Search for VHE gamma-ray emission from the TDE candidate AT 2021uqv with H.E.S.S.

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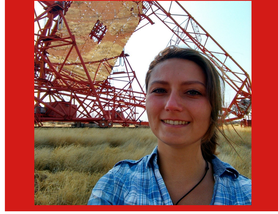
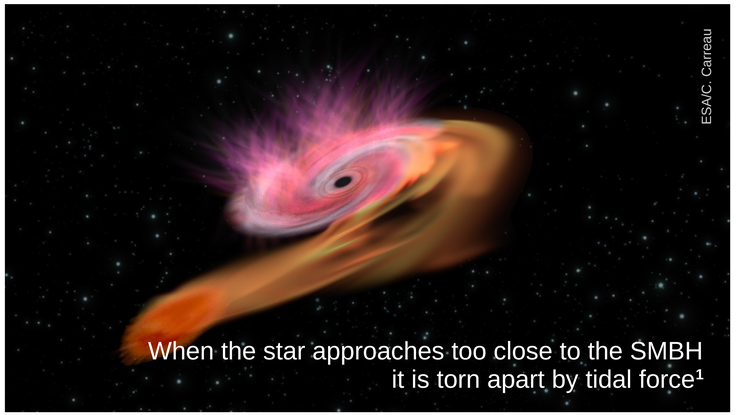
S. Ohm[3], F. Schüssler[4], S. Wagner[1]
for the H.E.S.S. Collaboration



What is Tidal Disruption Event (TDE)?



Multi-wavelength & multi-messenger

~Half of the star's mass remains bounded to SMBH → formation of accretion disc → flare of electromagnetic radiation:

- typically optical/UV range
- often thermal X-ray
- rarely non-thermal X-ray
- rarely radio
- neutrino events?

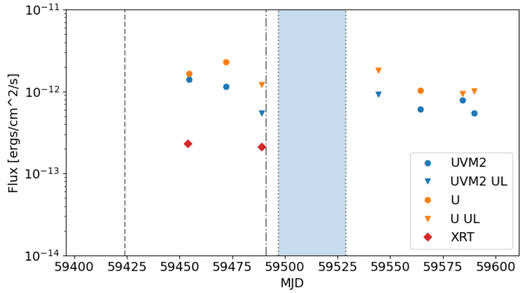
Distinction from other transients[2]

- nuclear event
- event timescales ~months/years
- light curve
  - longer rise and fade time than in SN
- spectroscopic features
  - hot, blue thermal continuum
  - very broad emission lines

classification timescales → ~a month

So far no gamma-ray emission detected from a TDE!

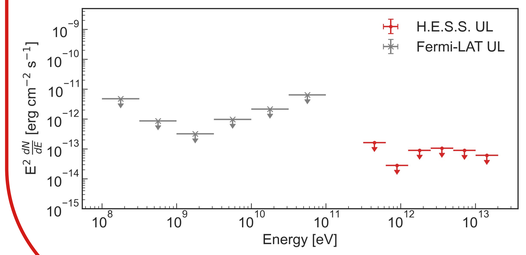
AT 2021uqv – first TDE candidate observed with H.E.S.S.



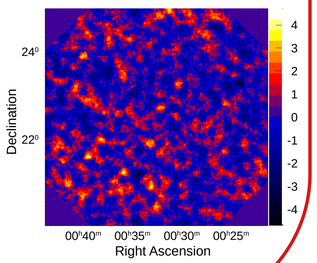
- discovery:
  - July 29th, 2021 by ZTF
  - ZTF21abqhkjd
- classification[3] on Oct 04th, 2021
- redshift z = 0.106
- Swift observations:
  - 7 runs (~monthly cadence)
  - XRT detections:
    - Aug 28th and Oct 2nd

- H.E.S.S. observations:
  - Oct 10th – Nov 11th
  - zenith angle ~45 - 55 deg
  - ~27 h of data
  - → no detection
- Fermi-LAT observations (same time period as H.E.S.S.)
  - → no detection

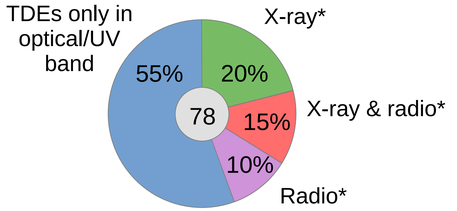
H.E.S.S. & Fermi-LAT UL



H.E.S.S. significance map



H.E.S.S. TDE program



* – besides optical/UV detection

Typical source of information: TNS[4], ATel[5]

- Since 2022 TDE follow-up is part of the H.E.S.S. legacy program

↓

- new trigger criteria:
  - non-thermal X-ray
  - radio
  - gamma-ray
  - neutrinos

- 78 TDE candidates in the last ~decade
  - mostly optically discovered
    - ZTF, Atlas, ASAS-SN etc
  - ~15% – X-ray discovered
    - Swift, XMM-Newton etc
  - only 4 jetted TDE candidates
- ~50% of TDEs are nearby (z<=0.1)
  - more chance for broad MWL follow-up campaign

Summary & Outlook

- TDE – long time known source class but relatively poorly studied
  - number of detection increased thanks to optical surveys
- AT 2021uqv – first TDE candidate observed with H.E.S.S.
  - no detection in ~27h
- TDE program is part of the HESS legacy program now
- Long classification time + lack of gamma-ray emission modelling + lack of MWL information → difficulties for the H.E.S.S. follow-up

Acknowledgements: https://www.mpi-hd.mpg.de/hfm/HESS/pages/publications/auxiliary/HESS-Acknowledgements-2021.html

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References:

1. M. Rees, Nature 333, 523–528, 1988
2. S. van Velzen et al, ApJ 872 198, 2019
3. https://www.wis-tns.org/object/2021uqv
4. https://www.wis-tns.org/
5. https://www.astronomerstelegram.org/