



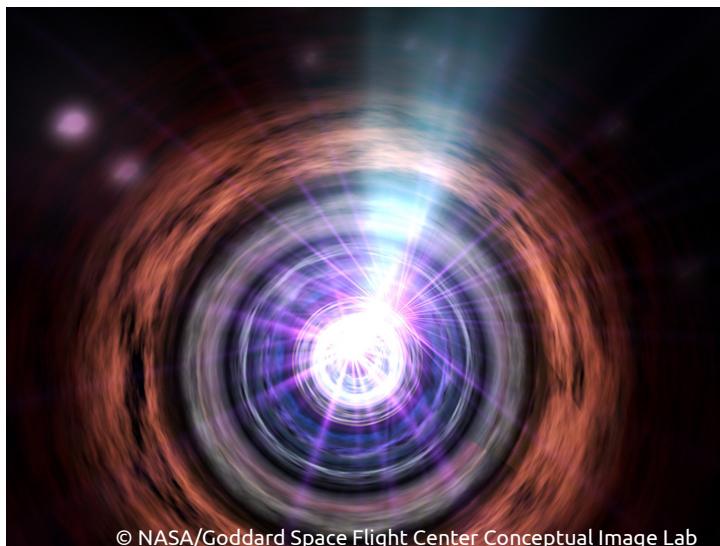
Synergies with other messengers

J.-P. Lenain (LPNHE, CNRS/IN2P3)

GRAND Workshop, LPNHE, Paris, 09–11/02/2015

Transient sources

AGN

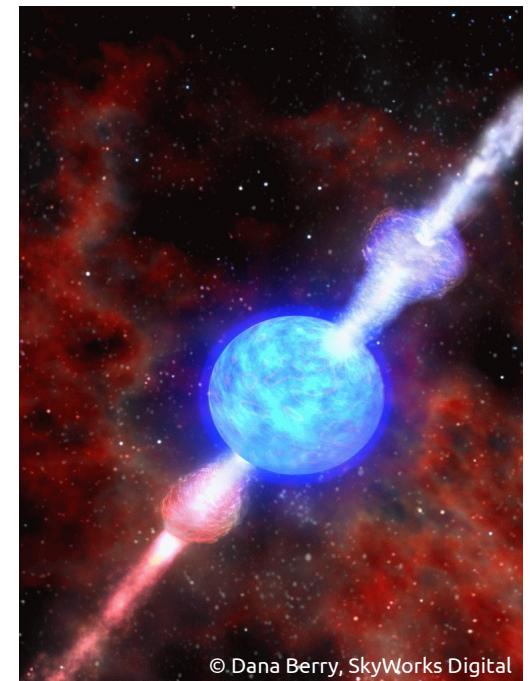


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Pulsars



GRB

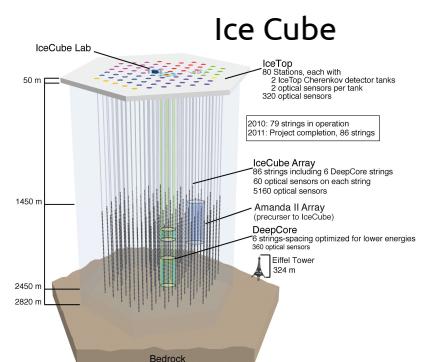
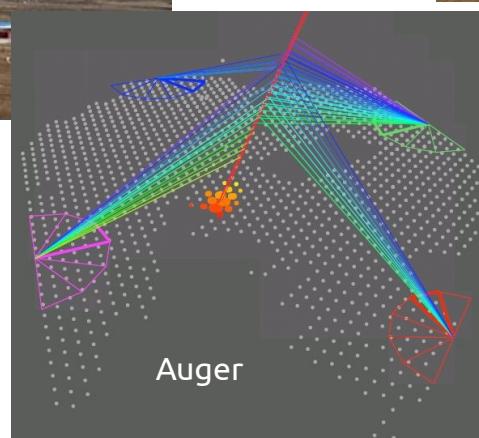
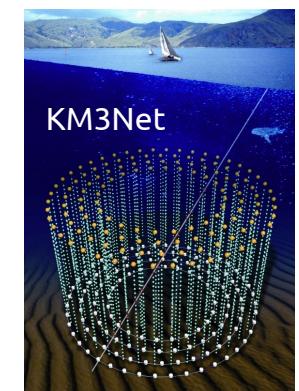
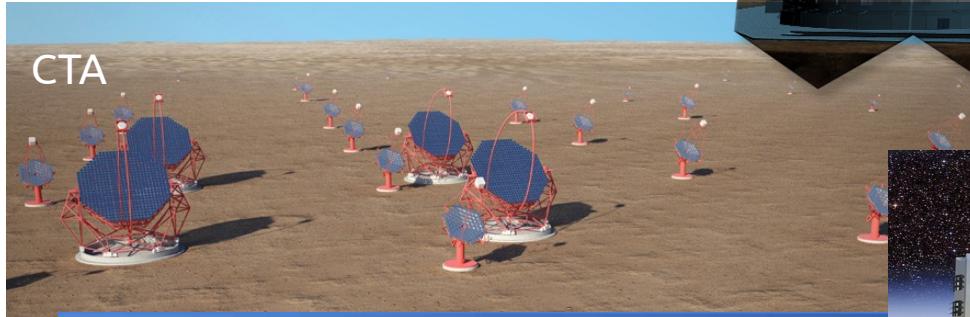
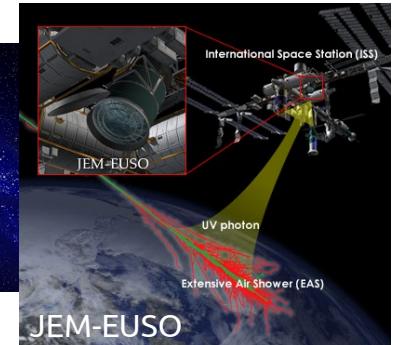
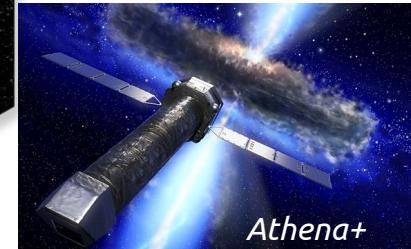
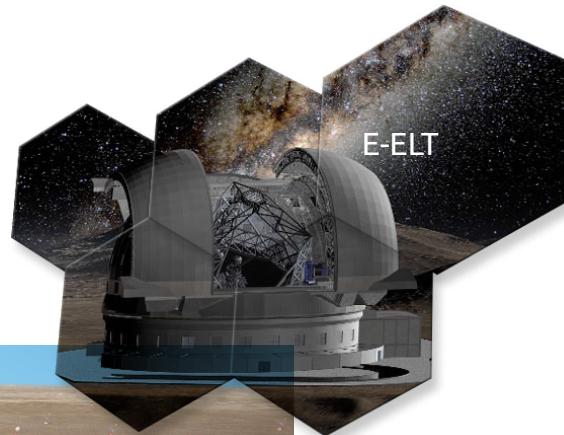
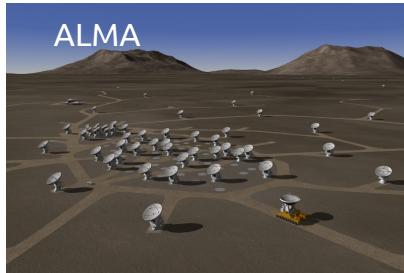


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Search for signal from transients events, triggered from external inputs
→ temporal & spatial coincidence
→ Minimize the background

e.g. Pradier (2010)

Multi-wavelength/messenger instruments



Strategies between ν and γ

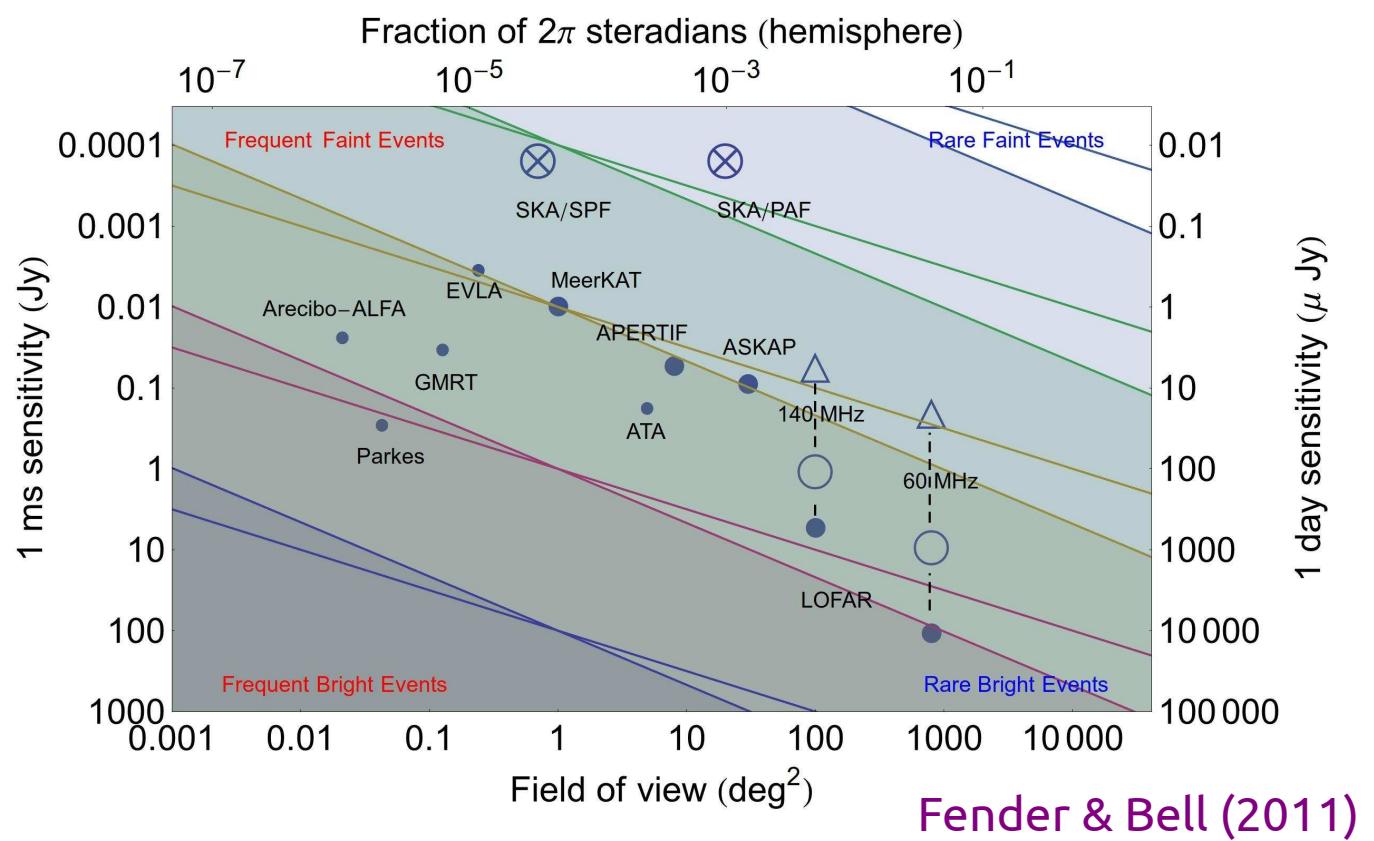
- Past : input from EM observations for neutrino searches
- Present: follow-up observations of neutrino events
- Future: real-time observations of sources ?

cf. Fabian Schüssler @ CTA perspectives workshop, OBSPM, July 2014

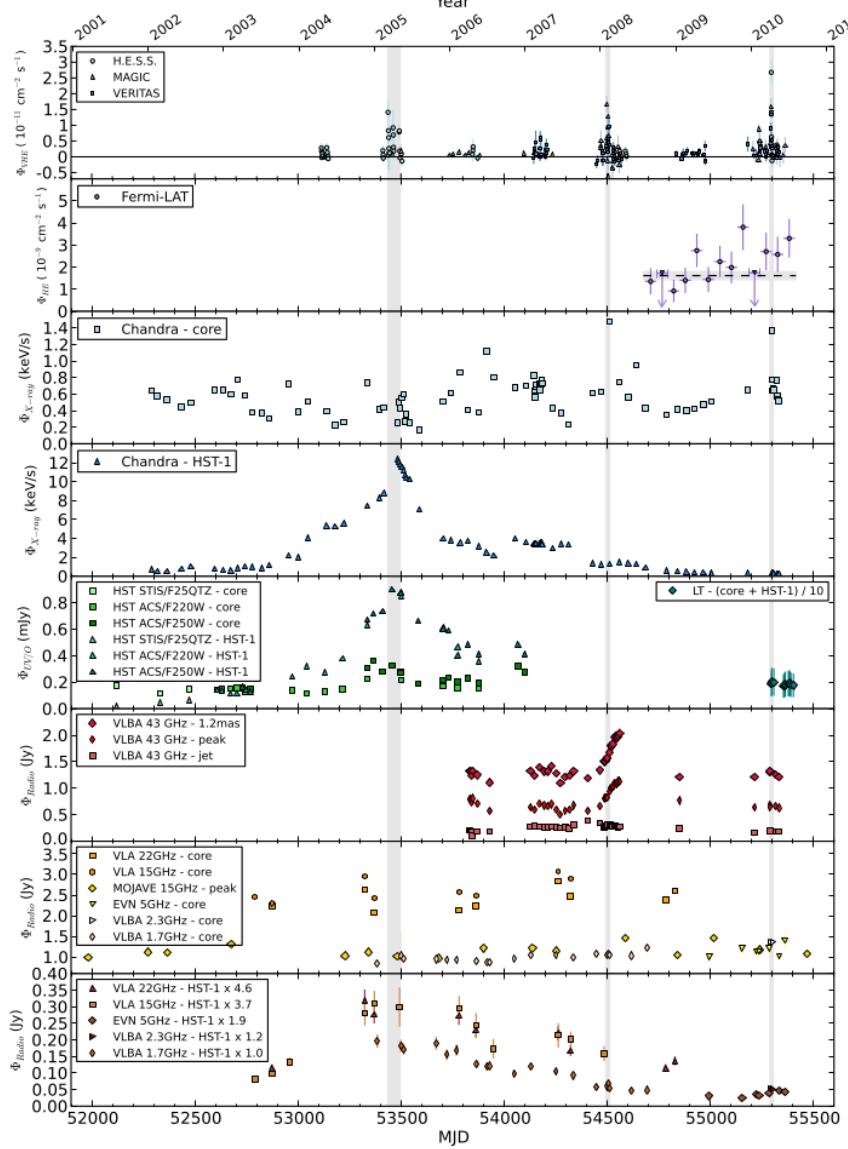
Time domain astronomy

Some examples of existing/future instruments:

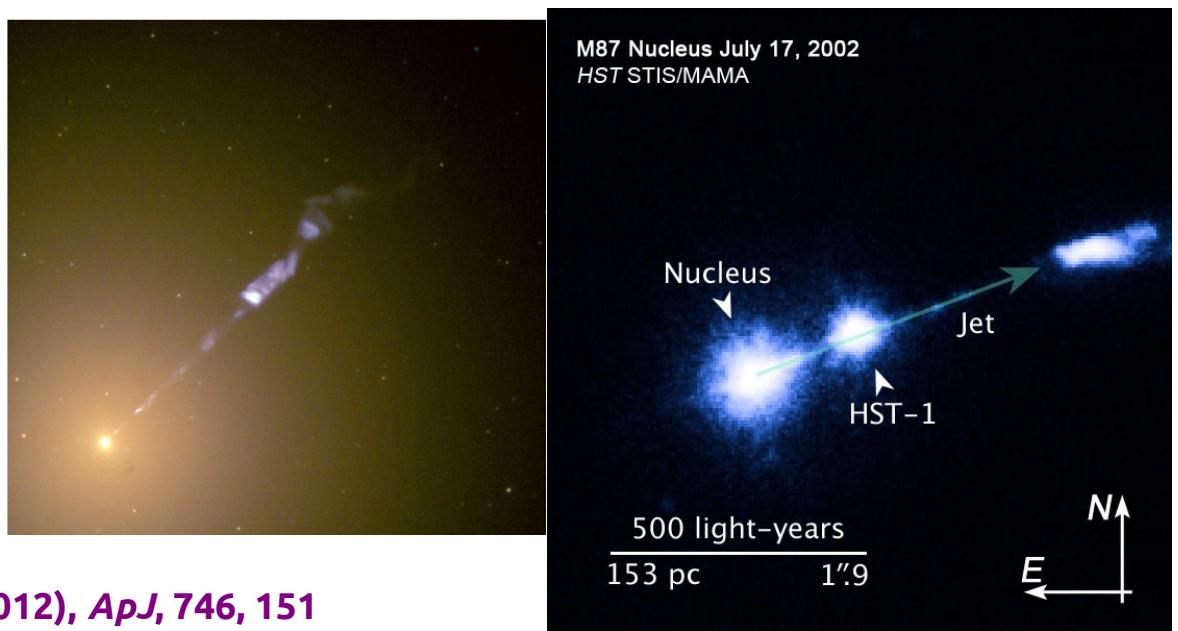
- CTA
- HAWC
- *Fermi*
- MAXI
- *NuSTAR*
- *ATHENA+*
- *eROSITA*
- LSST
- SKA, LOFAR
- Arecibo-ALFA
- EVLA
- Parkes



Importance of MWL: example of M 87

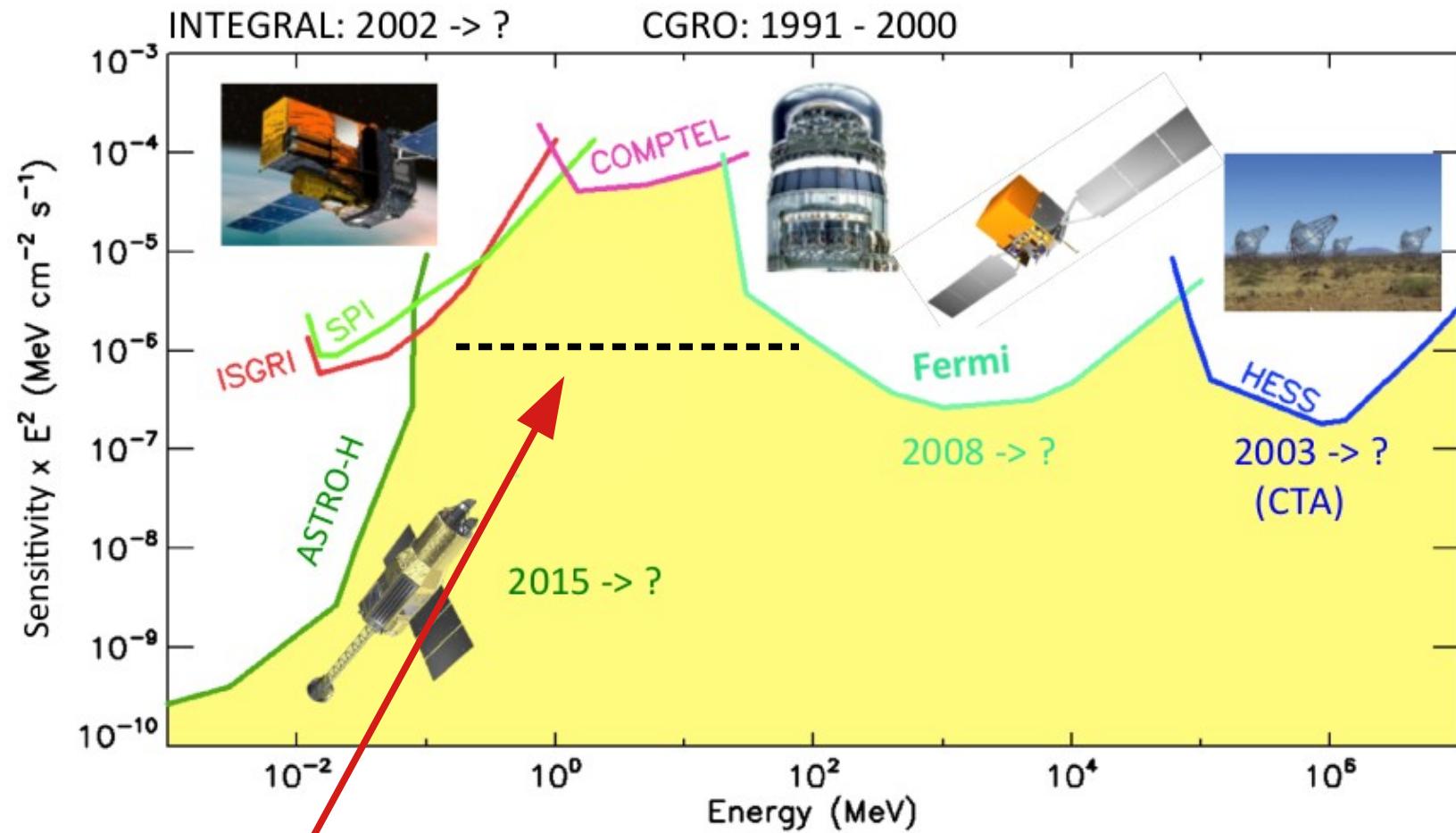


- MWL campaign:
H.E.S.S., MAGIC, VERITAS,
Fermi/LAT, *Chandra*, *HST*, Liverpool
Telescope, VLBA, VLA, EVN, MOJAVE
- 2008 & 2010 flares:
no enhanced emission from HST-1,
core favored for VHE emitting region.



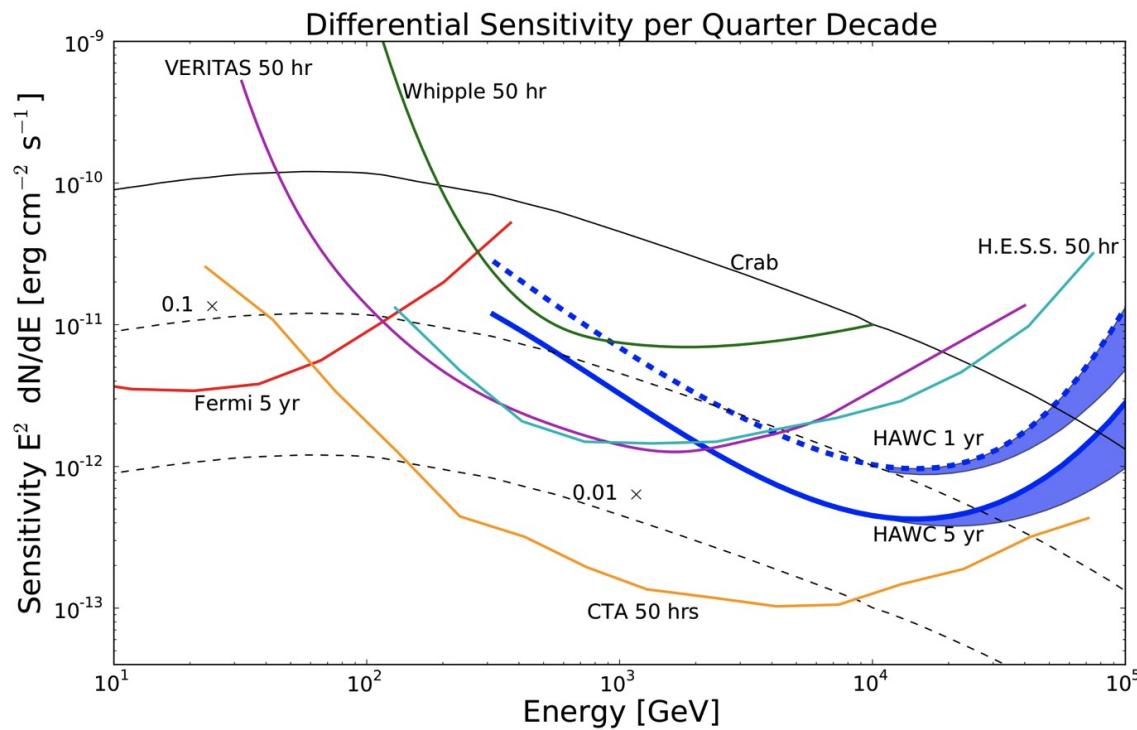
H.E.S.S., MAGIC, VERITAS collaborations et al. (2012), *ApJ*, 746, 151

HE astronomy: sensitivities

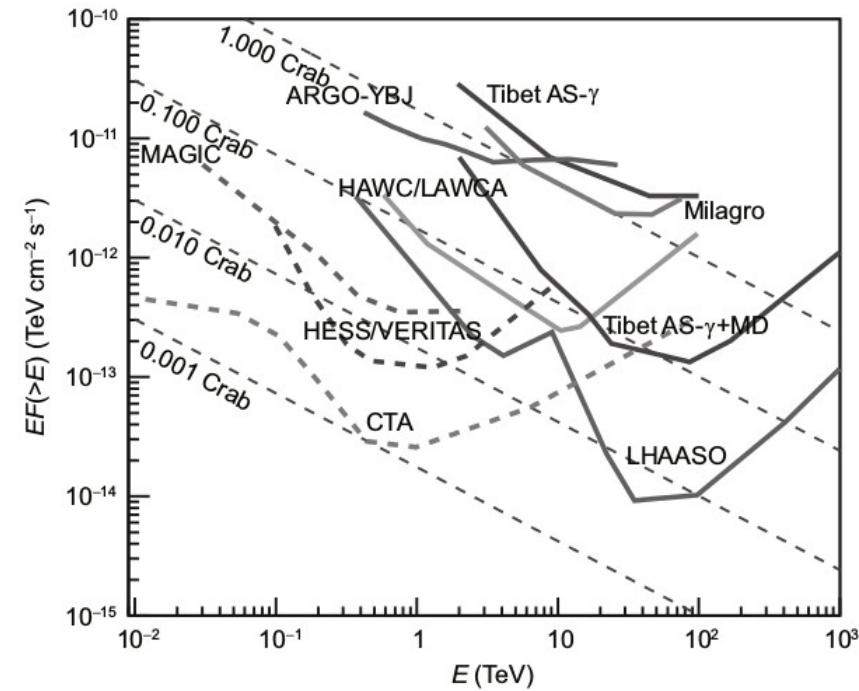


Plans: e.g. AstroMeV, ESA's M4 call, 100 keV-100 MeV

VHE astronomy: sensitivities



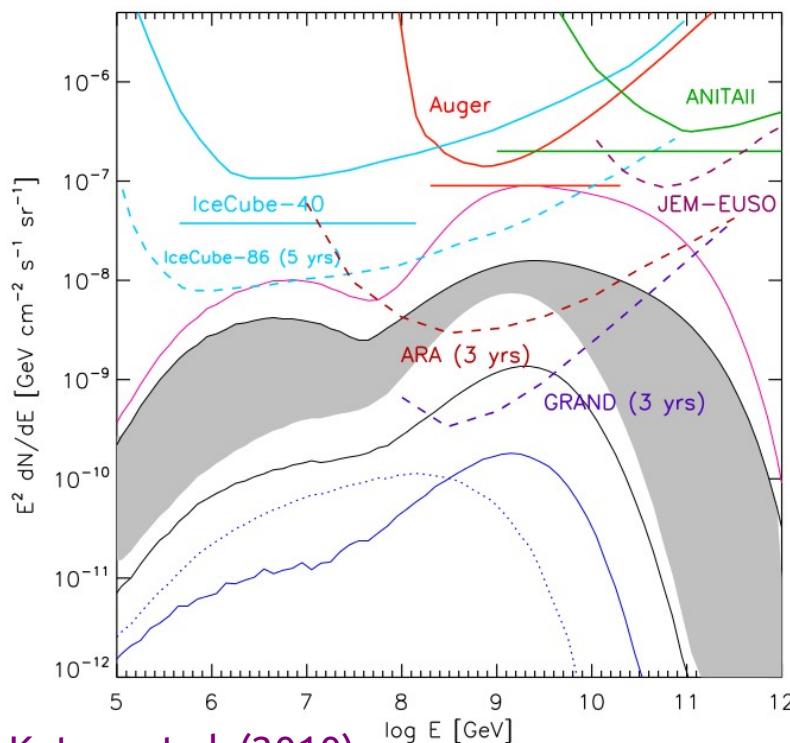
Courtesy S. Wagner



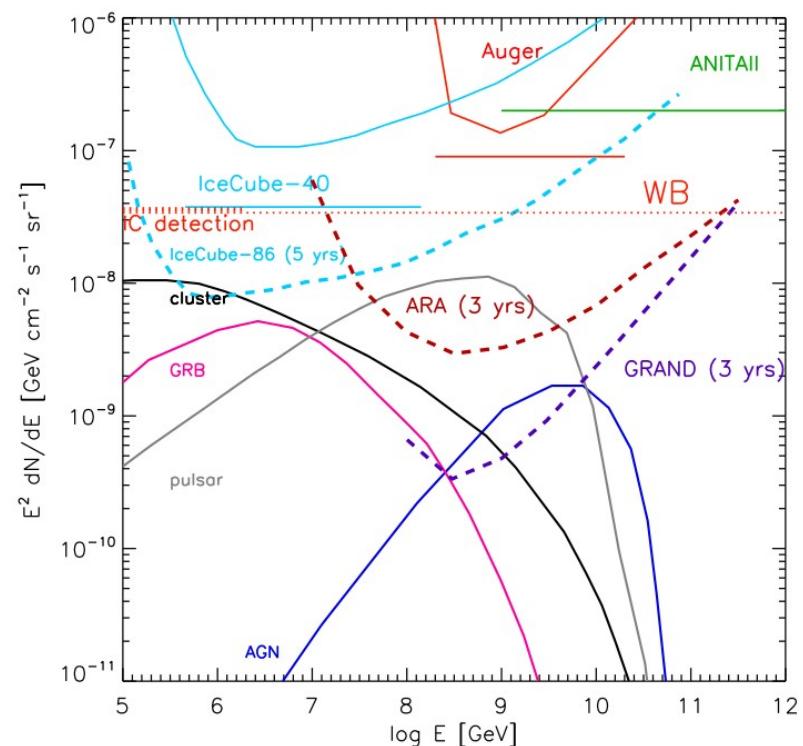
SongZahn Chen, 2013

Synergies with cosmic rays

- UHECR as parent particles of ν
 - Study of accelerators
 - Study of cosmogenic neutrinos

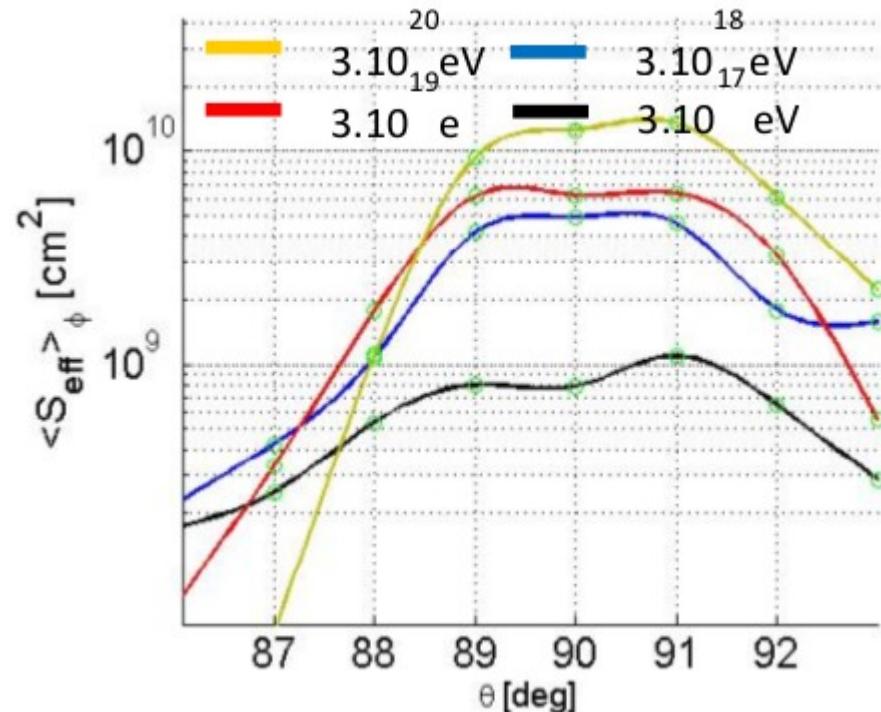


Kotera et al. (2010)



GRAND: Observational strategy

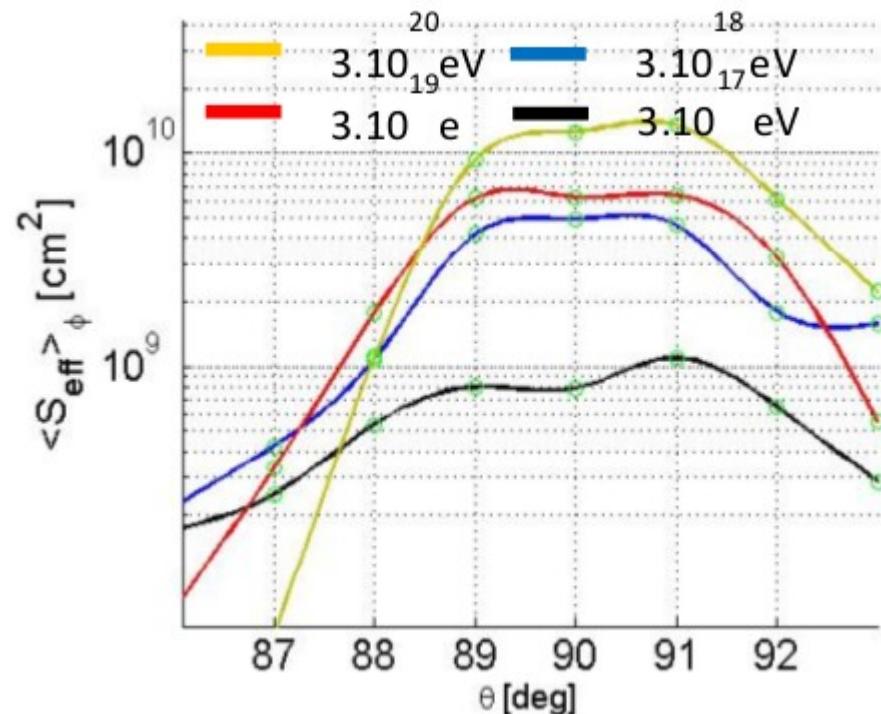
- Energy range: $E_\gamma \sim 0.1 E_\nu$
 - PeV-EeV neutrinos \rightarrow PeV γ -rays (\rightarrow LHAASO)
- Observational visibility:
Earth-skimming $\nu \rightarrow$ best coverage/simultaneity with HAWC ?



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→ Discussion



Other ideas ?