FOLLOW-UP CAMPAIGNS YOU HAVE JOINED

Event Name	Alert Type	Trigger Origin	Trigger Time	Campaign Deadline	Event Type	Event properties	Degree of interest	Images taken	Associated transients	Obs. Plan
ZTF22aabjpxh	GRB	ZTF	2022-02-19 09:27:00	0 Days 00 Hours 58 Minutes 42 Seconds	BNS	Dist (Mpc): -1 -1 P _{low} = 0 P _{high} = 0	5,005	0	0	Telescope myTelescope Display Alert

There is not any current alert you are not being a part of !

YOUR OBSERVATION PLAN

Show 10 entries

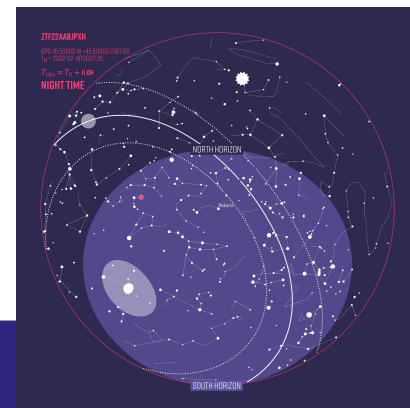
Search:

Target ID	Telescope	RA [deg]	DEC [deg]	Metric	host galaxy infos	Aladin view	# images taken	Last observation	Upload FITS
735748	myTelescope	240.9139656	31.2346451	1			0	no data	Upload Fit

Showing 1 to 1 of 1 entries

[Previous](#) [1](#) [Next](#)

[All Observations of this event](#)





Kilonova-Catcher:

Provide tools to quickly analyze the data sent by the KNC astronomers

A lot of work to do here !

1. Use of STDPipe as the main detection transient pipeline (**automatisation with the KNC image server**)
2. **Automatic** report of the results in the KNC database + Skyportal ?
3. Light curve **automatically** built and visu of it (Skyportal ?)
4. Finding charts **automatically** built (included in STPipe)
5. Use of Muphoten for photometry ?



Kilonova-Catcher:

Provide educational contents about the MM time-domain astronomy

We have an FAQ on the KNC website !

I need you to enrich it with more contents or correct the informations
(available without any KNC account)





Kilonova-Catcher:

Provide educational contents about the MM time-domain astronomy

We should provide an observer guide for O4!

- Which filter do we use and when ?
 1. Transient characterisation : sdss-gri or Johnson/Cousins BVRI filters
 2. Galaxy targeting searches: Clear or sdss/Johnson filters?
- How long should I expose ?
 1. It depends on the expected source brightness (GW alerts + KN models provide an estimate of the apparent mag) and your telescope configuration (diameter, camera response, accuracy of your tracking system, etc.). Training is the only way to know which sensitivity you reach which a given exposure time
 2. We encourage the co-addition of “short” (TBD) exposure time to reach the expected magnitude
- How fast should I respond to a GW alert and send my images to the KNC server ?
 1. As soon as possible for both. Typically, we have few hours up to 1 day (at maximum) after the GW alert to find the optical counterpart before it becomes too faint for 40cm telescope apertures. Responsiveness is the key!



KILNOVA CATCHER

Kilnova-Catcher:

Whoever in GRANDMA is interested in contributing is more than
welcome!

Contact me @ damien.turpin@cea.fr