

# KM3NeT detects the highest energy neutrino ever observed

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## Observation of an ultra-high-energy cosmic neutrino with KM3NeT

[The KM3NeT Collaboration](#)

[Nature](#) 638, 376–382 (2025) | [Cite this article](#)

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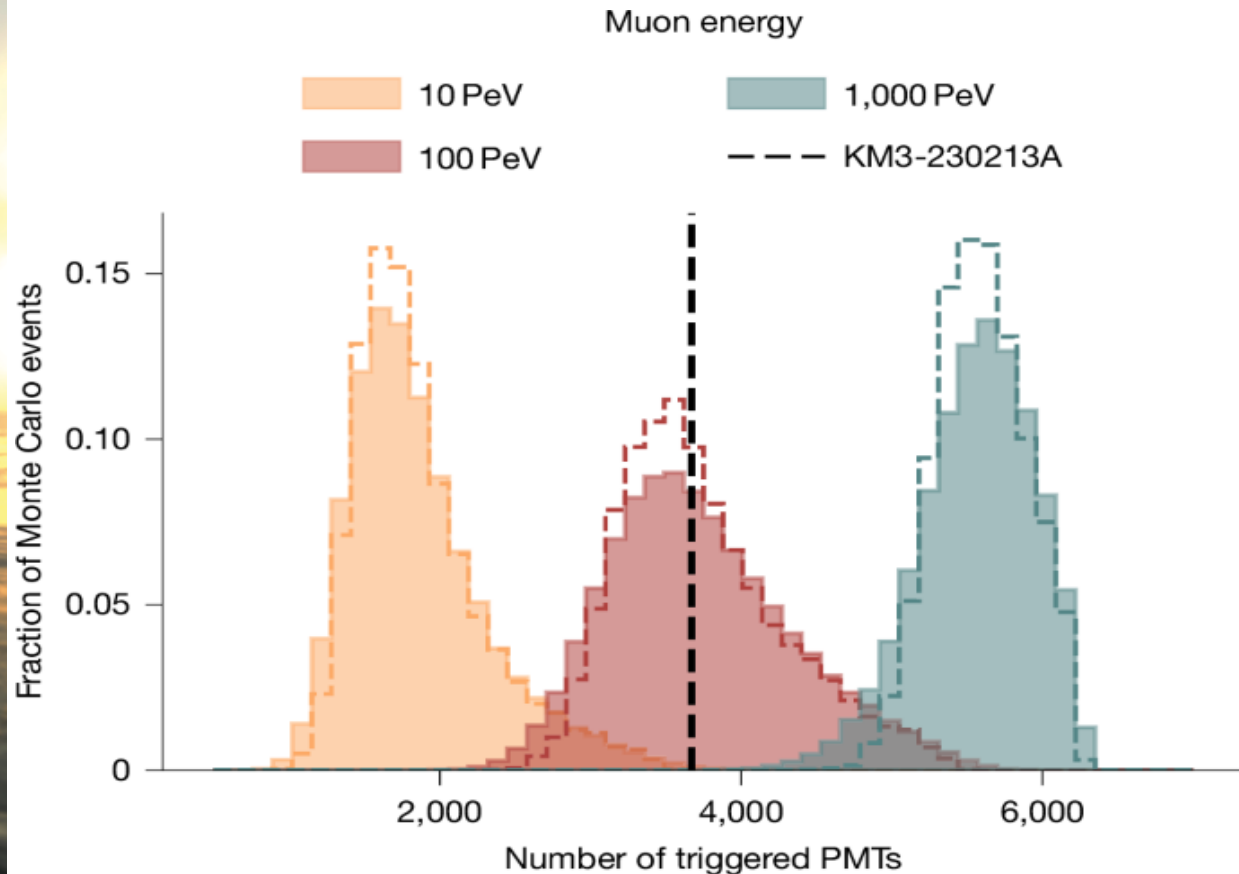
The international journal of science / 13 February 2025

# nature

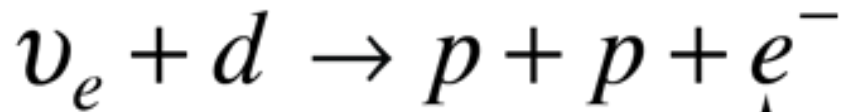


## COSMIC CATCHER

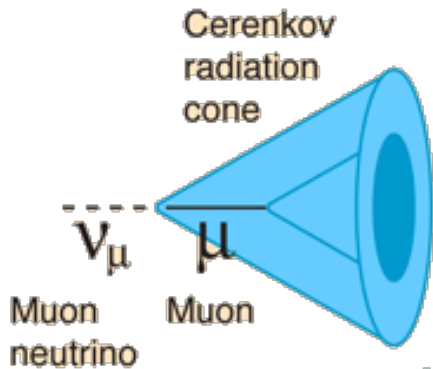
Deep-sea telescope detects neutrino with highest energy ever recorded



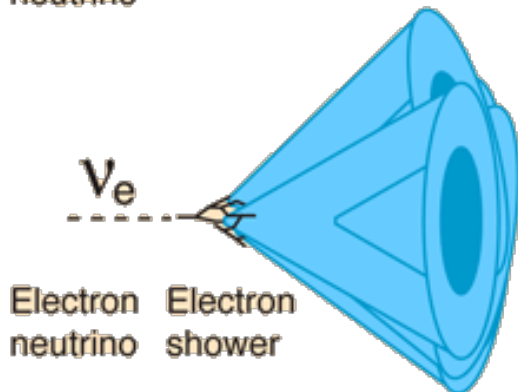
# Neutrino Detection



High speed electron produces Cerenkov radiation



The Cerenkov radiation from a muon produced by a muon neutrino event yields a well defined circular ring in the photomultiplier detector bank.



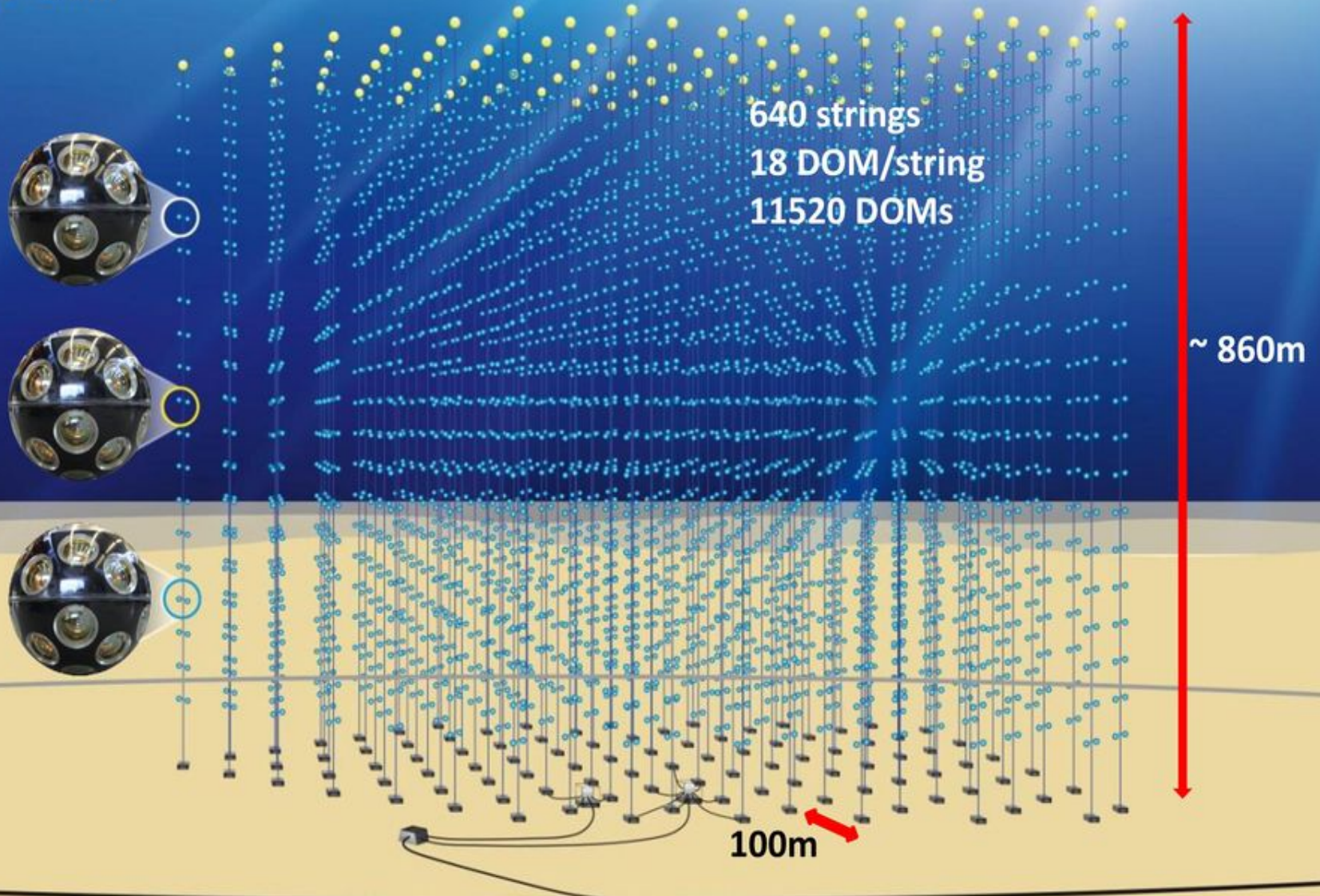
The Cerenkov radiation from the electron shower produced by an electron neutrino event produces multiple cones and therefore a diffuse ring in the detector array.

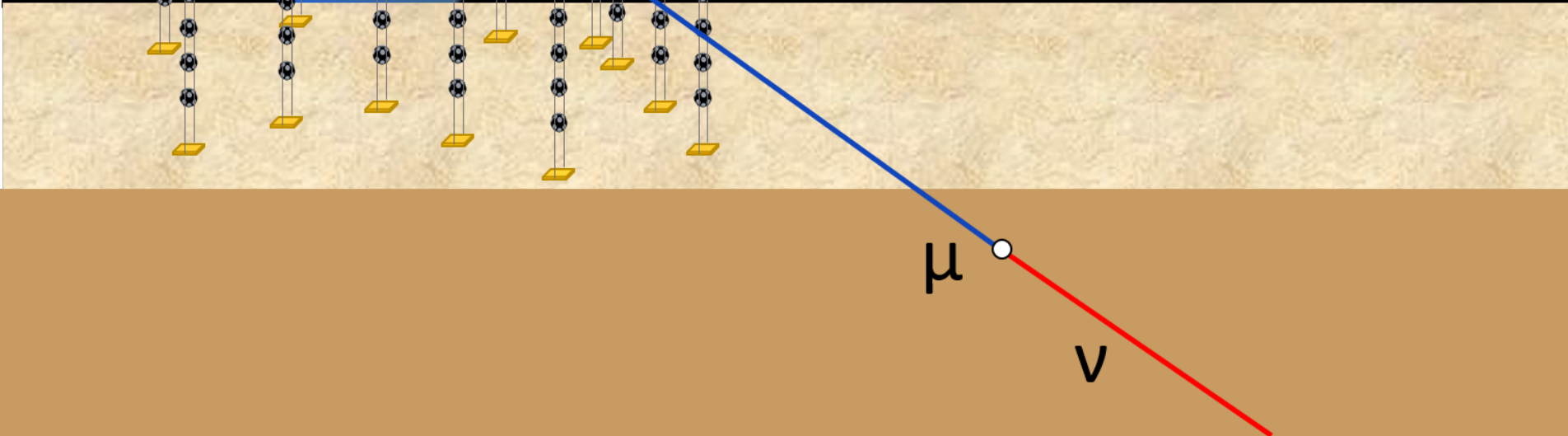
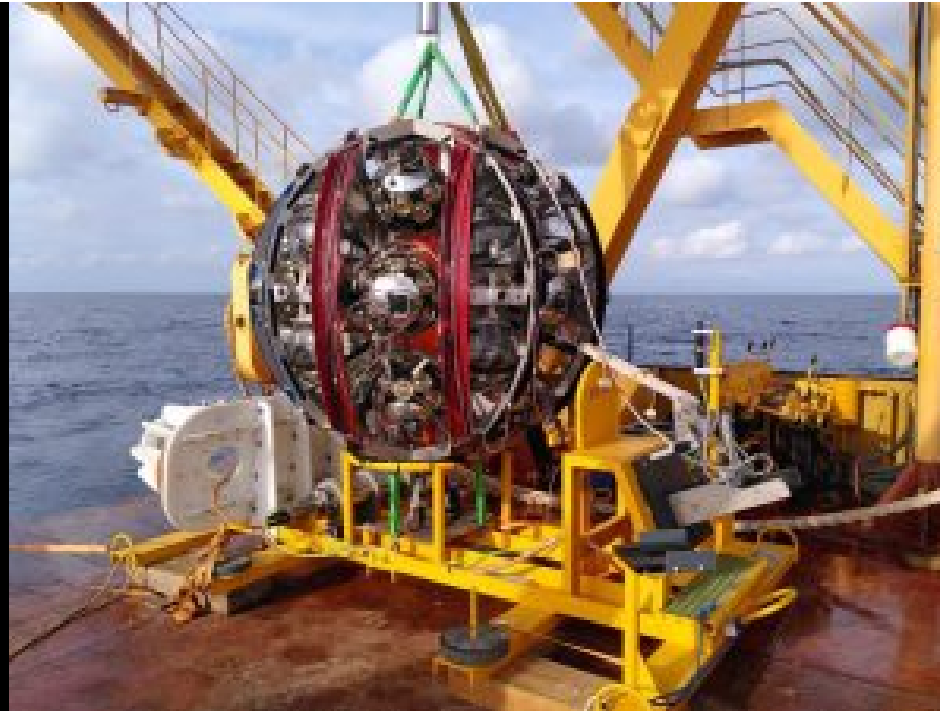
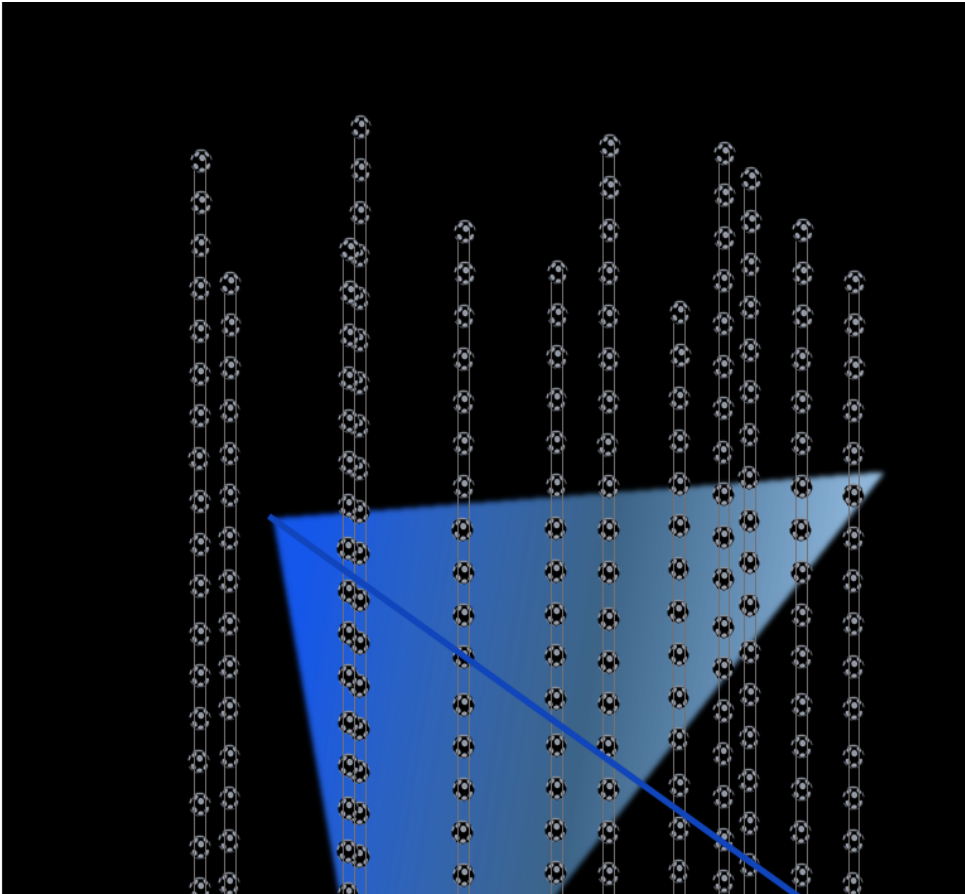




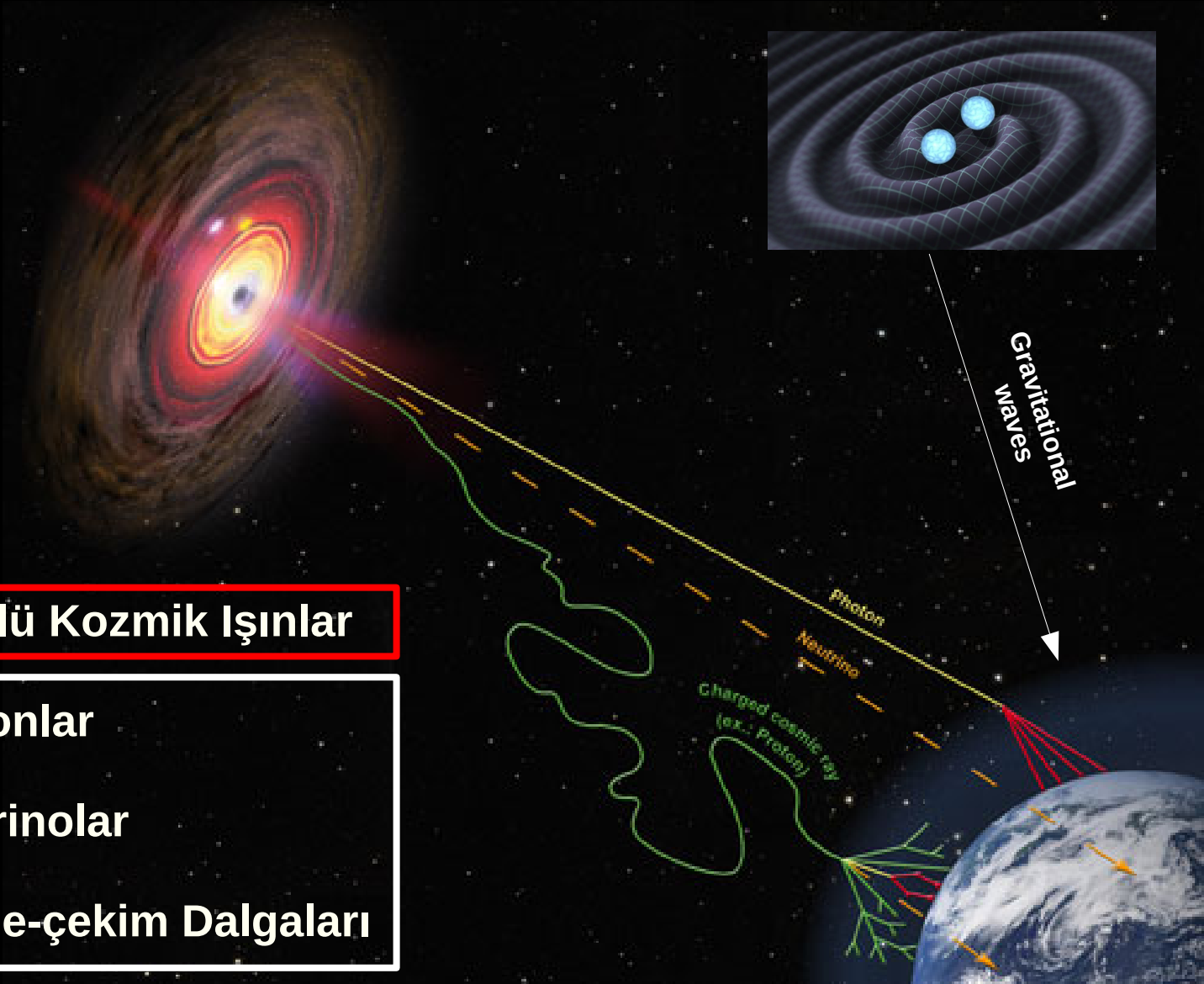
# KM3NeT Neutrino Telescope

Volume:  $\sim 5 \text{ km}^3$





# Astronomik Sinyaller (Haberciler)



1-) Yüklü Kozmik Işıklar

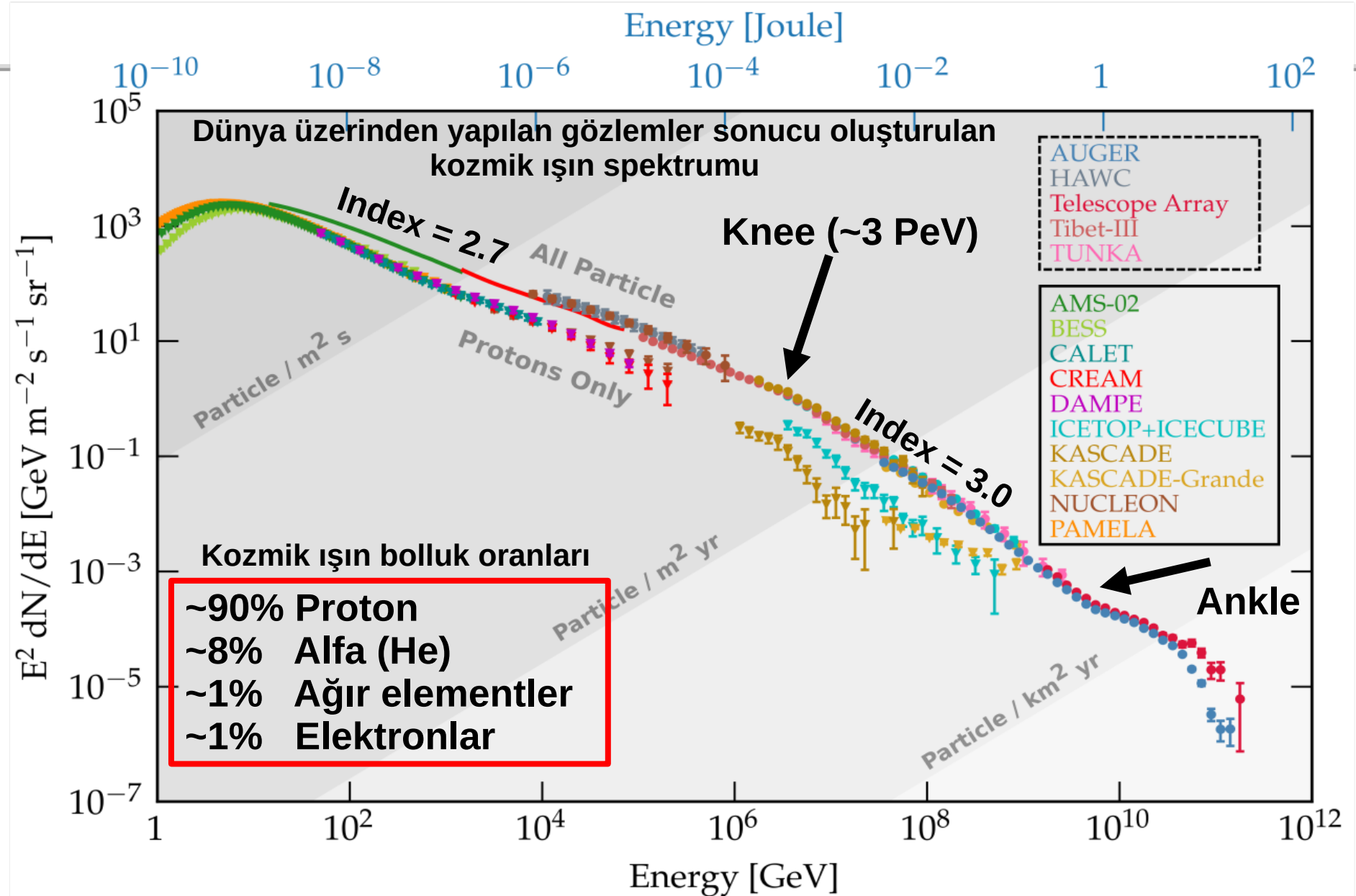
2-) Fotonlar

3-) Nötrinolar

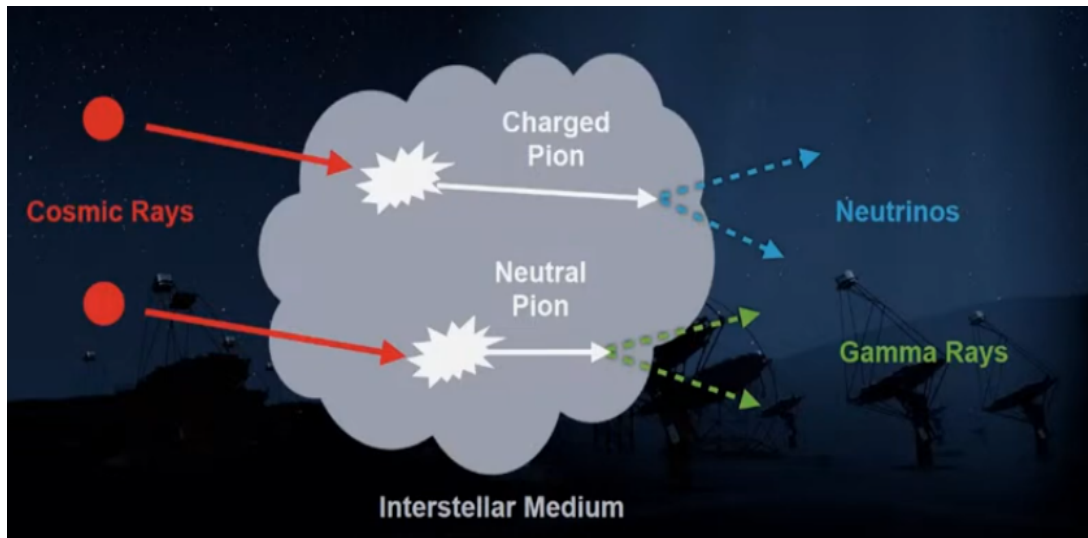
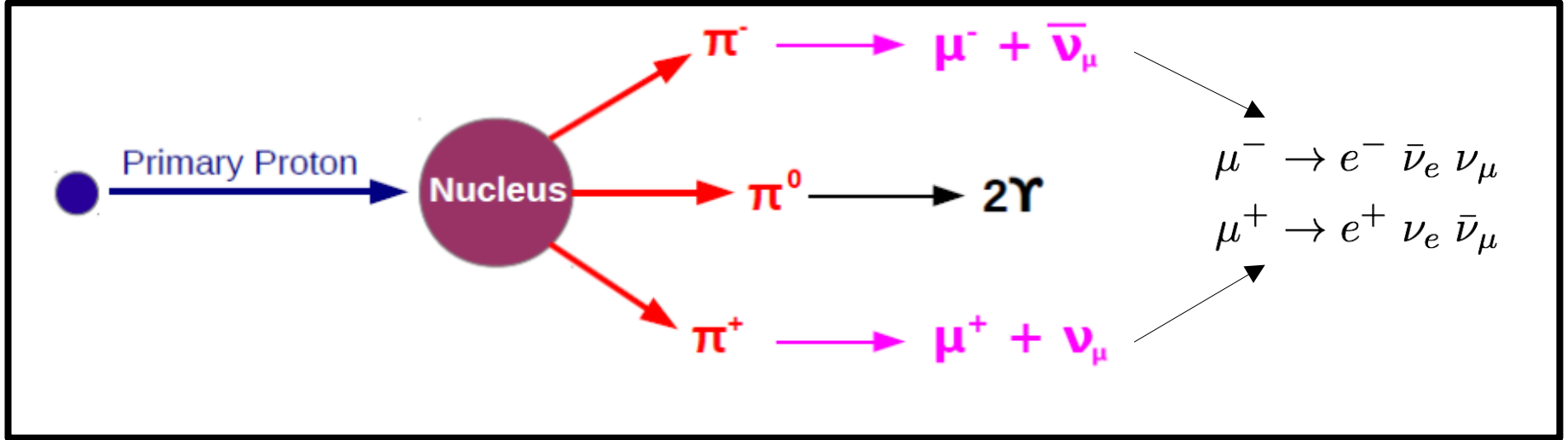
4-) Kütle-çekim Dalgaları



# Yüklü kozmik ışınlar : Dünya'ya izotropik olarak ulaşan yüklü parçacıklar



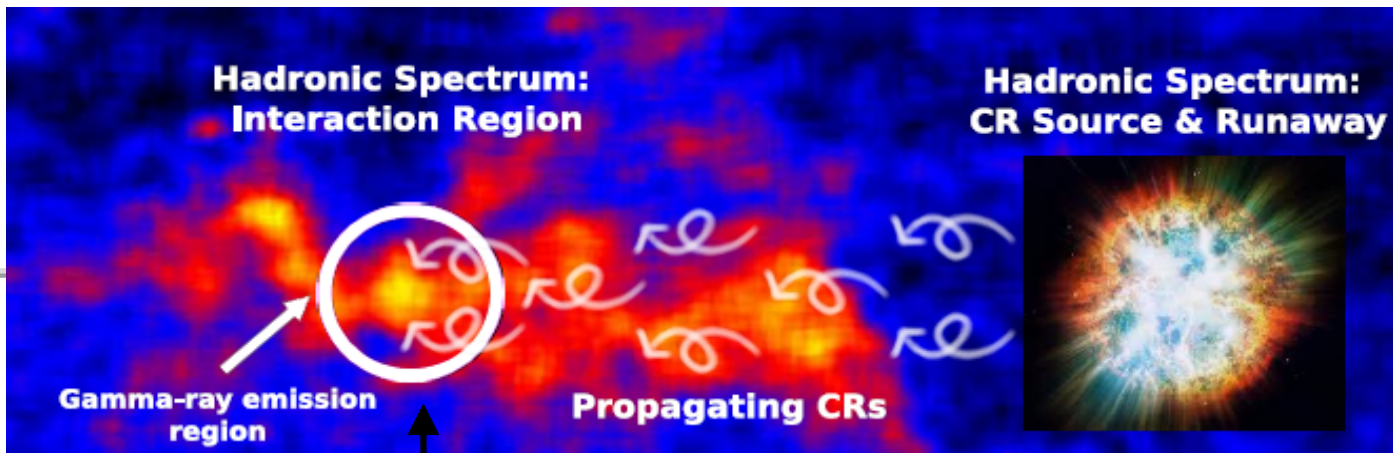
# Kozmik ışın etkileşimleri: Pion Bozunumu sonucu oluşan ikincil haberciler



- Pion bozunumu hadronik bir gamma-ışını/nötrino üretim mekanizmasıdır.

- Proton-proton (hadronik) çarpışmaları takip eden pionların bozunmaları sonucu gama-ışınları ve nötrinolar üretilir.

**1 PeV protonlar 100 TeV enerjideki gama/nötrino üretirler**



pp etkileşimleri sonucu oluşan gama-ışını (veya nötrino) akısı

$$\Phi_{\gamma}(E_{\gamma}) = c n_H \int_{E_{\gamma}}^{\infty} \sigma_{\text{inel}}(E_p) J_p(E_p) F_{\gamma}\left(\frac{E_{\gamma}}{E_p}, E_p\right) \frac{dE_p}{E_p}.$$

