

Cosmic Ray Helium Flux Measurement with the DAMPE Detector

Young Researchers' Day
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Cosmic... What?

... they asked, a century ago.

- Very high energy (up to $\sim 10^{21}$ eV) radiation originating in and propagating through space
- **Composition:** electrons, protons, atomic nuclei, neutrinos, gamma rays, ...
- **(Possible) sources:** supernovae, quasars, active galactic nuclei (AGNs), gamma ray bursts (GRBs), ...



Victor F. Hess, departing from Vienna (1911-12), was awarded the Nobel Prize in Physics in 1936 for his discovery of cosmic rays

<https://www.nytimes.com/2012/08/07/science/space/when-victor-hess-discovered-cosmic-rays-in-a-hydrogen-balloon.html>

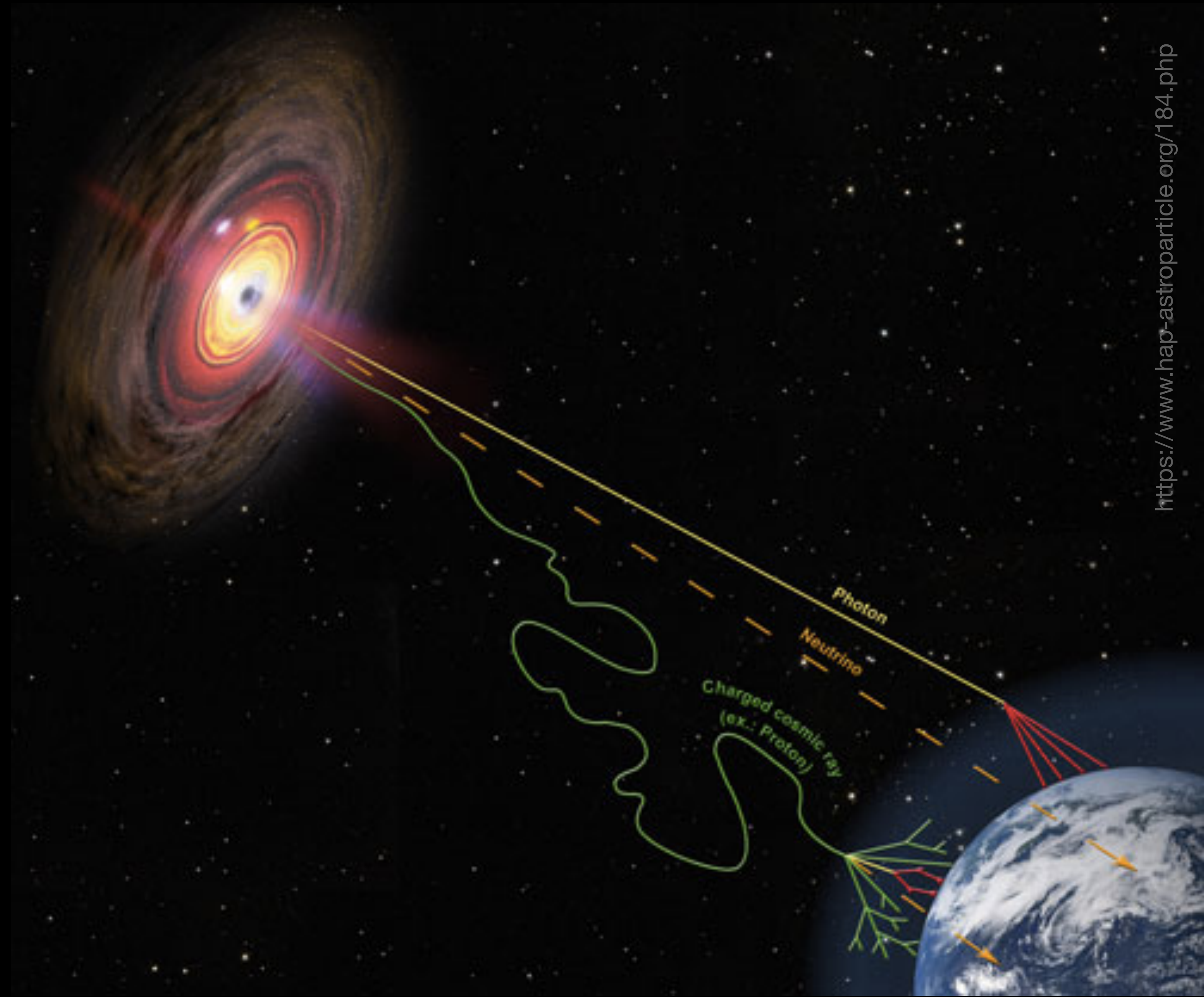
But seriously, why?

*... the sponsors asked, a century ago.**

Many open questions:

- Sources
- Acceleration mechanisms
- Propagation mechanisms
- Precise compositions
- Ultra high energies
- Dark matter
- ...

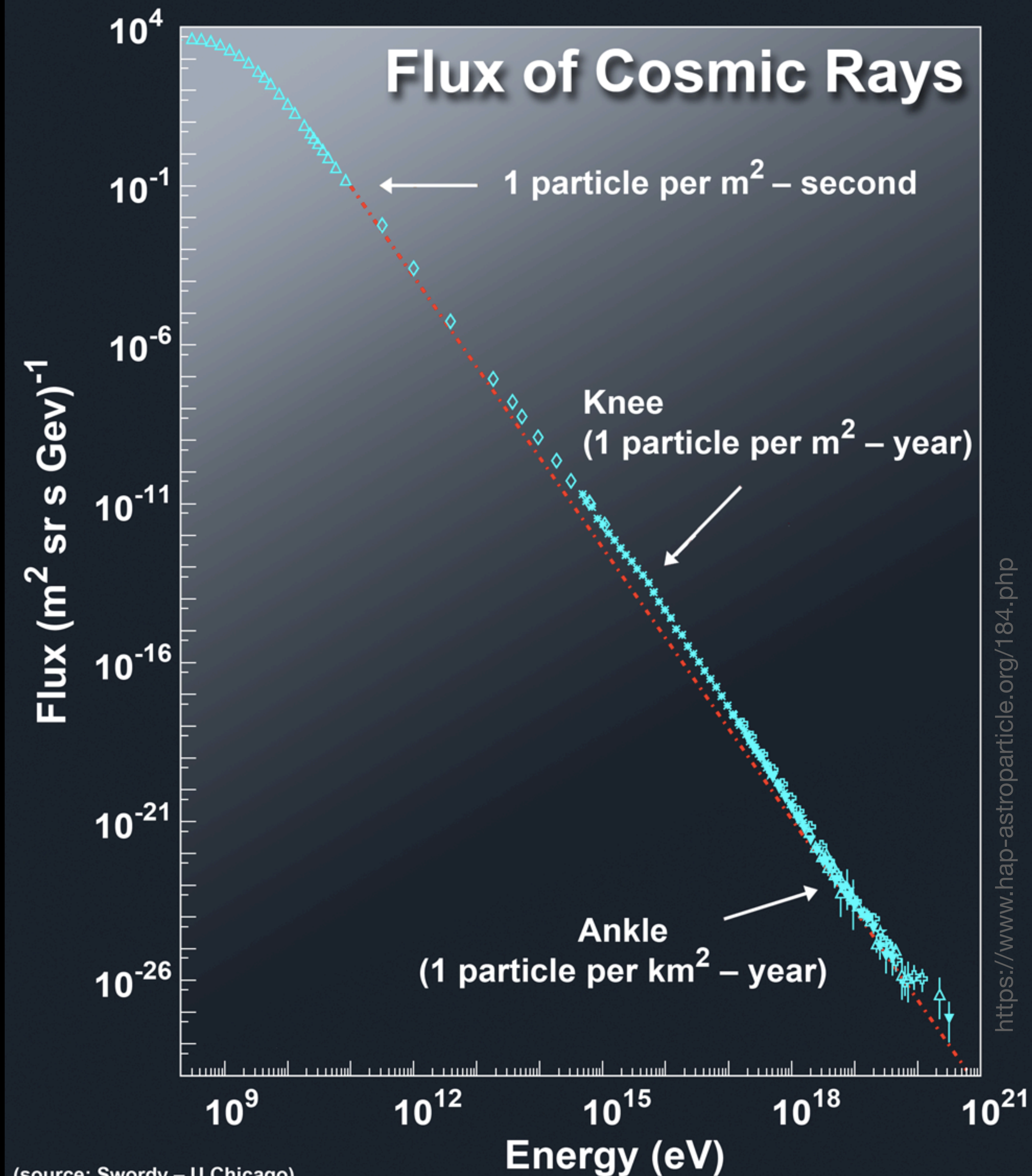
**They still do.*



Ok, so what do we have?

Show me the data!

- Theory suggests a single power law spectrum (red points) of the cosmic ray flux below the “knee”
- But — some experiments made more precise studies in this region and found deviations...
- ... thereby challenging our current understanding of the acceleration and propagation mechanisms!



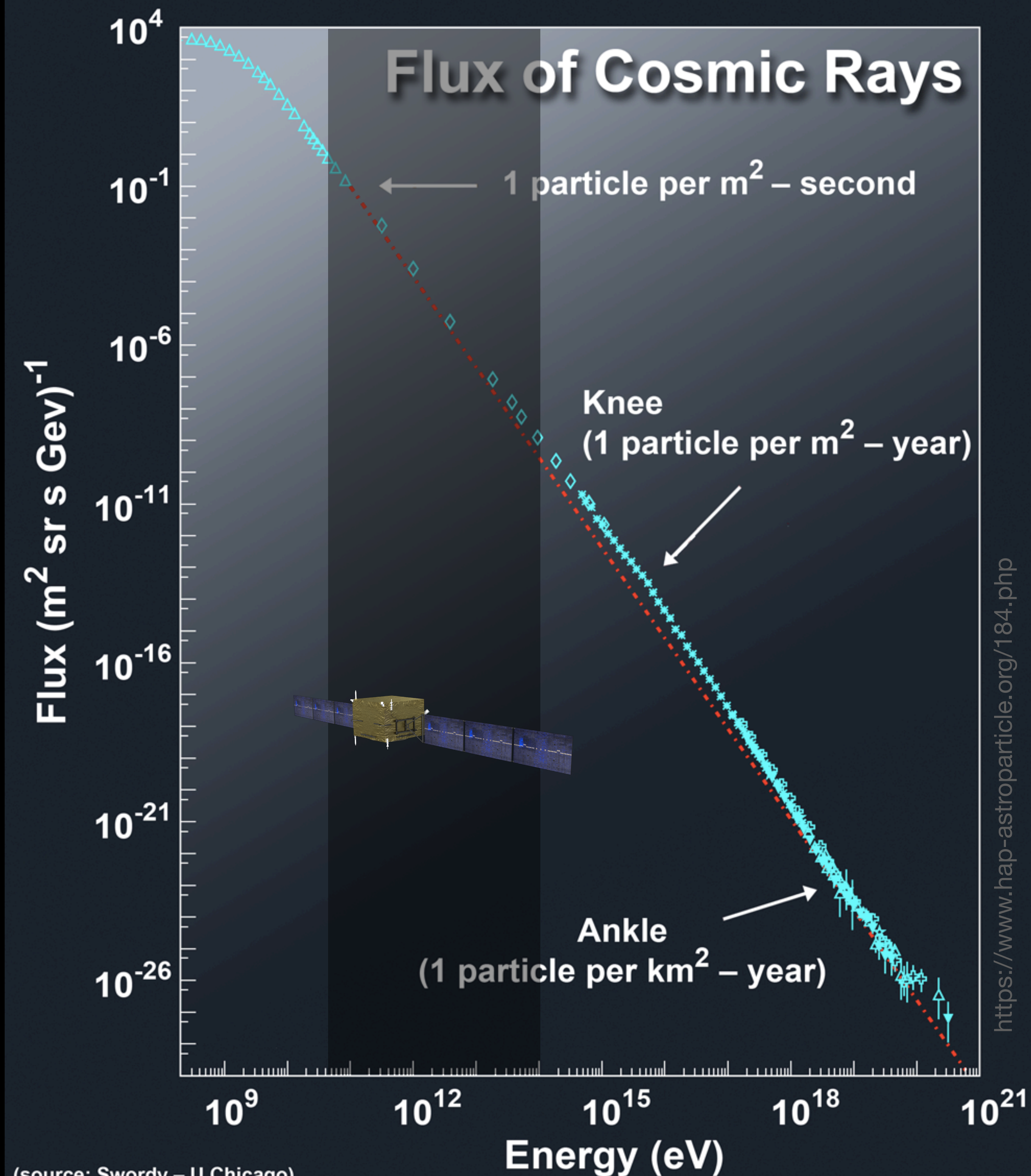
Enter: DAMPE

The DArk Matter Particle Explorer



DAMPE's launch in December 2015 from the Jiuquan Satellite Launch Center in China

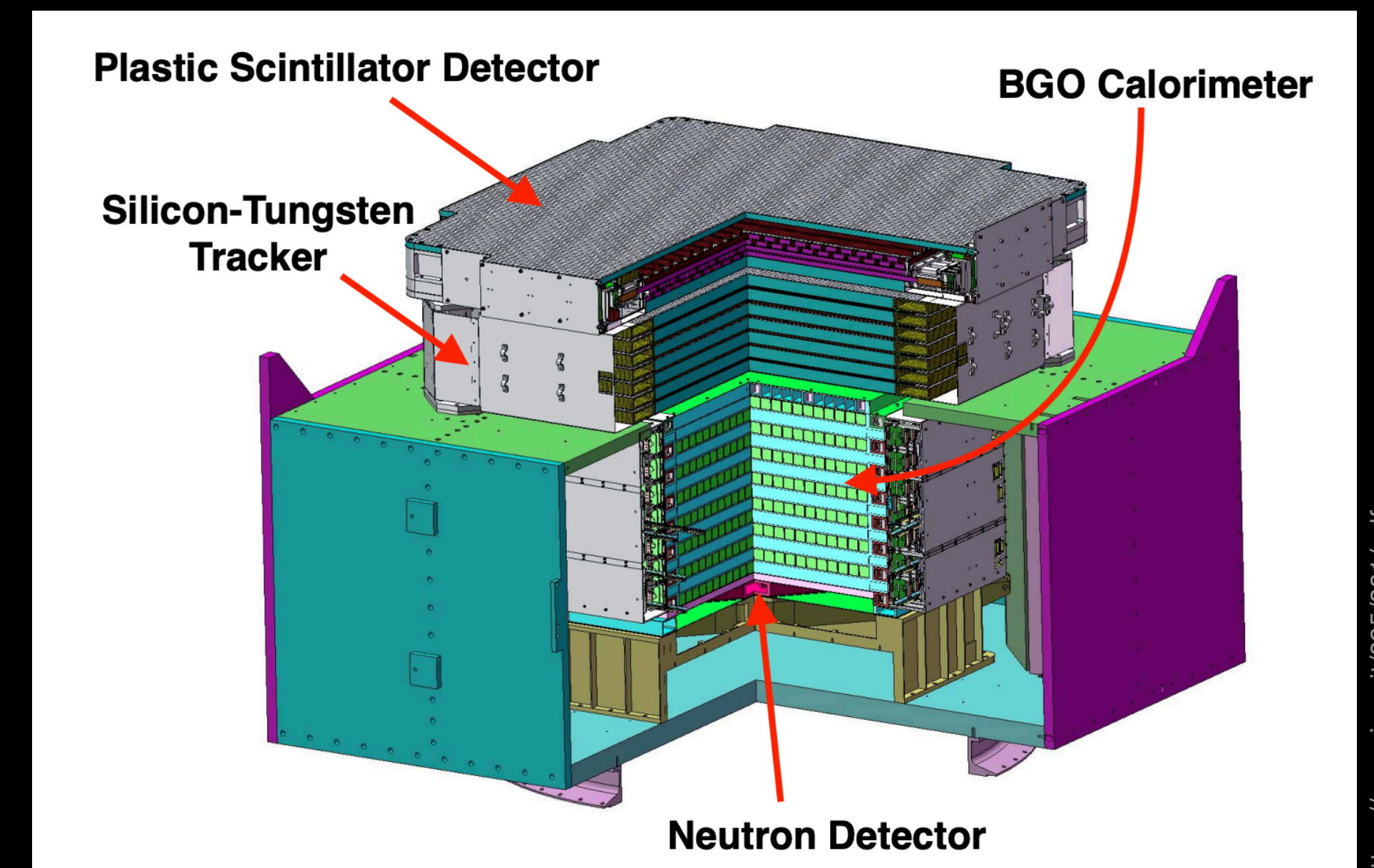
<http://dpnc.unige.ch/dampe/>



DAMPE

“Tell me more!”, you said? Um, ok, but just a little.

- Large field of view
- Large effective area and acceptance
- Very high resolution
- Overcomes some limitations of magnetic spectrometers and balloon-borne experiments
- Various sub-detectors for particle trajectory and energy measurement, and charge identification
- Provides precise measurements in the GeV-TeV energy region

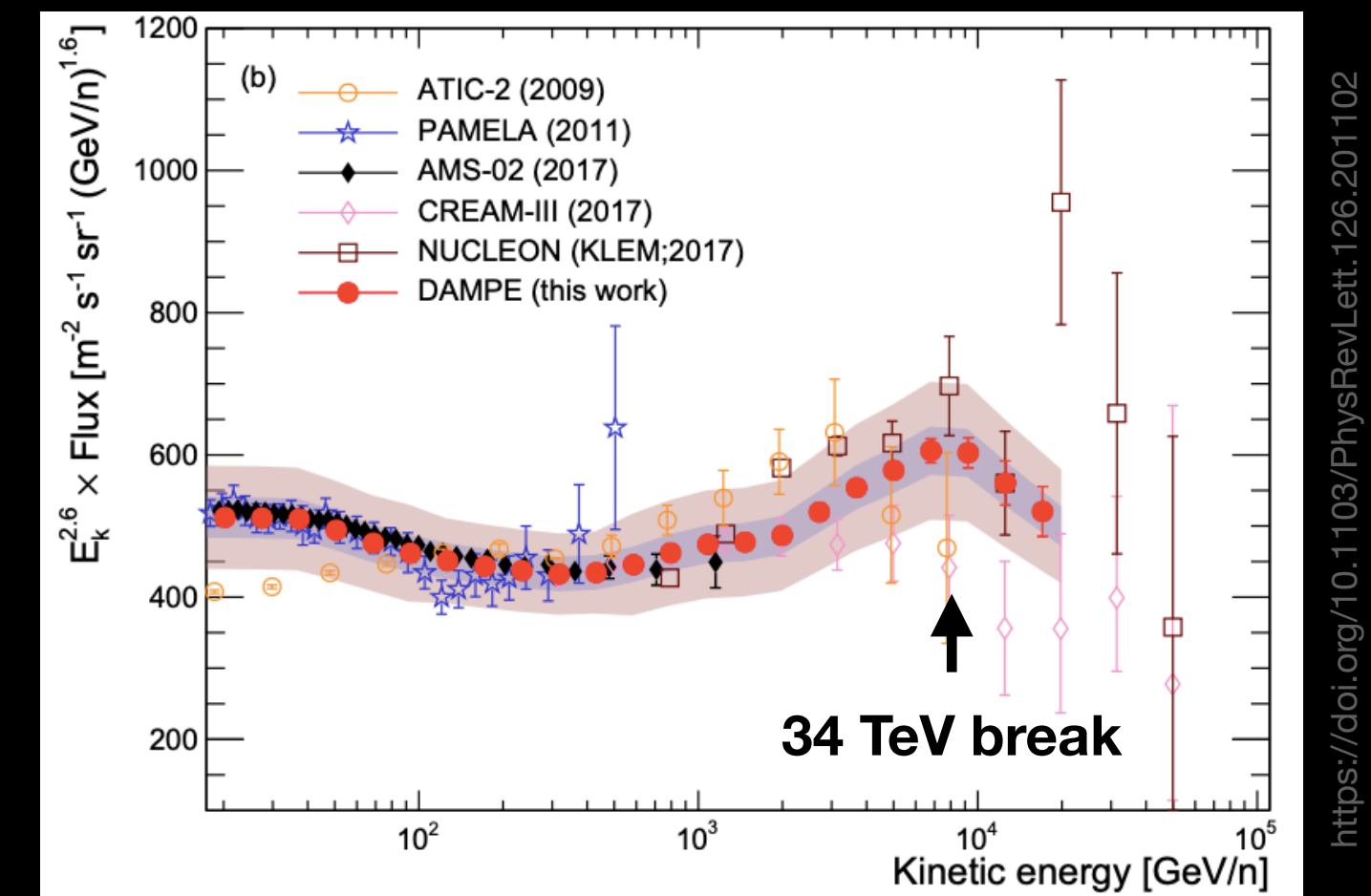


<https://pos.sissa.it/395/081/pdf>

The Helium Flux with DAMPE

Do you hear my chipmunk voice?

- Features observed in the (published) proton and helium spectra are consistent with other experiments and calls for further studies in our cosmic ray models
- Current challenges:
 - Trying to extend to higher energies $>100\text{TeV}$
 - Particle identification starts getting worse at $>10\text{TeV}$
 - The group is also developing machine learning methods to tackle this!
 - Studies are ongoing...



***Thank you for your attention
and I'm happy to answer
your questions!***

