Helium Flux Measurement with Alpha Magnetic Spectrometer

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On behalf of the AMS collaboration

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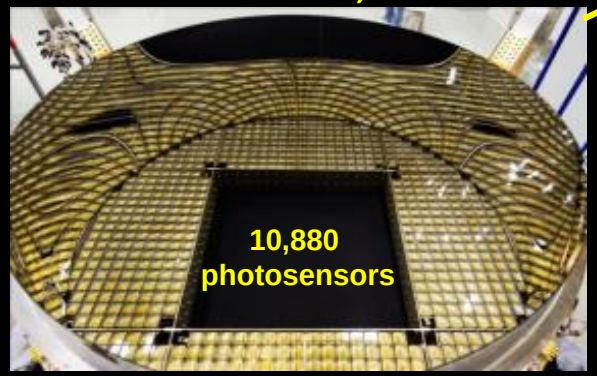
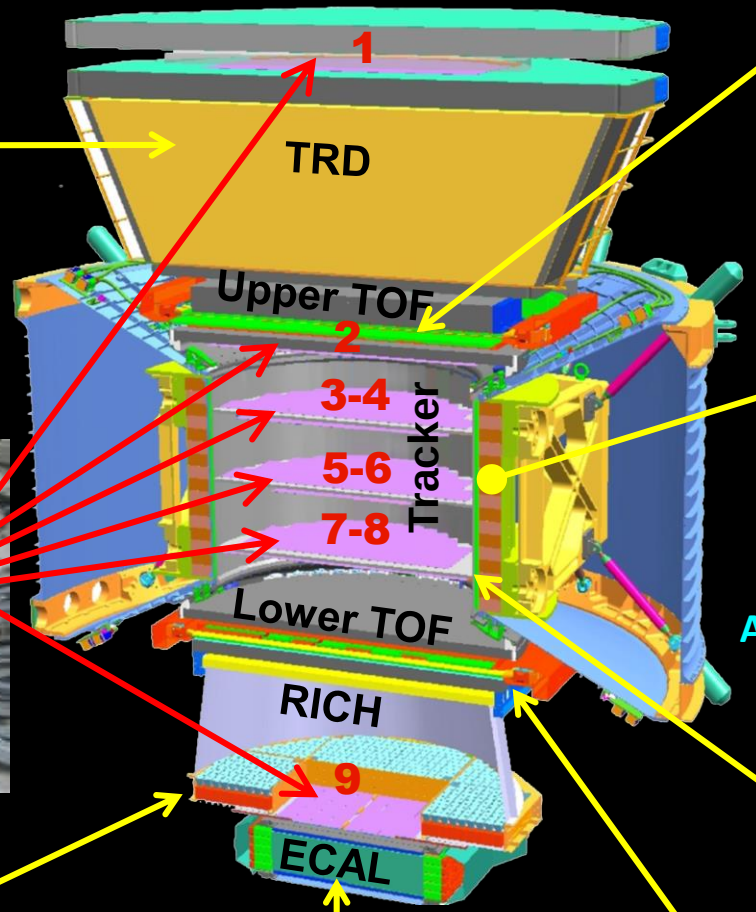
AMS is a space version of a precision detector used in accelerators

Transition Radiation Detector (TRD)
identify e^+, e^-

Silicon Tracker
measure Z, P

Ring Imaging Cerenkov (RICH)
measure Z, E





Electromagnetic Calorimeter (ECAL)
measure E of e^+, e^-

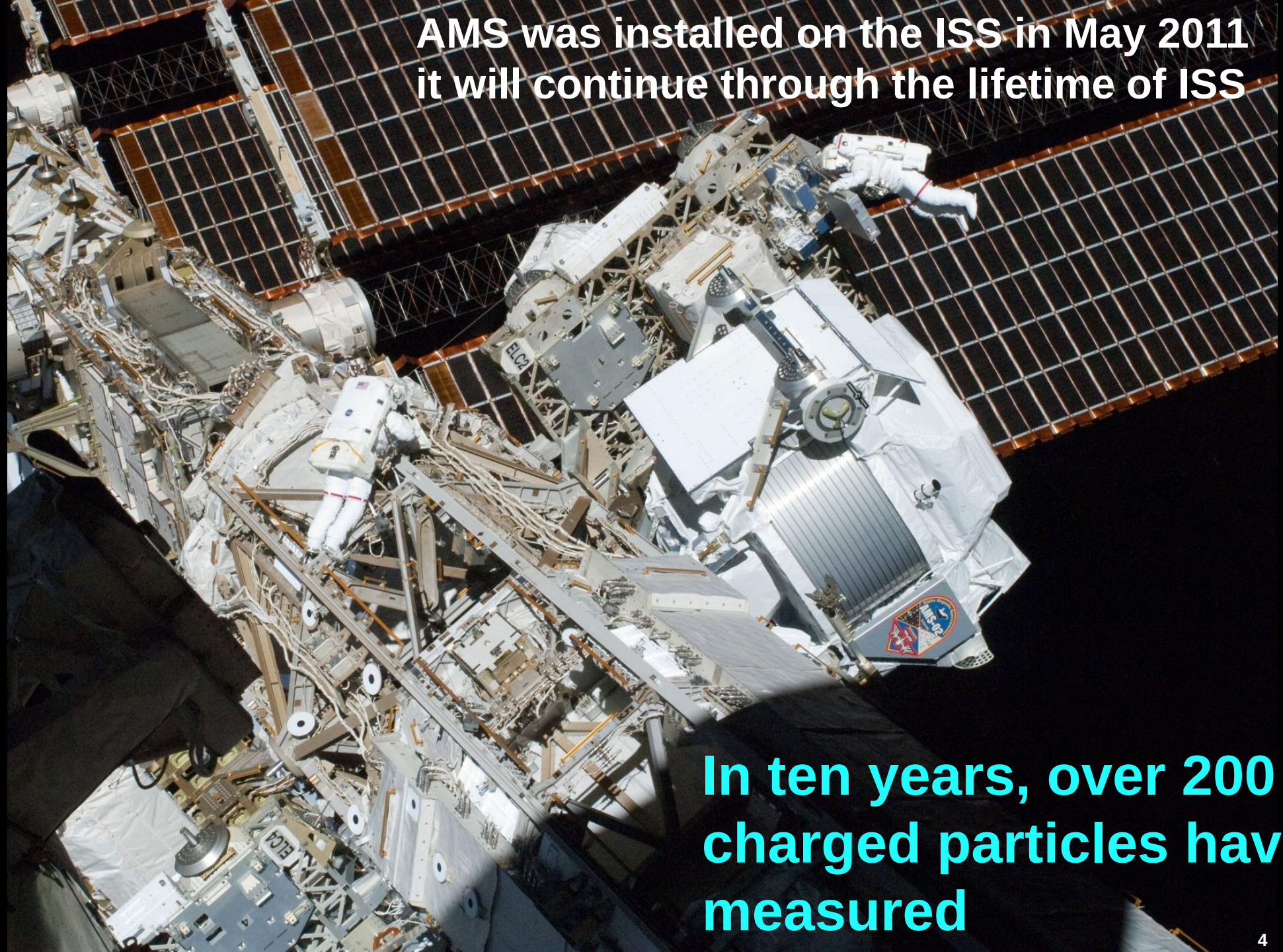
Upper TOF measure Z, E

Magnet identify ±Z, P

Anticoincidence Counters (ACC)
reject particles from the side

Lower TOF measure Z, E


AMS
300,000 electronics channels
650 processors
5m x 4m x 3
7.5 tons

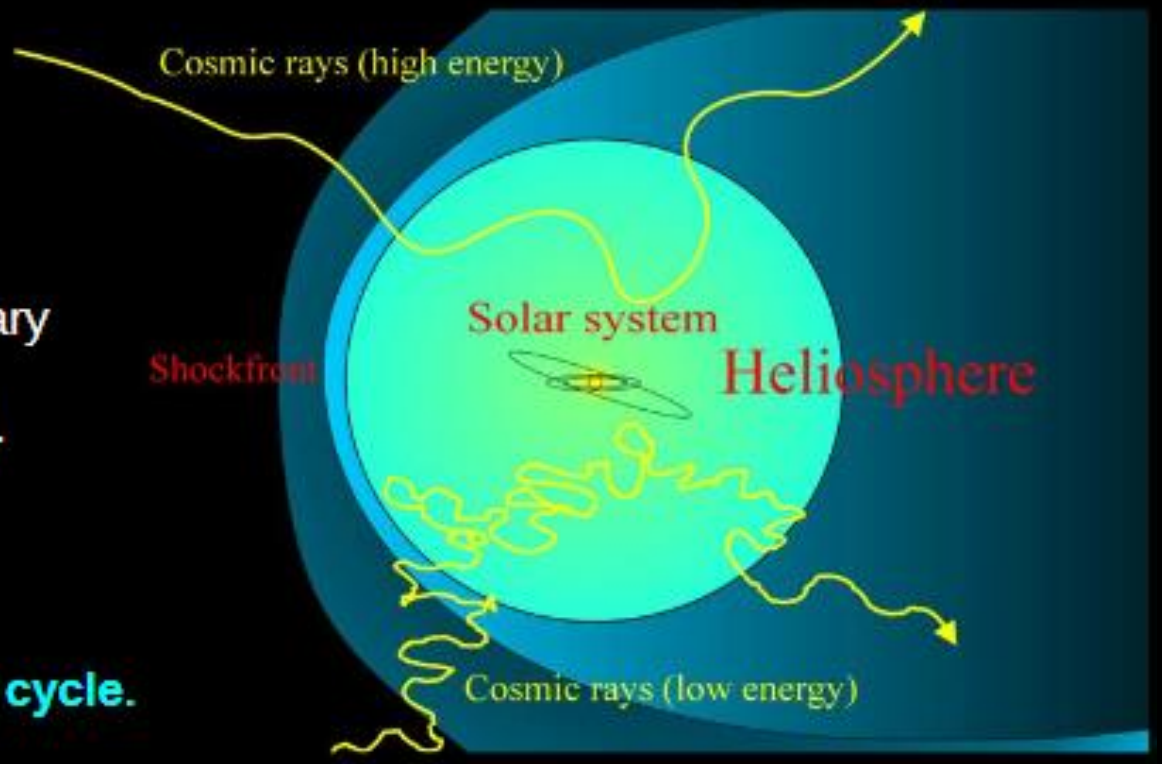

AMS was installed on the ISS in May 2011
it will continue through the lifetime of ISS
In ten years, over 200 billion charged particles have been measured

Solar Modulation of Low Energy Cosmic Rays

Cosmic rays entering the Heliosphere experience the influence of the solar activity.

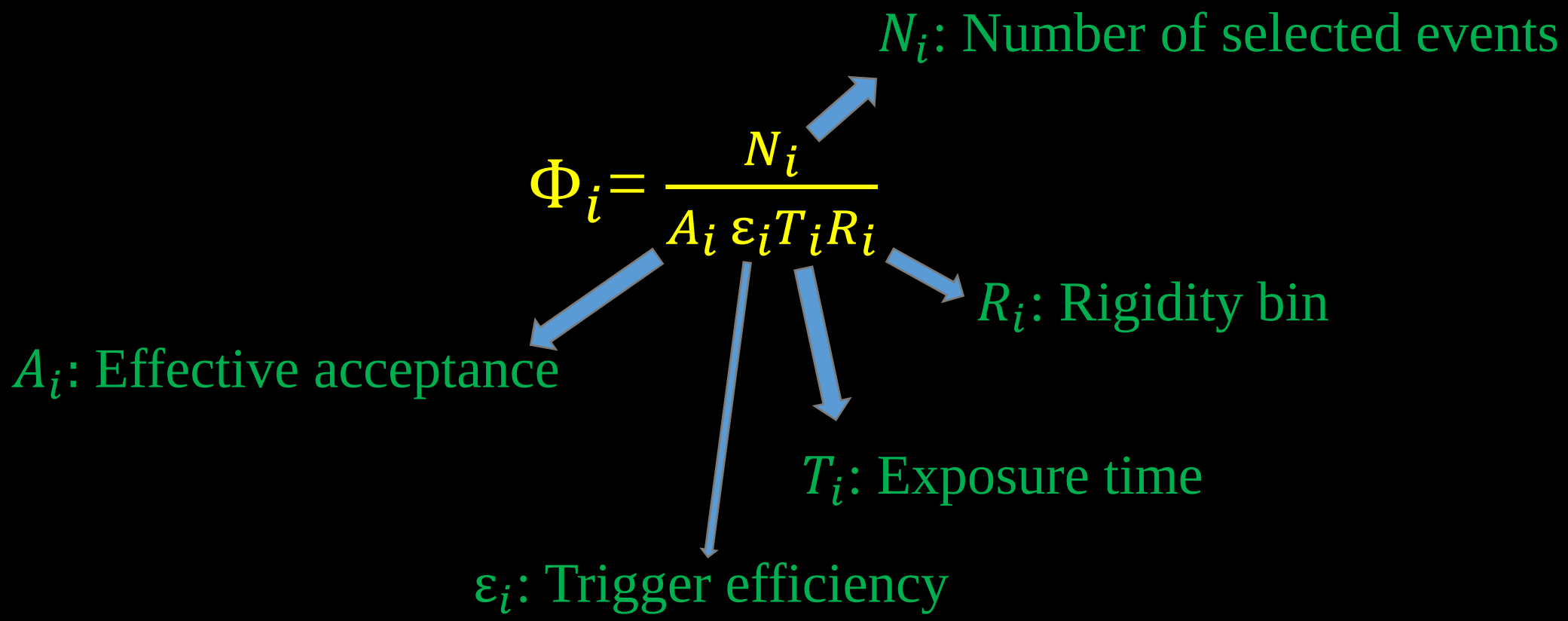
The temporal evolution of the interplanetary space environment causes cosmic-ray intensity variations (i.e. solar modulation).

The solar modulation is particularly visible at rigidities below 100 GV, and it changes with the 11-years solar cycle.



Helium Flux Measurement

- Flux is calculated as:



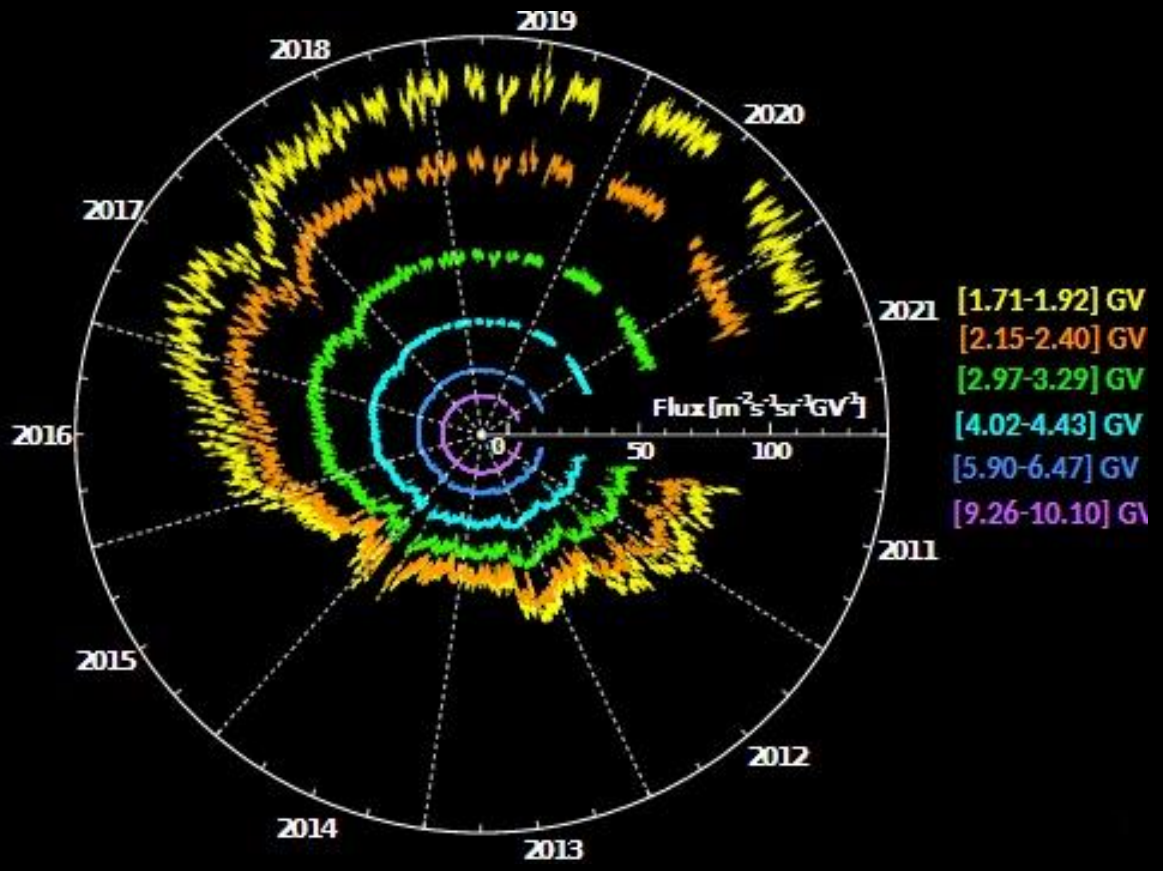
- M. Aguilar, L. Ali Cavasonza, et al., "Precision Measurement of the Helium Flux in Primary Cosmic Rays of Rigidities 1.9 GV to 3 TV with the Alpha Magnetic Spectrometer on the International Space Station," Phys. Rev. Lett., 2015

Daily Helium Fluxes: May 20, 2011 – May 2, 2021

850 million helium nuclei collected from **May 20, 2011** to **May 2, 2021**

The helium flux exhibits variations on multiple timescales.

The relative magnitude of the variations decrease with increasing rigidity



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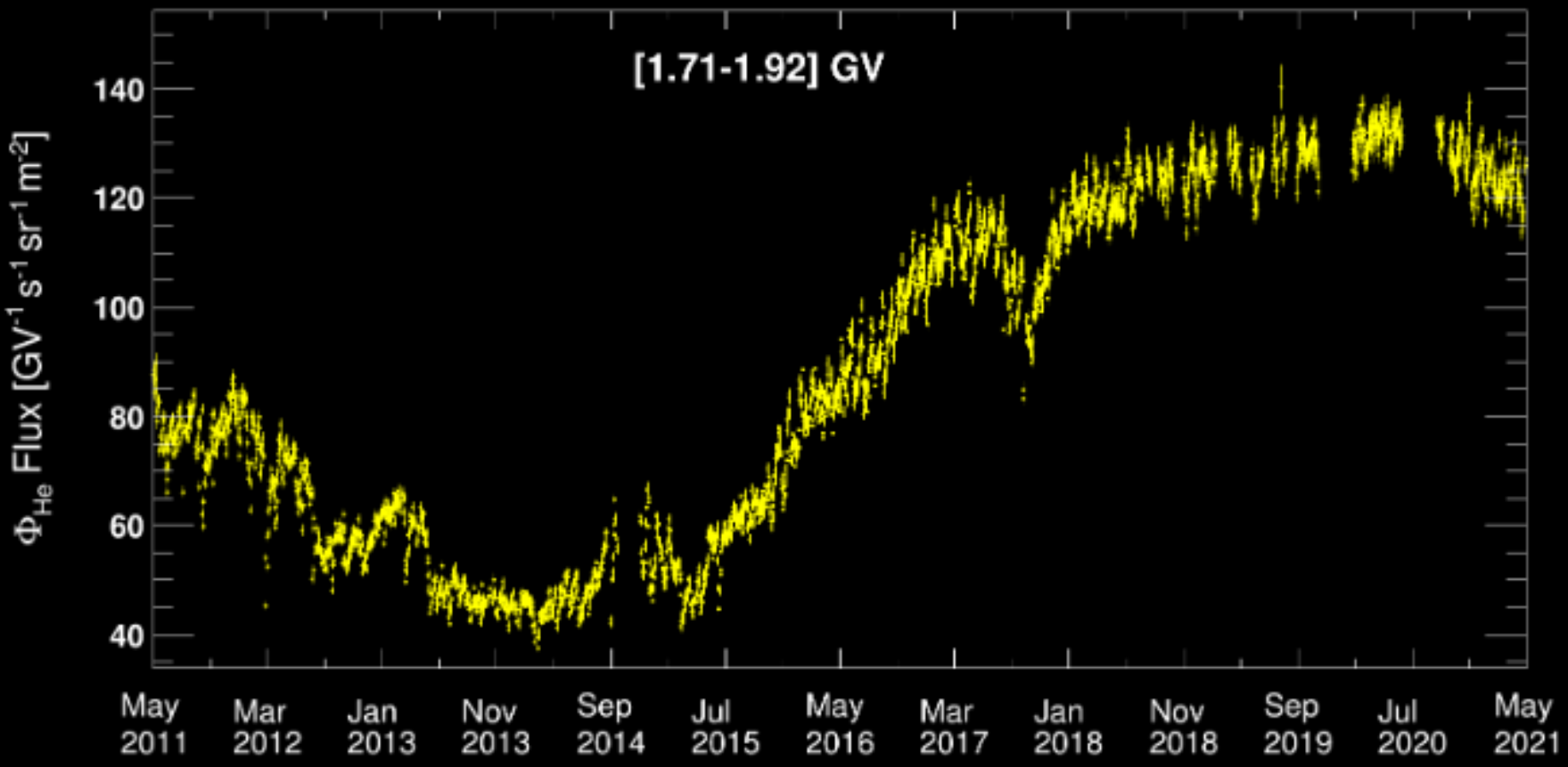

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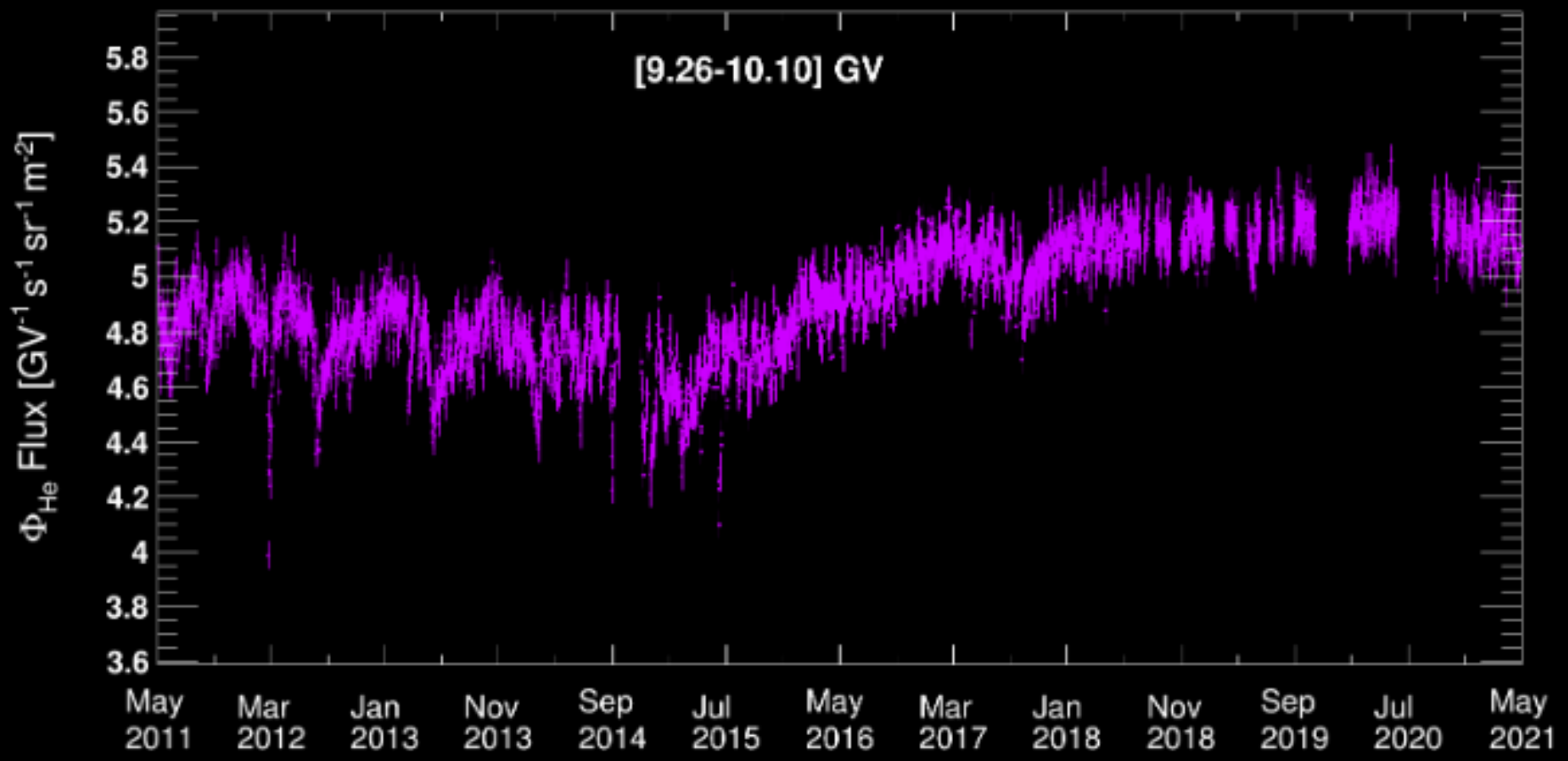

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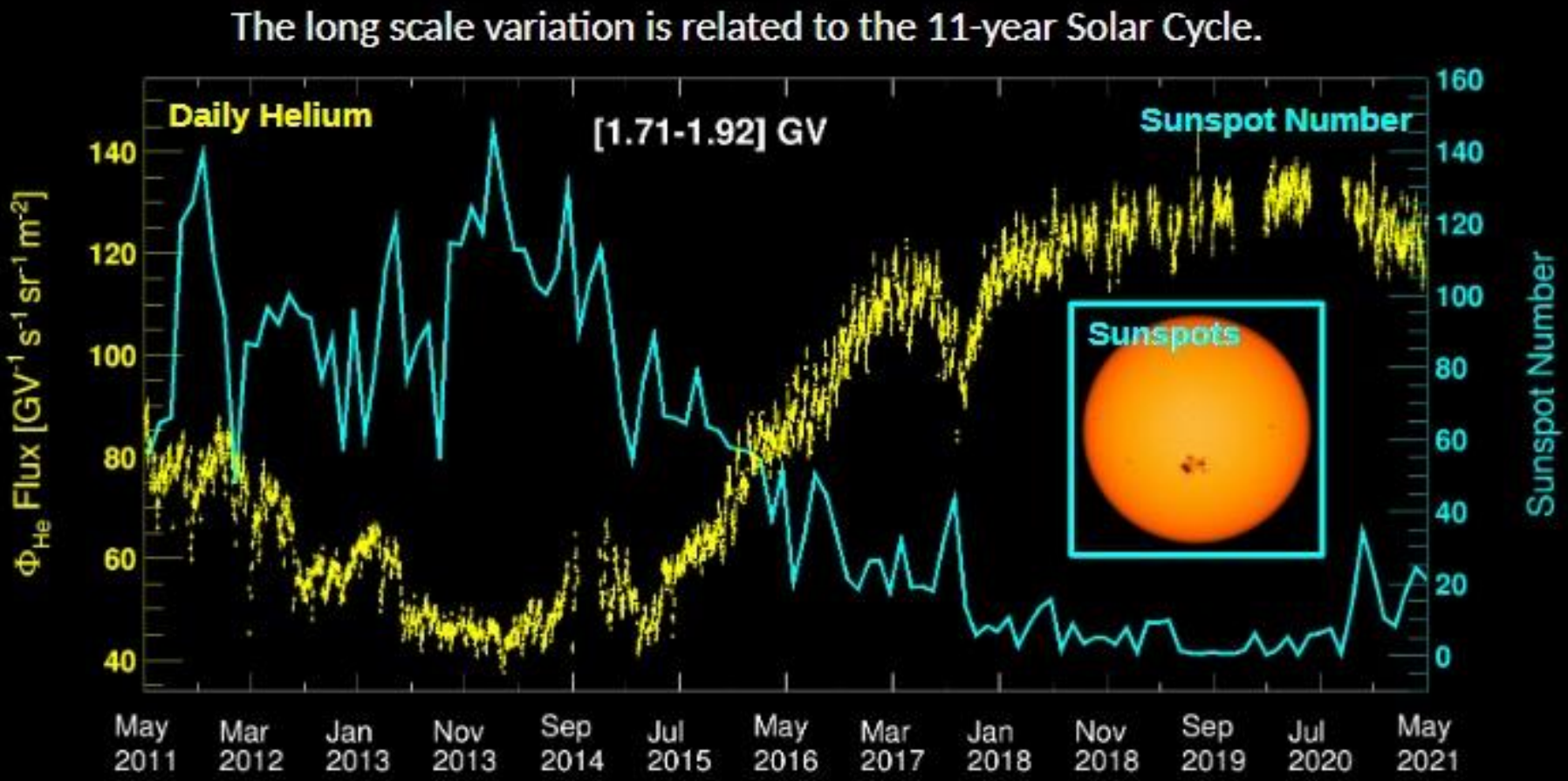
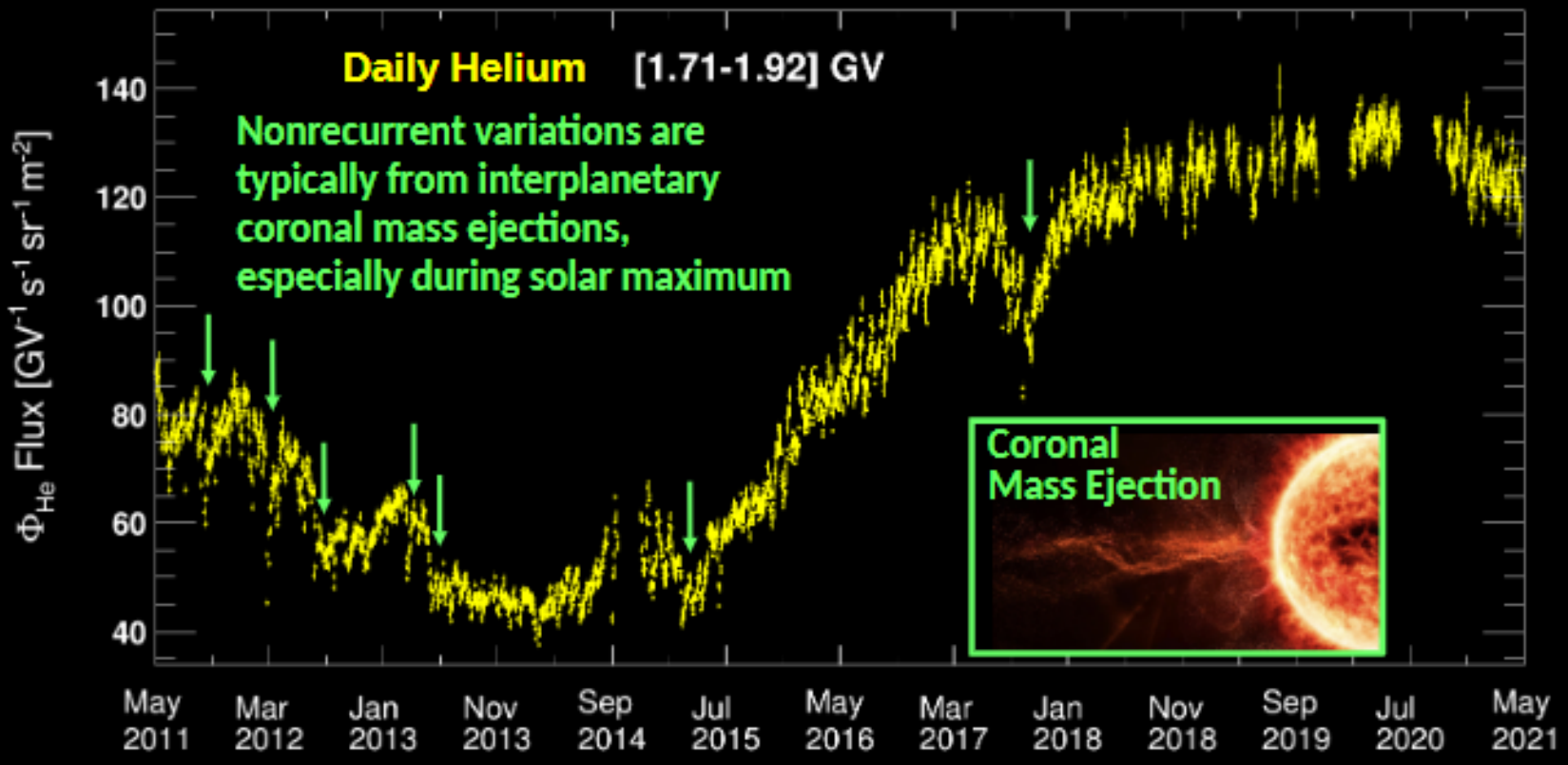
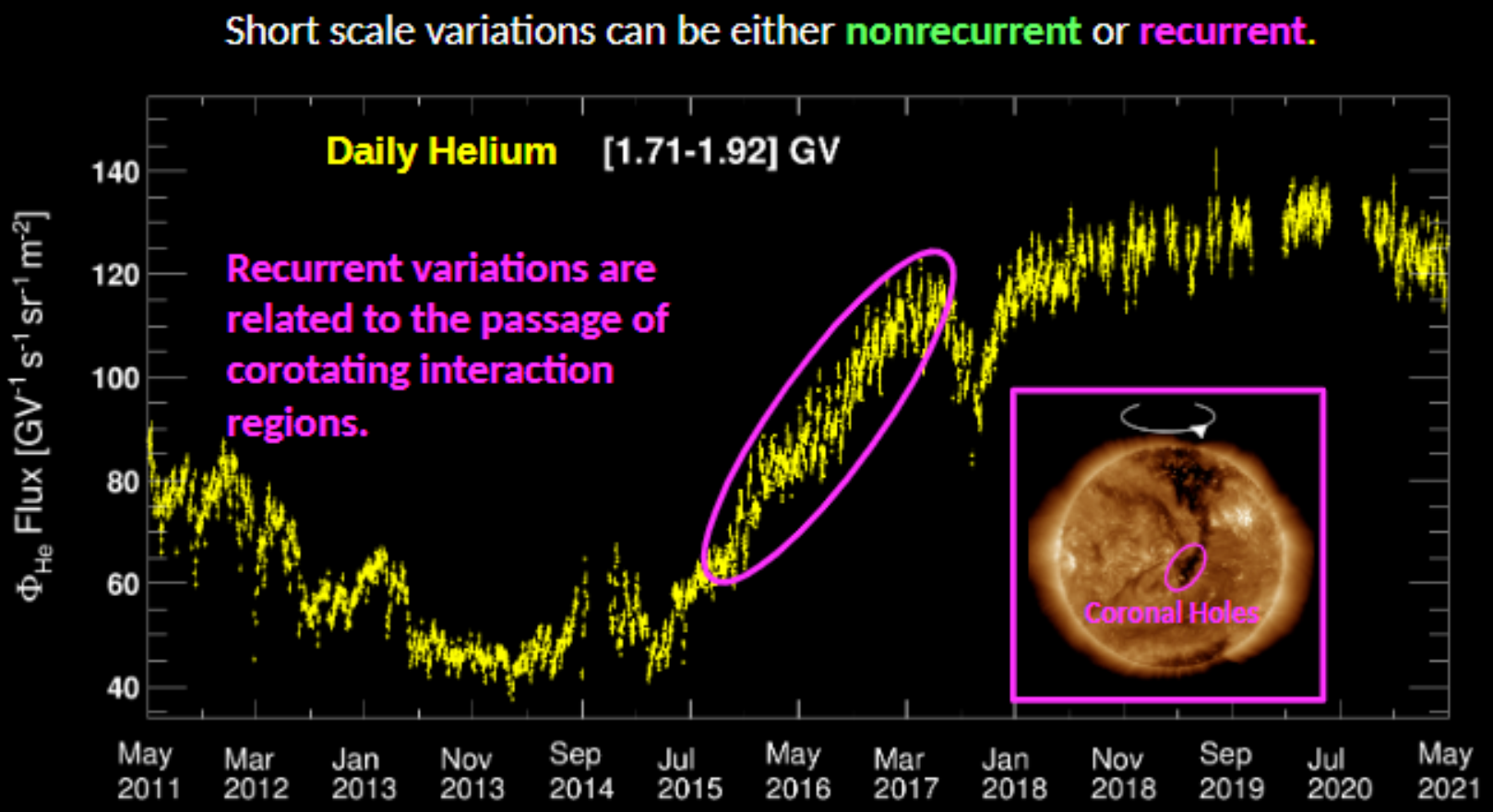


Daily Helium Fluxes: Nonrecurrent Variations

Short scale variations can be either **nonrecurrent** or **recurrent**.



Daily Helium Fluxes: Recurrent Variations



Conclusion

- The AMS daily Helium flux measurement from 1.7 to 100 GV between May 20, 2011 and May 2, 2021 was presented.
- Studying cosmic rays is very essential to calculate the radiation exposed by the space missions.
- Studying cosmic rays in low energy region can help us to predict the variations of the solar parameters.

Daily He, p and He/p Flux Ratio

The helium to proton flux ratio exhibits variations on multiple timescales.