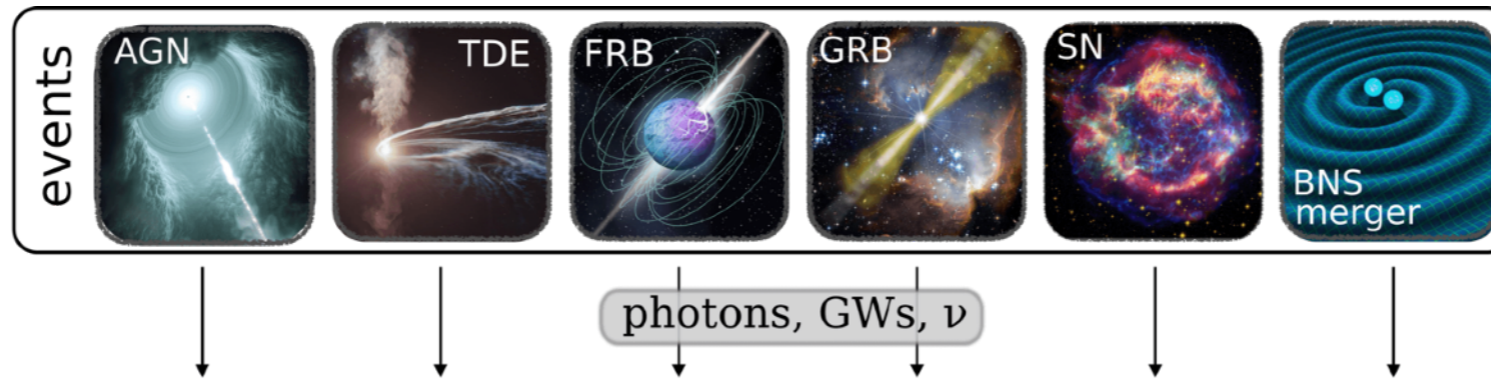


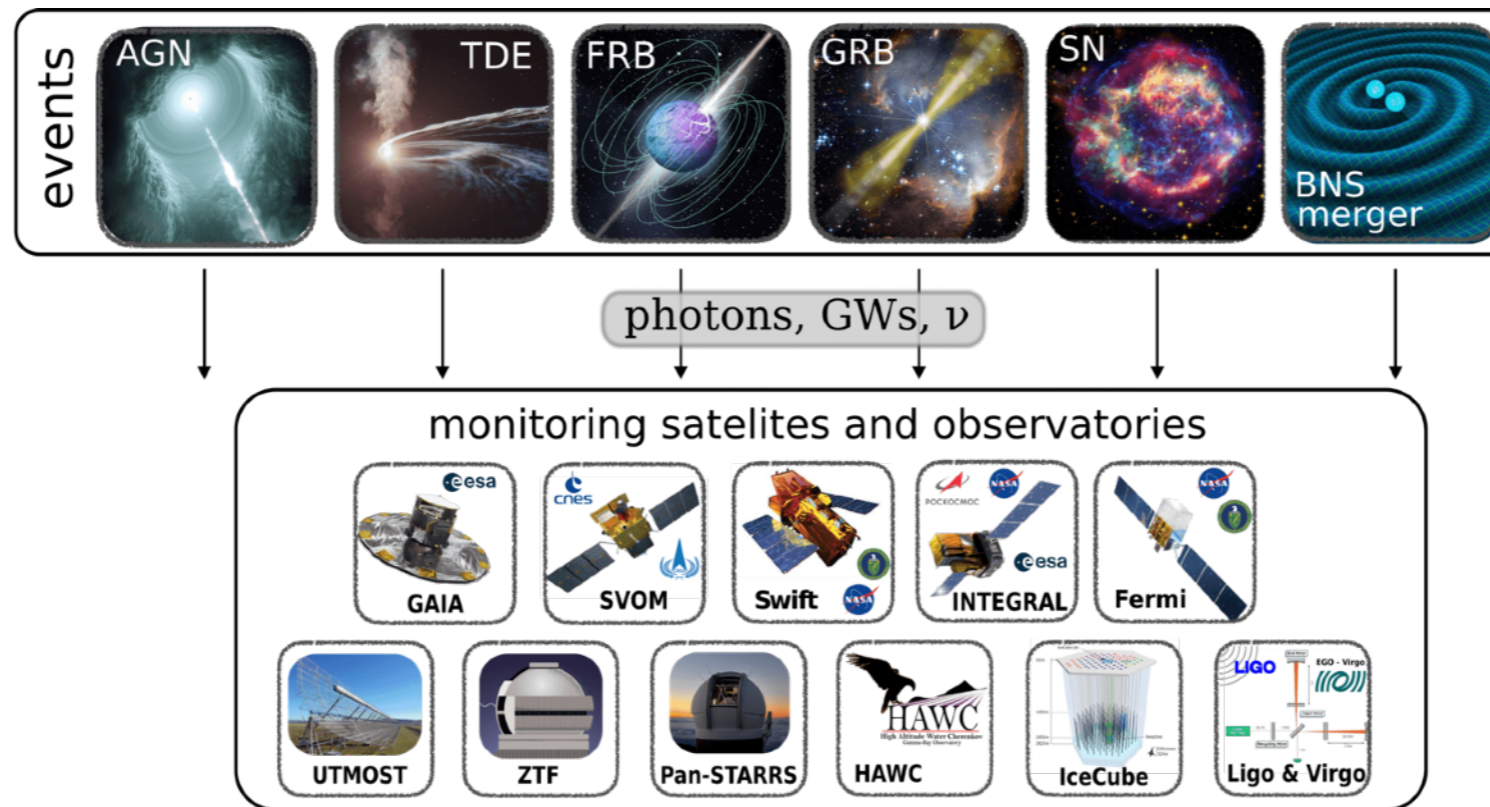
Multi-messenger + transients



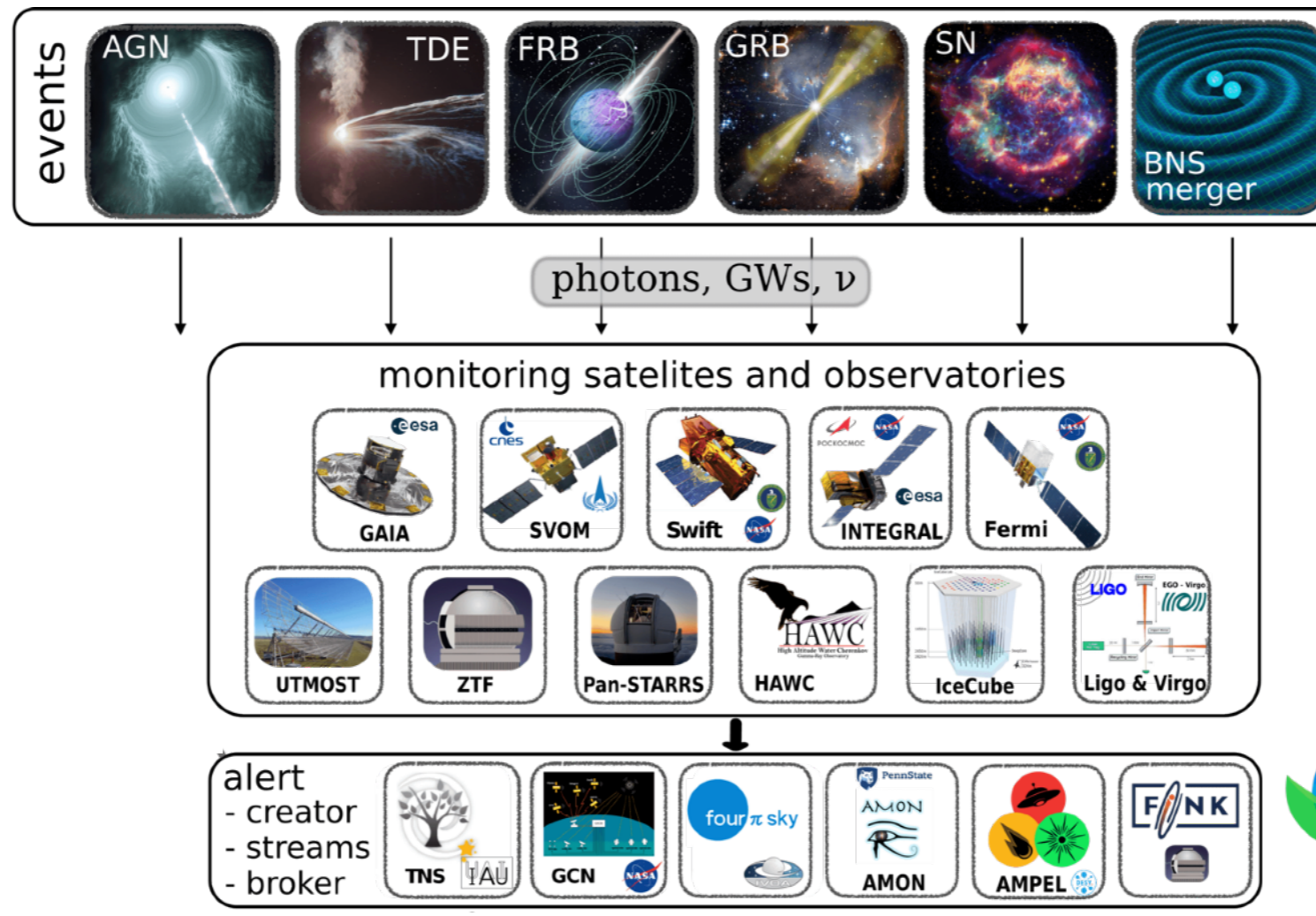
Diego Götz
Lucas Guillemot
Fabian Schüssler



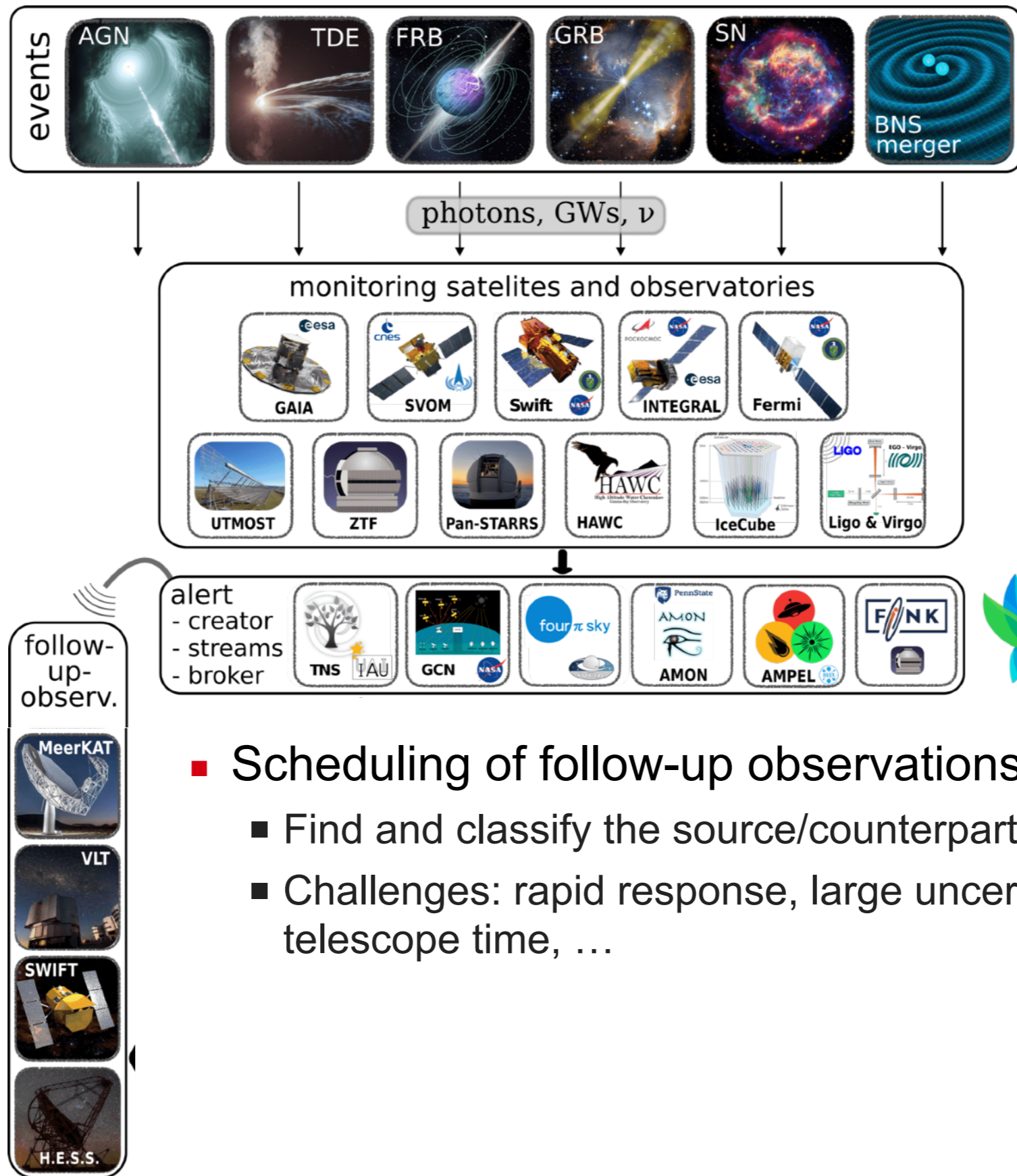
- Large range of source + messengers
 - Multi-messenger astrophysics well established
 - Number of events still extremely low $O(1)$
 - Risk of backlash due to early overhype (?)
 - “Recent” breakthroughs
 - Fast Radio Bursts
 - GW170817
 - TXS 0506+056 et al.
 - TeV gamma-rays from GRBs and novae
 - kilonova from long GRBs
 - slow pulsars $O(20\text{min})$
 - GWs @ Pulsar Timing Arrays
 - ...



- Improvement of real-time data analyses + alert sending
 - Observatory internal data streams, reconstruction, filtering, classification, etc.
 - New observatories and thus new alerts coming online soon
 - SVOM (and other GRB detectors)
 - KM3NeT (+ IceCube-Gen2, etc.)
 - Vera Rubin / LSST
 - ...
 - Sub-threshold event streams (?)

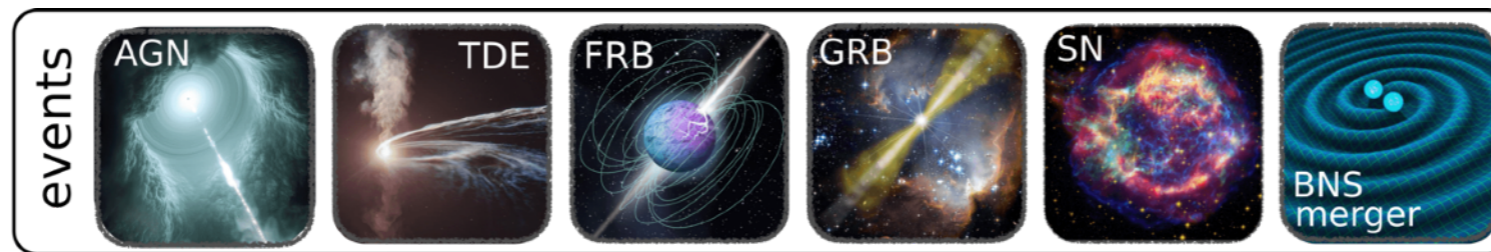


- Alert transmission + distribution
 - Common formats and standards (e.g. evolution of GCN towards Kafka, IVOA)
 - Filtering + identification of the most interesting alerts (e.g. AI/ML)
- Improved information and new alerts from available data streams
 - X-correlations with catalogs, other transients, etc.
 - (Sub-threshold) combinations and correlations

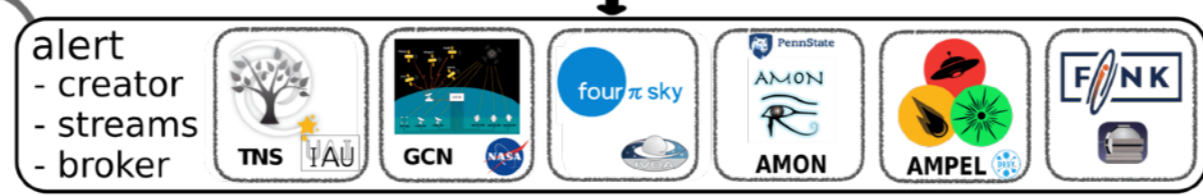
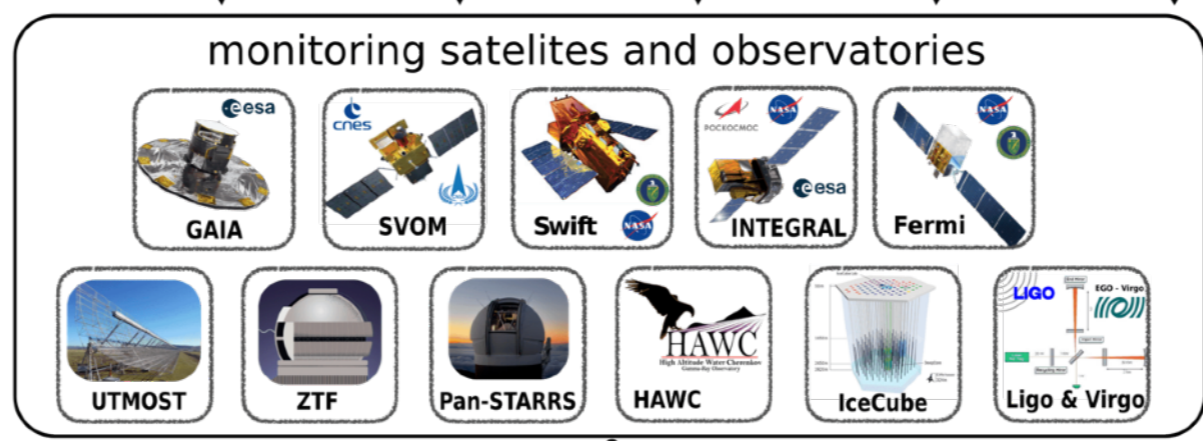


- Scheduling of follow-up observations

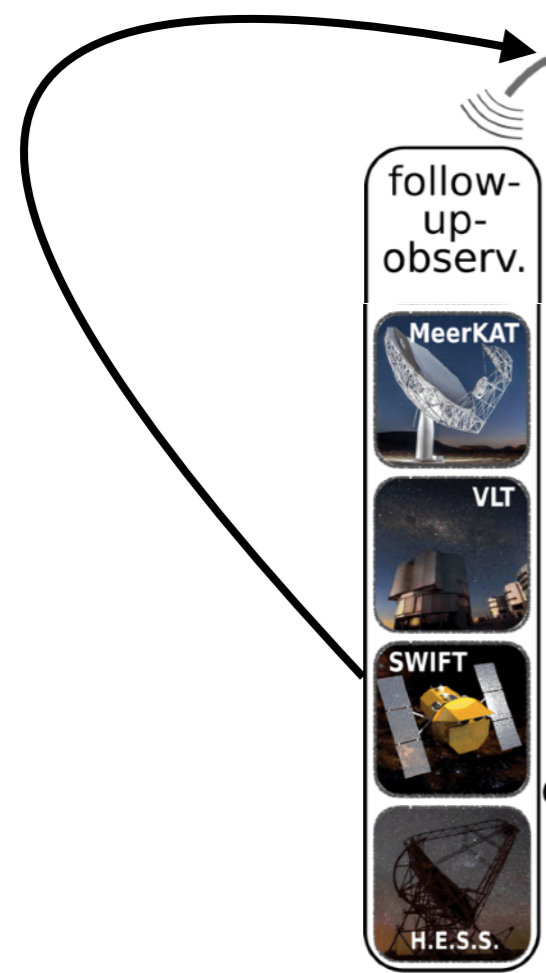
- Find and classify the source/counterpart
 - Challenges: rapid response, large uncertainty regions, limited telescope time, ...



photons, GWs, ν



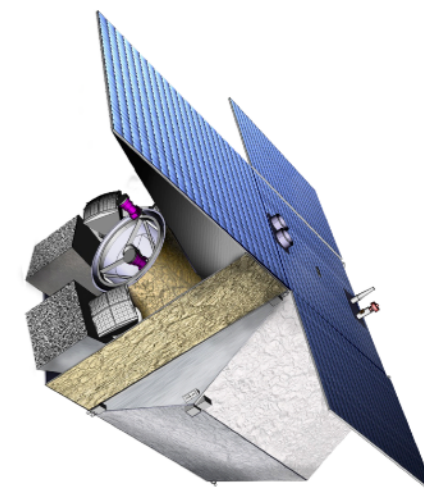
inform the community (incl. ourselves)



- Scheduling of follow-up observations
 - Find and classify the source/counterpart
 - Challenges: rapid response, large uncertainty regions, limited telescope time, ...
- Rapid data reduction + publication (automatisation ?)
- Citizen science (?)

Upcoming opportunities + challenges

- Balance between monitoring/detection and follow-up instruments
 - Vera Rubin / LSST => MISTRAL@OHP + ...
 - LHAASO + SWGO => CTA
 - ?? => NewAthena
- **Theseus**: multi-wavelength payload (NIR->soft-gamma-rays), ideally suited for providing and following up alerts
 - France: mission co-lead and IRT telescope PI
 - In the ESA M7 pipeline: Phase A down selection in November this year (5-> 2 or 3 mission); Phase A 2024-2026; if selected: launch 2037
 - Synergies with CTA, LSST, newAthena, Einstein Telescope, ELTs, LISA, ...
- How can the PNHE help?
 - The instrumental panorama looks well adapted for the next years, and the support of the PNHE to these and future experiments shall continue
 - Support the community driven initiatives towards data and alert sharing



Discussion / comments / ideas / ...

- Services d'observation: sondage par le PNHE pour prioriser les services "à faire labelliser"? p.e. broker(s) ZTF/Rubin
- ...

- Shared document: https://docs.google.com/document/d/1ejDDXC87F72vN_2aTzsNSNxJwR94dAOFTTy8lyfexcA/edit?usp=sharing