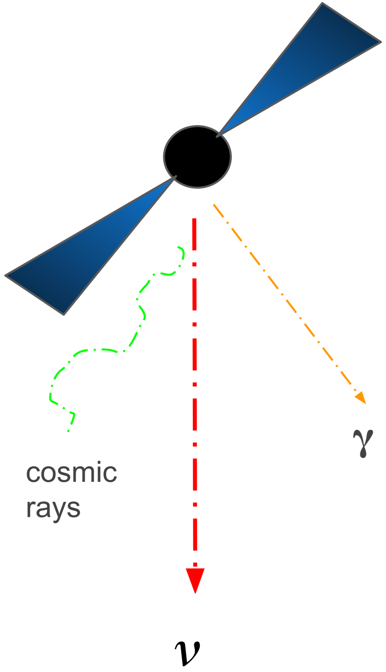
22nd Feb. 2025, Particle Astrophysics in Poland conference



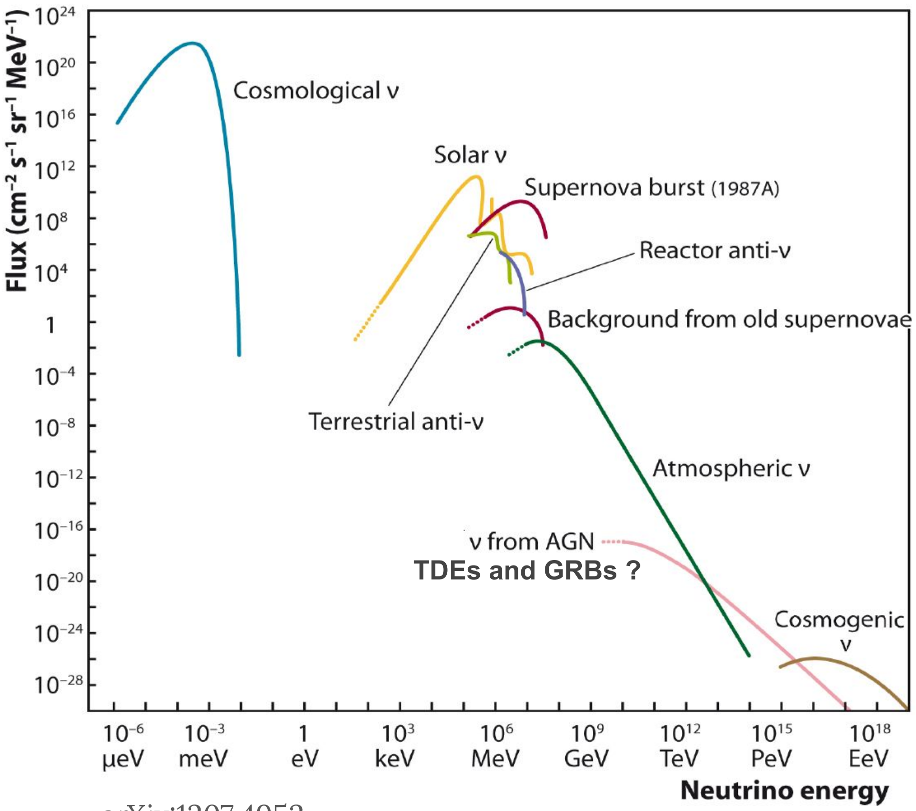
TDEs as potential candidates of high-energy neutrinos

Kalyani C K Mehta

Faculty of Physics and Applied Computer Science
AGH University of Krakow

Astrophysical neutrinos

- ➔ Neutrinos: neutral, stable, and weakly interacting particles
- ➔ Unknown astrophysical origins and mechanism of production high-energy neutrinos
- ➔ Their interaction products are detected via Cherenkov radiation measured in PMTs

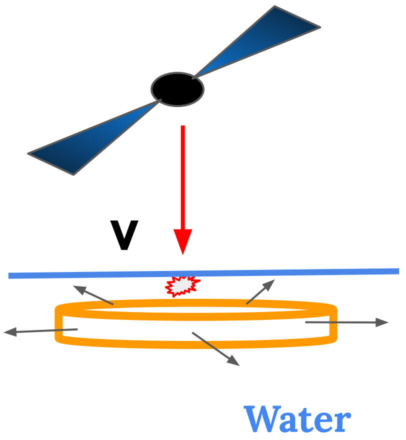


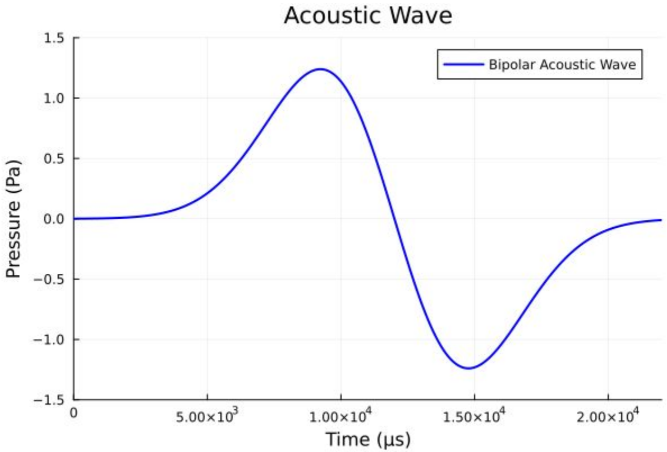
arXiv:1207.4952

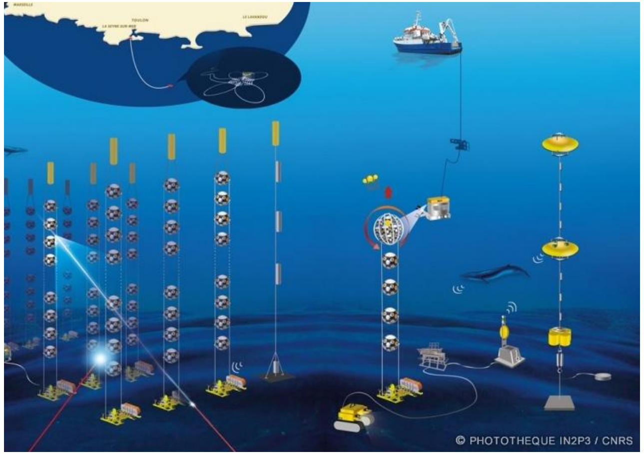
Innovative Acoustics Detection of UHE neutrino

Phenomenon | **Pulse** | **KM3NeT**

- Thermo-acoustic effect:
- Energy deposited by UHE ν heats water up







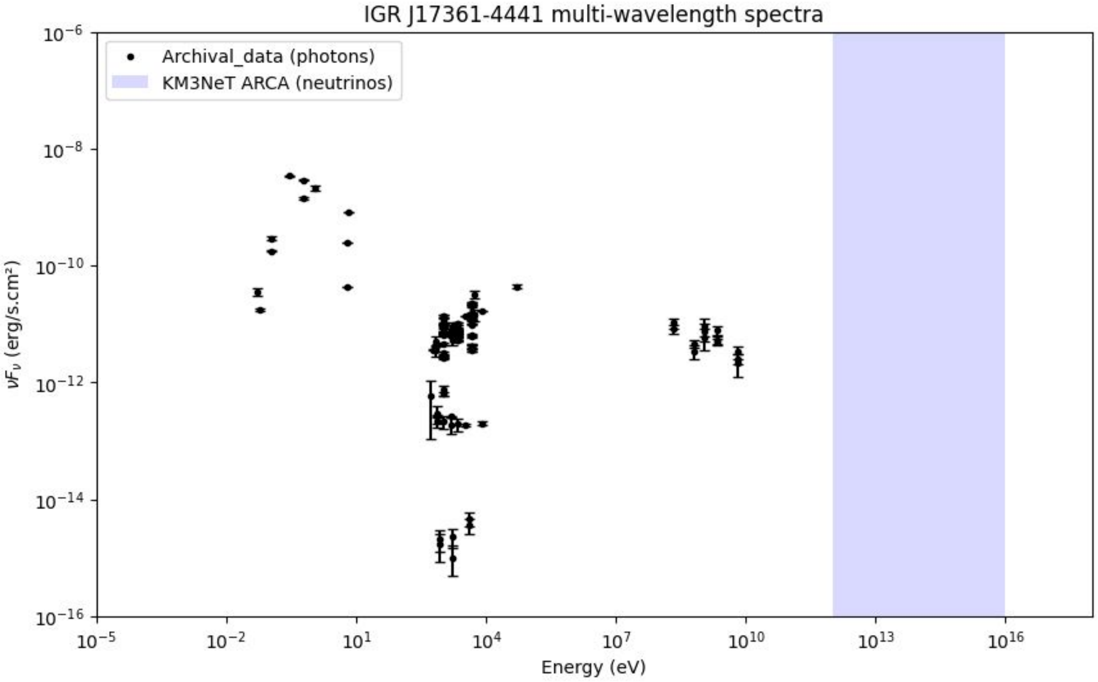
- Angular resolution < 0.1° (Optical detection) Eur. Phys. J. C 84, 885 (2024)
- Hydrophone sensitivity: -173 dB relative 1V/μPa up to 70kHz

arXiv:1910.09065

G.A. Askaryan, Sov. J. At. Energy 3, 921–923 (1957)

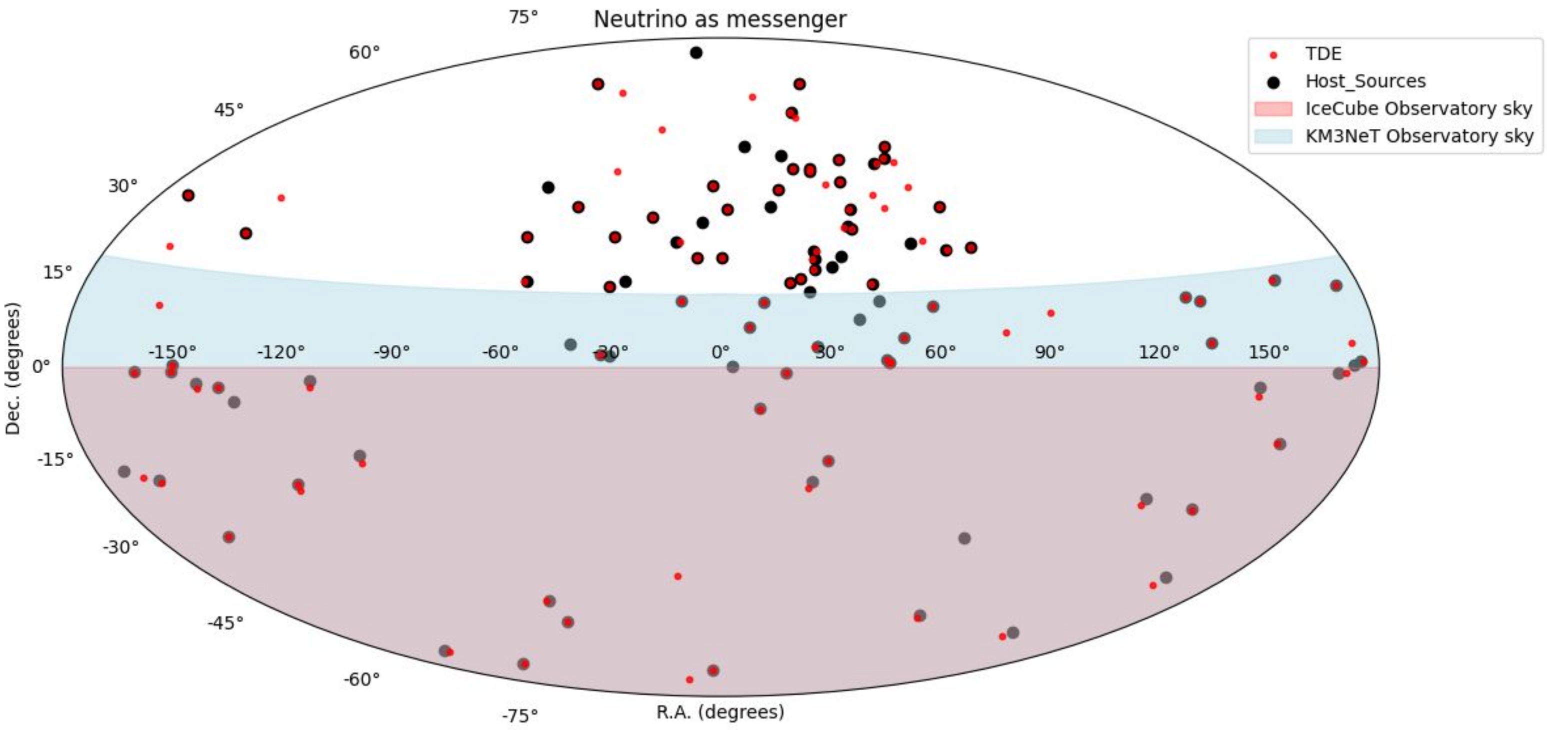
Study of origins via Tidally Disrupted Events

- ➔ TDE: massive black hole and star system reaching Roche limit
- ➔ SED analysis for estimating the accretion efficiency
- ➔ Likelihood analysis for 102 raw TDE samples



https://tools.ssdc.asi.it

Study of origins via Tidally Disrupted Events



Based on data in catalog: Aaron Goldtooth et al 2023 PASP 135 034101

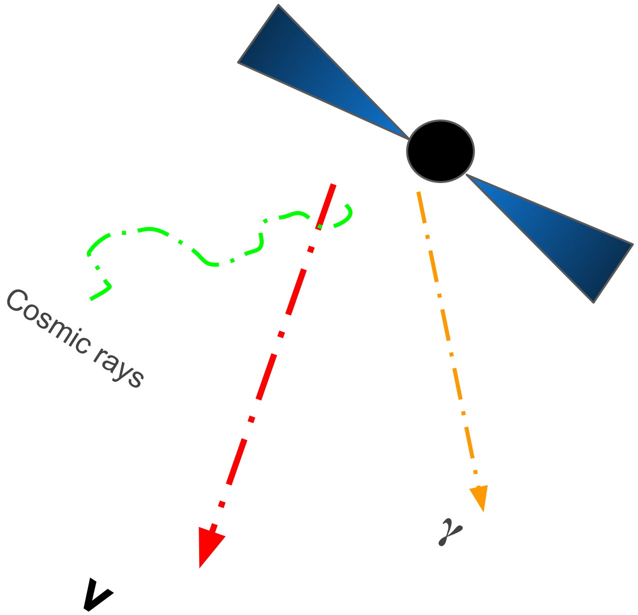
Summary and conclusion

➔ TDE pristine class of transients to study shock interaction, jet formation, and HE neutrinos production

- GW can be detected by LIGO and DECIGO
- HE neutrinos with KM3NeT

➔ Developing dedicated acoustic software: SUNSET (Simulation of Underwater Neutrino-induced Sound Emission and Transport)

- Signal generation and propagation
- Noise Analysis

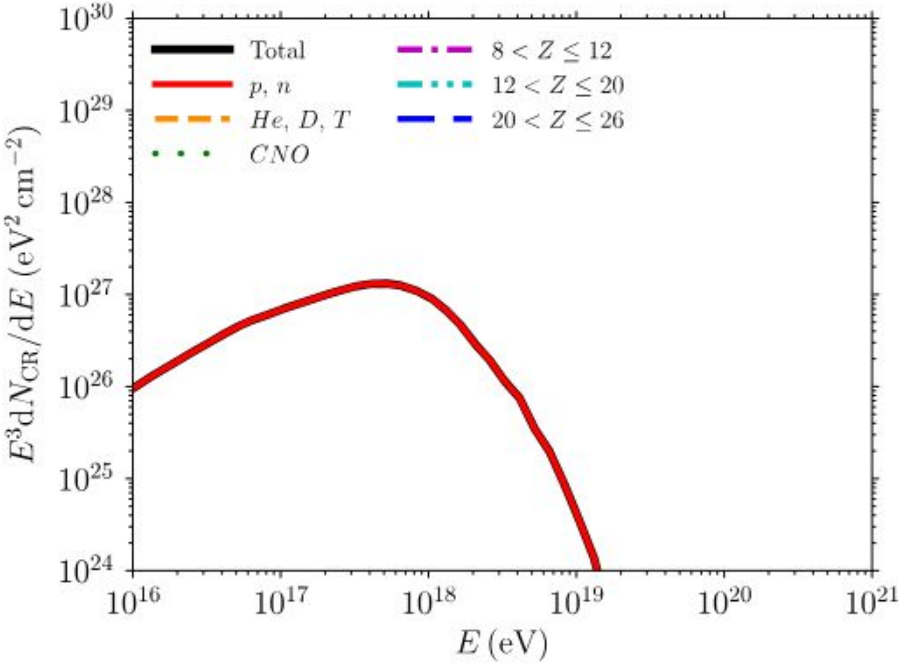


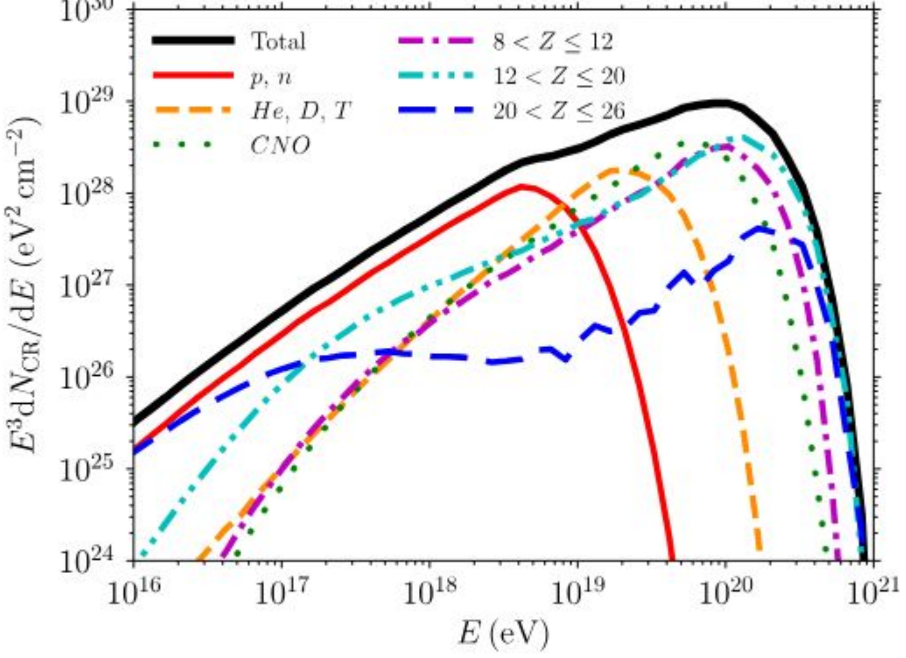
Back up

Supplementary material

- Cosmic-ray spectra for one source with pure iron injection
- Most highly super-Eddington TDEs are powered by the complete disruption of massive star

arXiv:1711.11274





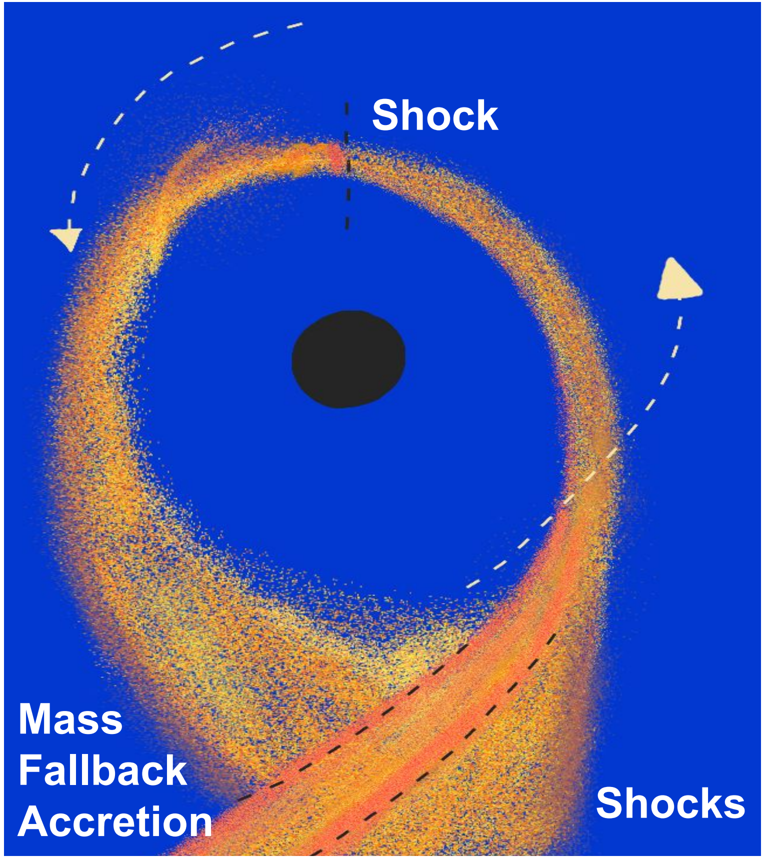
Supplementary material

- High-energy neutrino emission is correlated with temporal and spatial emissions across all the multi-messenger
- Tidally disrupted events are one of the potential candidates of high energy neutrinos

Daniel J. Price et al 2024 ApJL 971 L46

Supplementary material

- Multi-messenger properties:
  - Spectral classification by UV - optical color diagram into TDE-H, TDE-H+He, and TDE-He
  - At X-ray and radio energies non-thermal emissions
  - Very high-energy neutrinos of TeV and PeV
  - Gravitational waves candidate up to 10 Hz



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