DATA ANALYTICS MEETINGS WORKSHOP

HOW TO AUTOMATE SPACE SCIENCE

JESENNÁ 5, KOŠICE

8.3.2023

5 PM

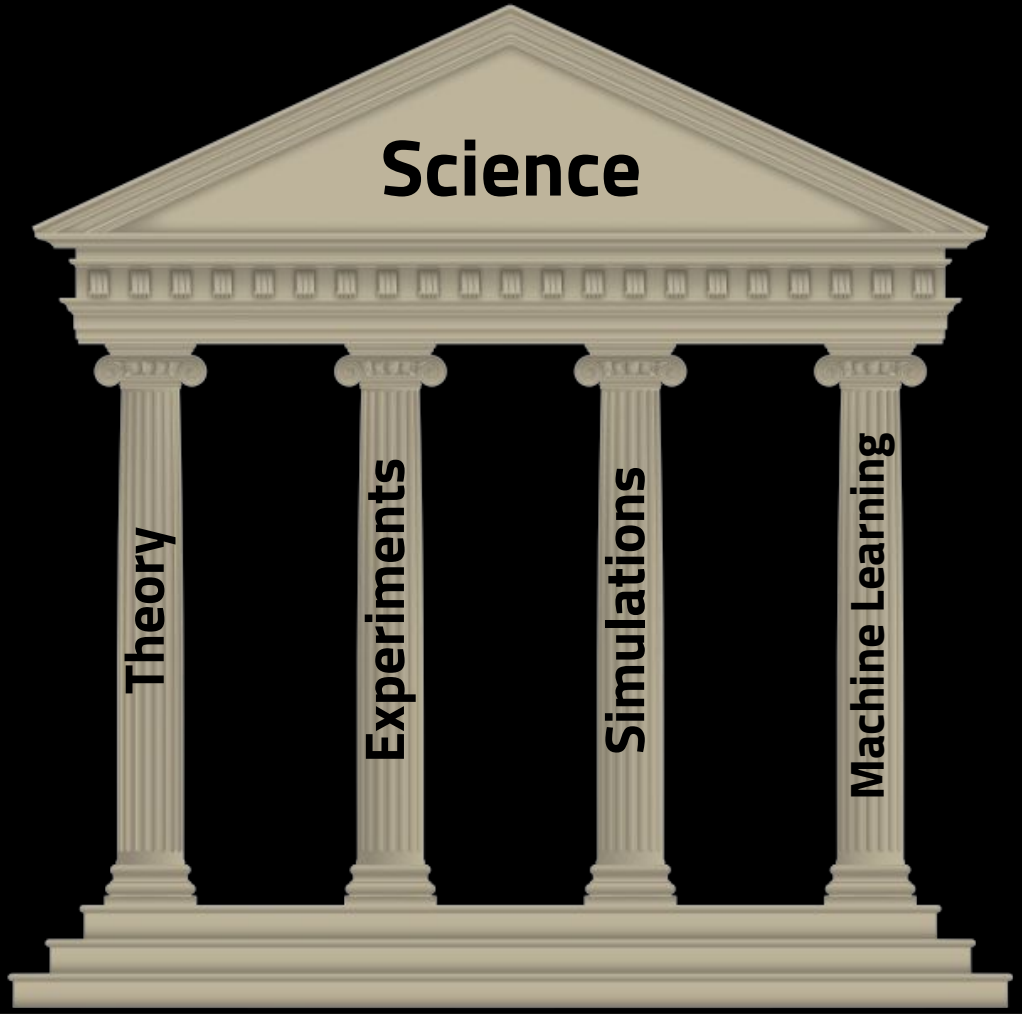
ZÁVÄZNÉ PRIHLASOVANIE TU:

DAM.SCIENCE.UPJS.SK

Šimon Mackovjak & Vierka Krešňáková

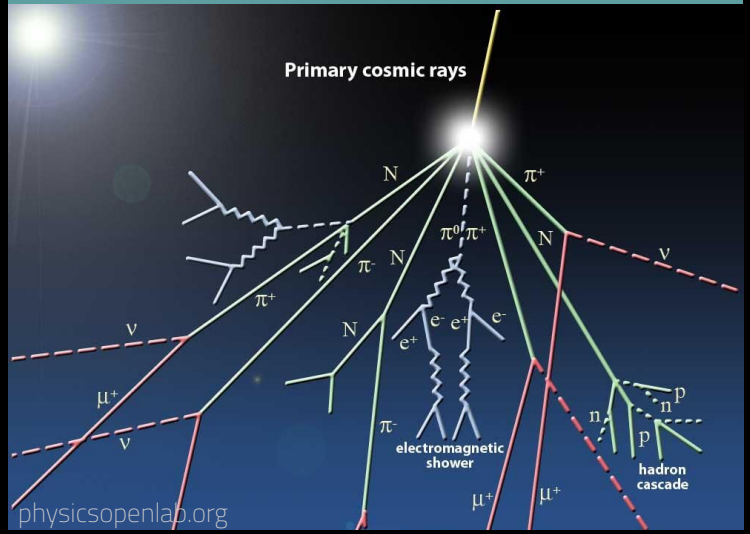
SPACE::LAB

CHI Centrum hospodarskej informatiky

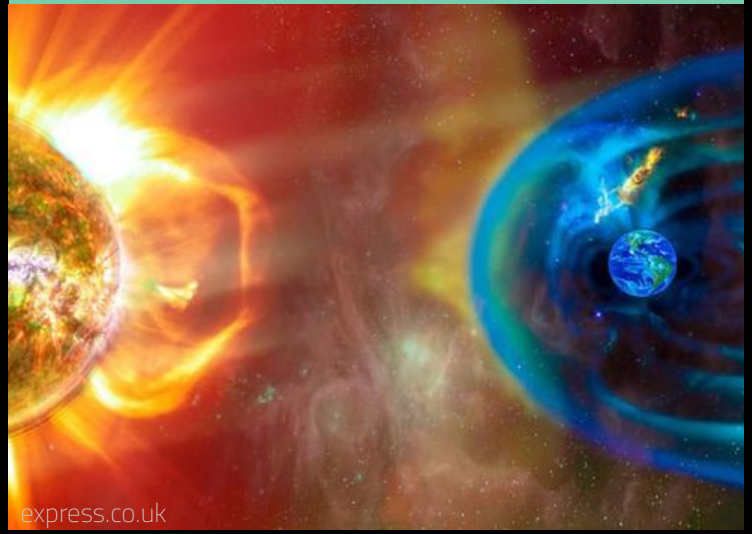

Science
Theory
Experiments
Simulations
Machine Learning

Main topics at **Slovak Academy of Sciences** in Košice

Cosmic rays

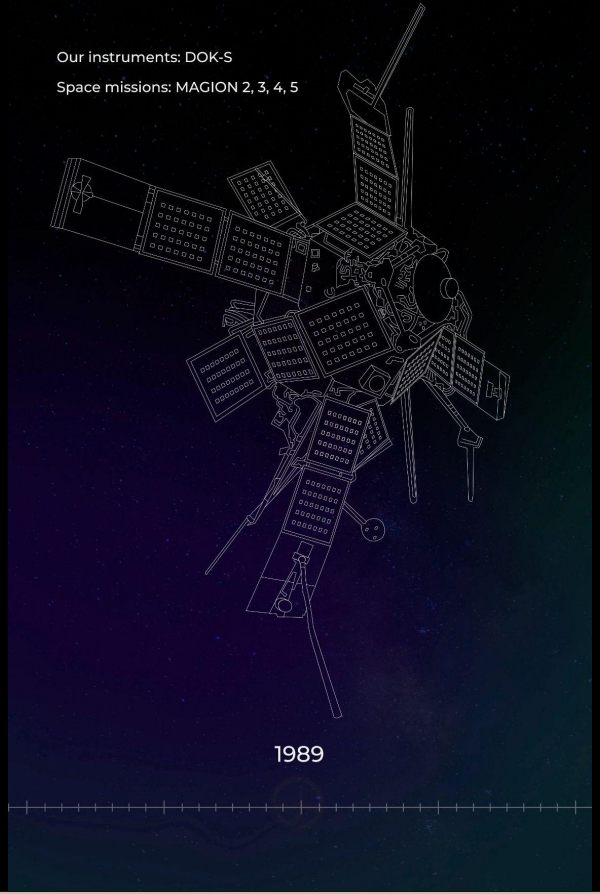


Space weather

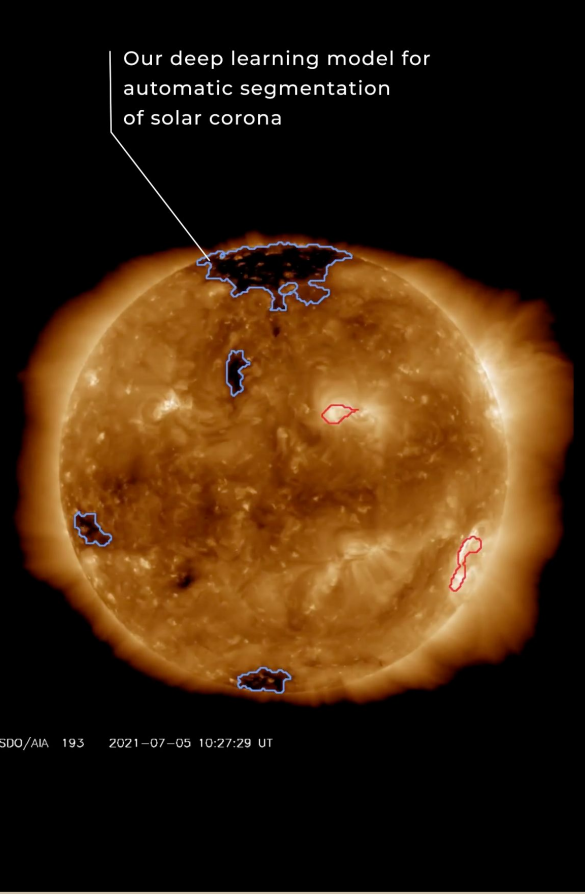


Own measurements

Cooperation in Space



Digital solutions



DEŇ ESA NA SLOVENSKU

"ESA DAY IN SLOVAKIA"

16.03.2023

Congress Hotel Centrum, Košice, Slovakia


steelpark
PARK VEDY
17. 03. 2023 • Kulturpark, Kukučínova 2, Košice
VESMÍR NA DOTYK
MINISTERSTVO ŠKOLSTVA, VEDY, VÝSKUMU A ŠPORTU SLOVENSKEJ REPUBLIKY
SLOVENSKÁ VESMÍRNA KANCELÁRIA
Popularizačný deň určených pre študentov a verejnosť
Touch of Space: awareness raising event for students and public
VSTUP VOĽNÝ

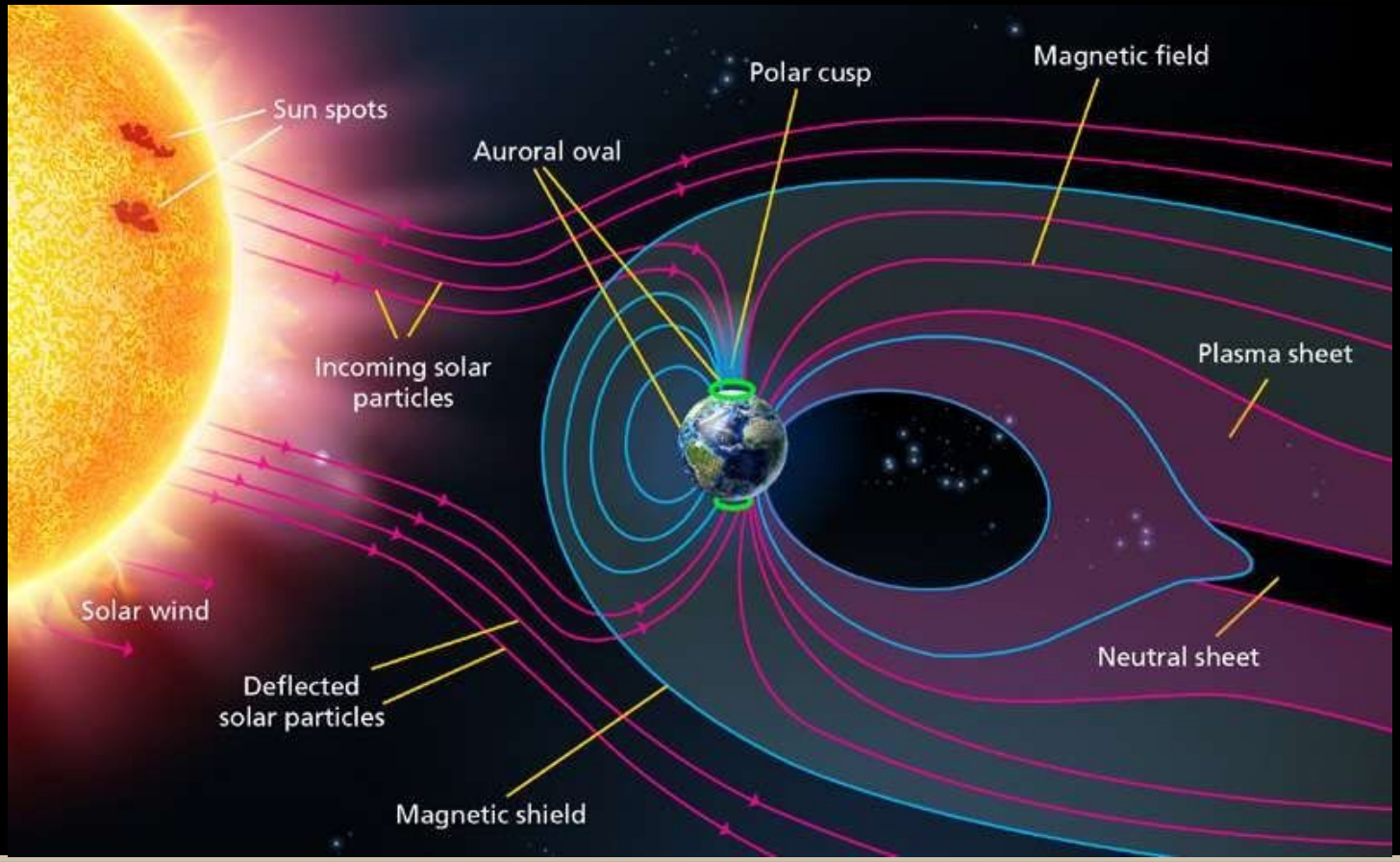
LET'S IMAGINE SPACE SCIENCE AS THE FOLLOWING PIPELINE:

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE.

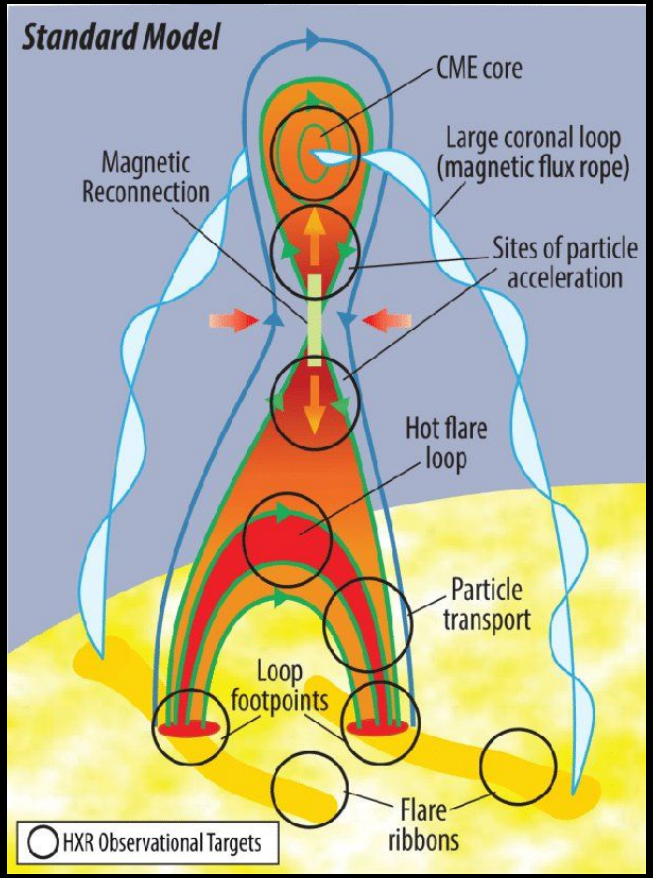
IS IT POSSIBLE TO AUTOMATE ALL THESE STEPS? IF YES, WHO SHOULD DO IT, PHYSICISTS, ENGINEERS, INFORMATICIANS, DATA SCIENTISTS, MATHEMATICIANS, OR SPACE SCIENTISTS?

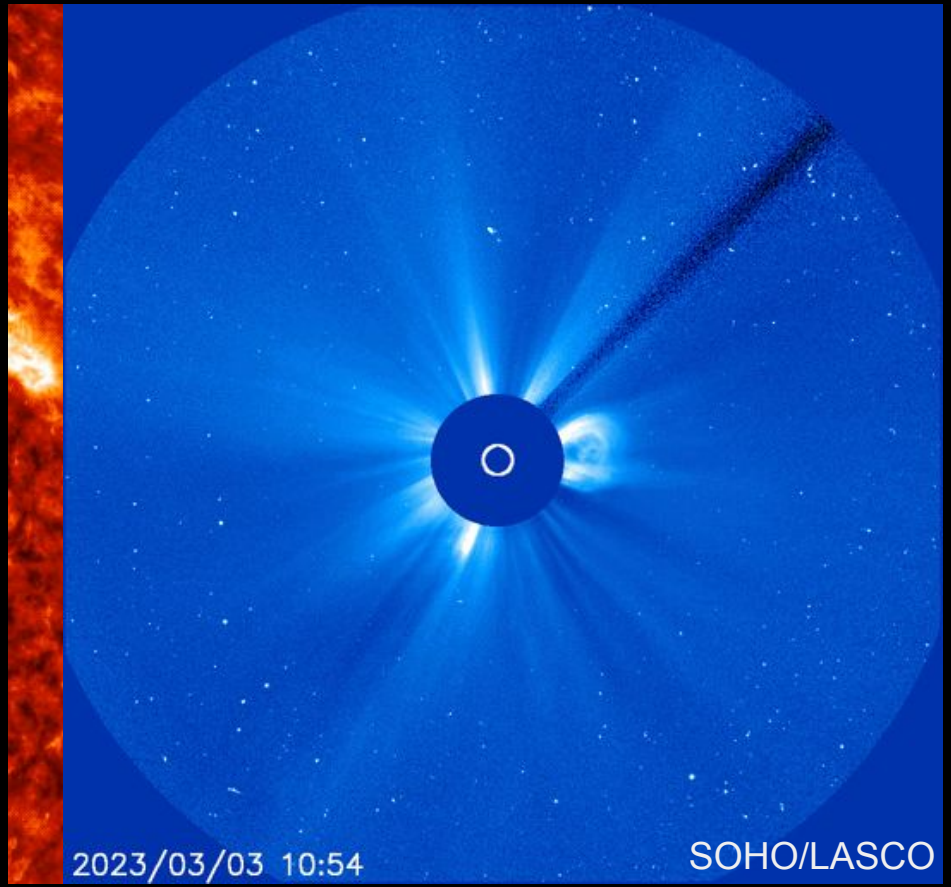
SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

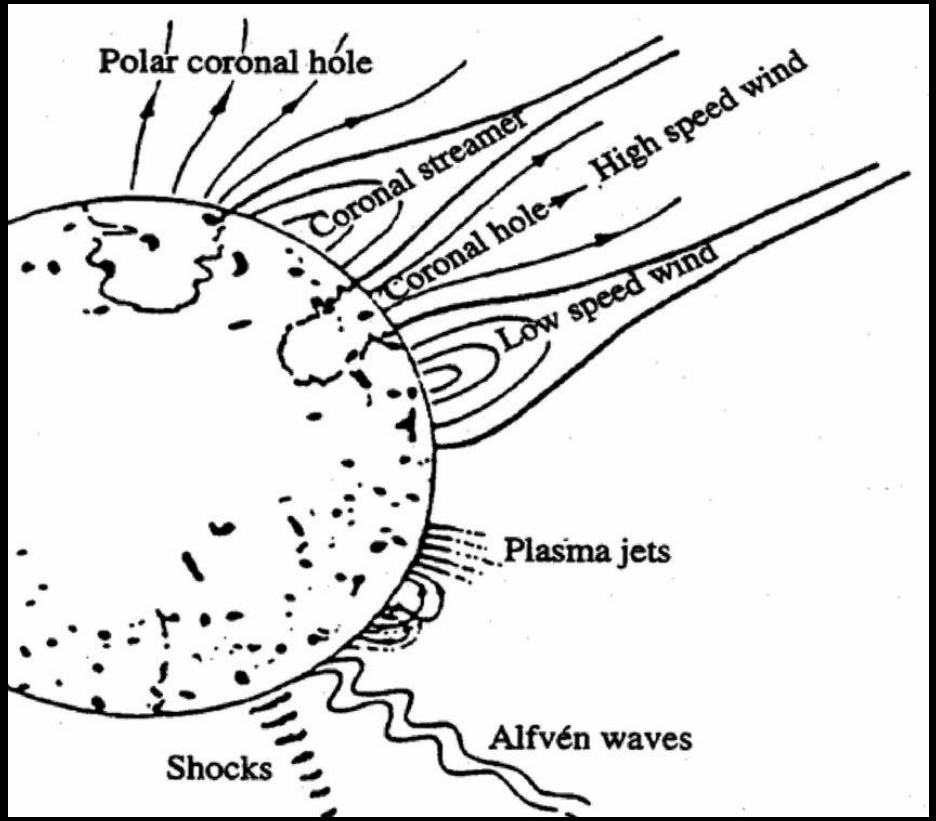


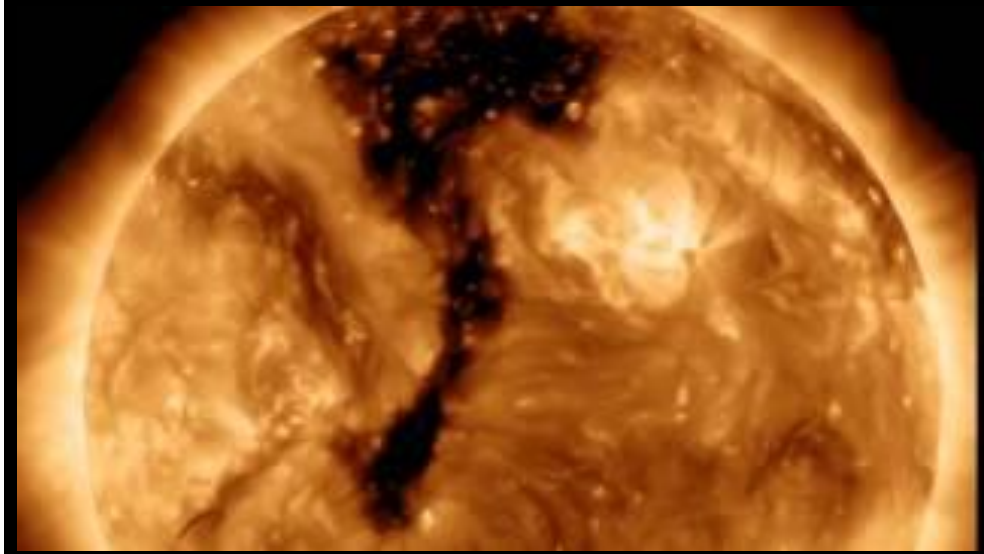
SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE





SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE



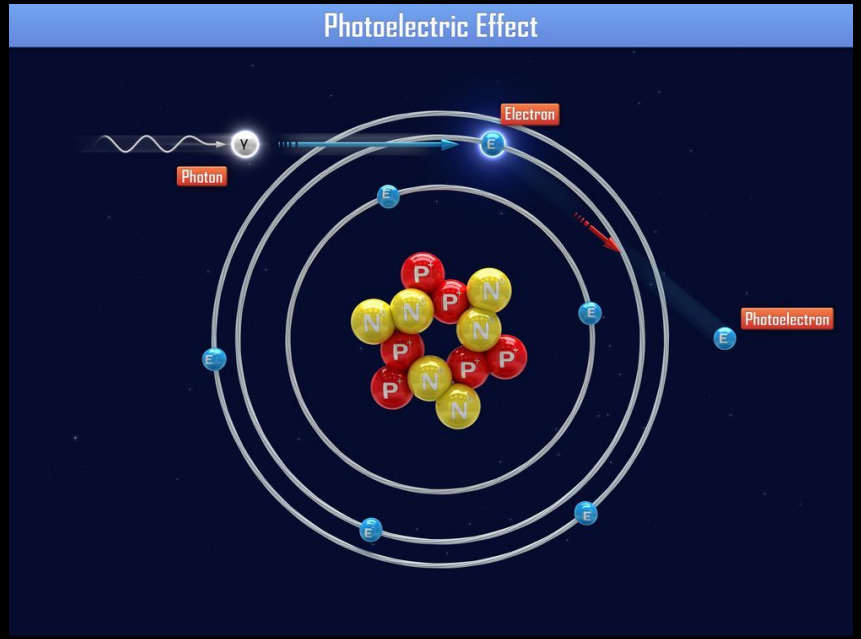


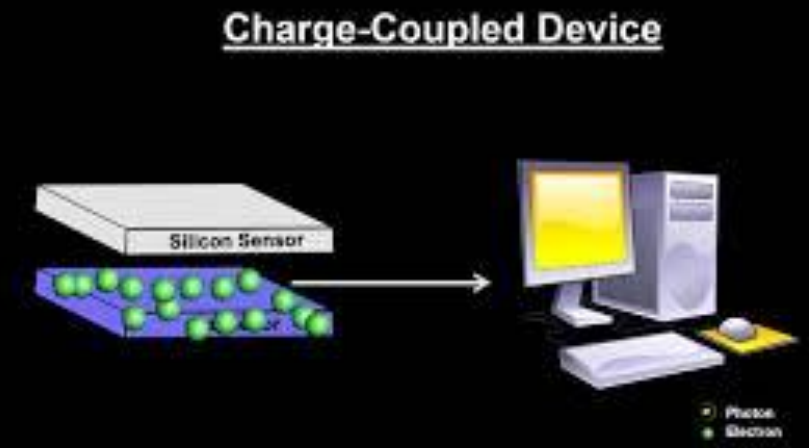
Aurora is consequence of Coronal Holes.

Are you sure?

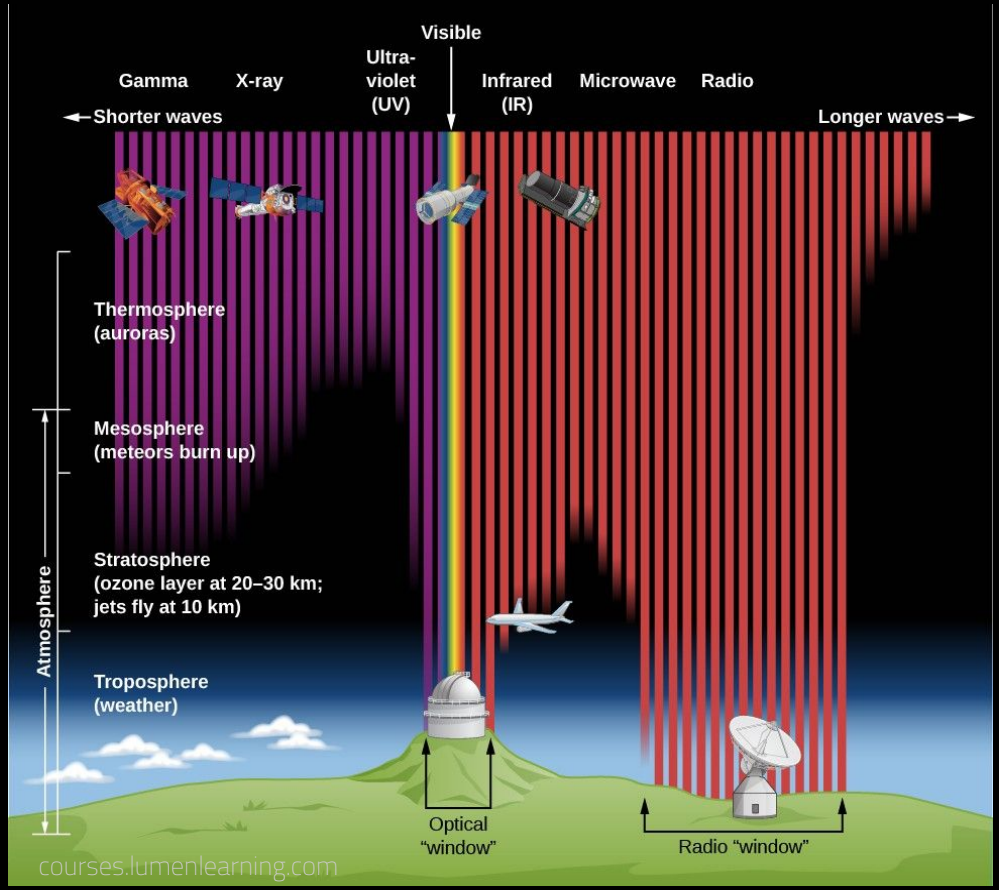
Prove it!

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

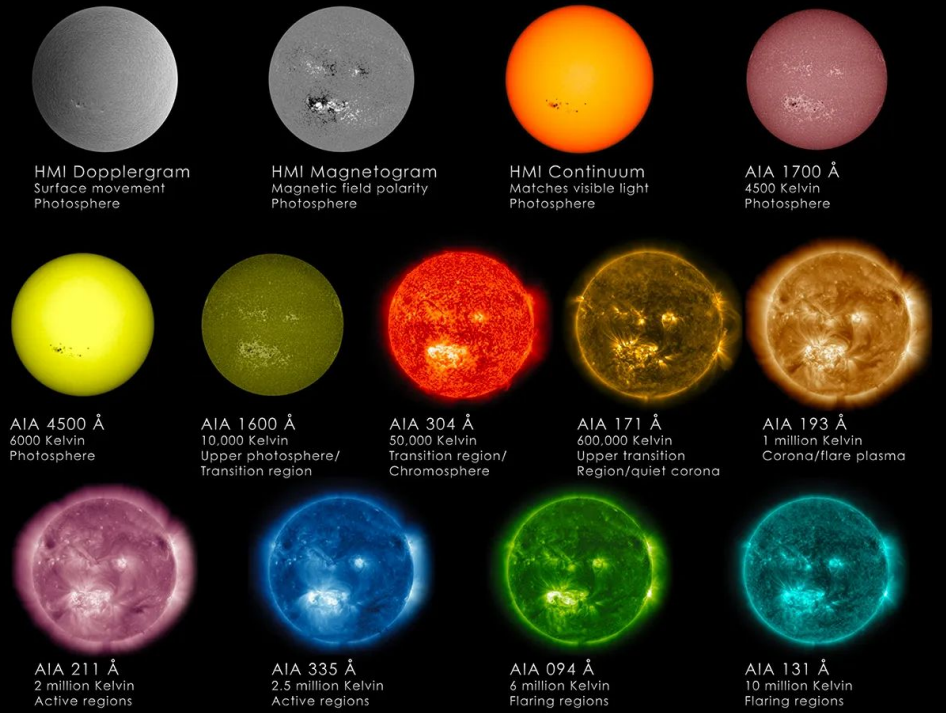




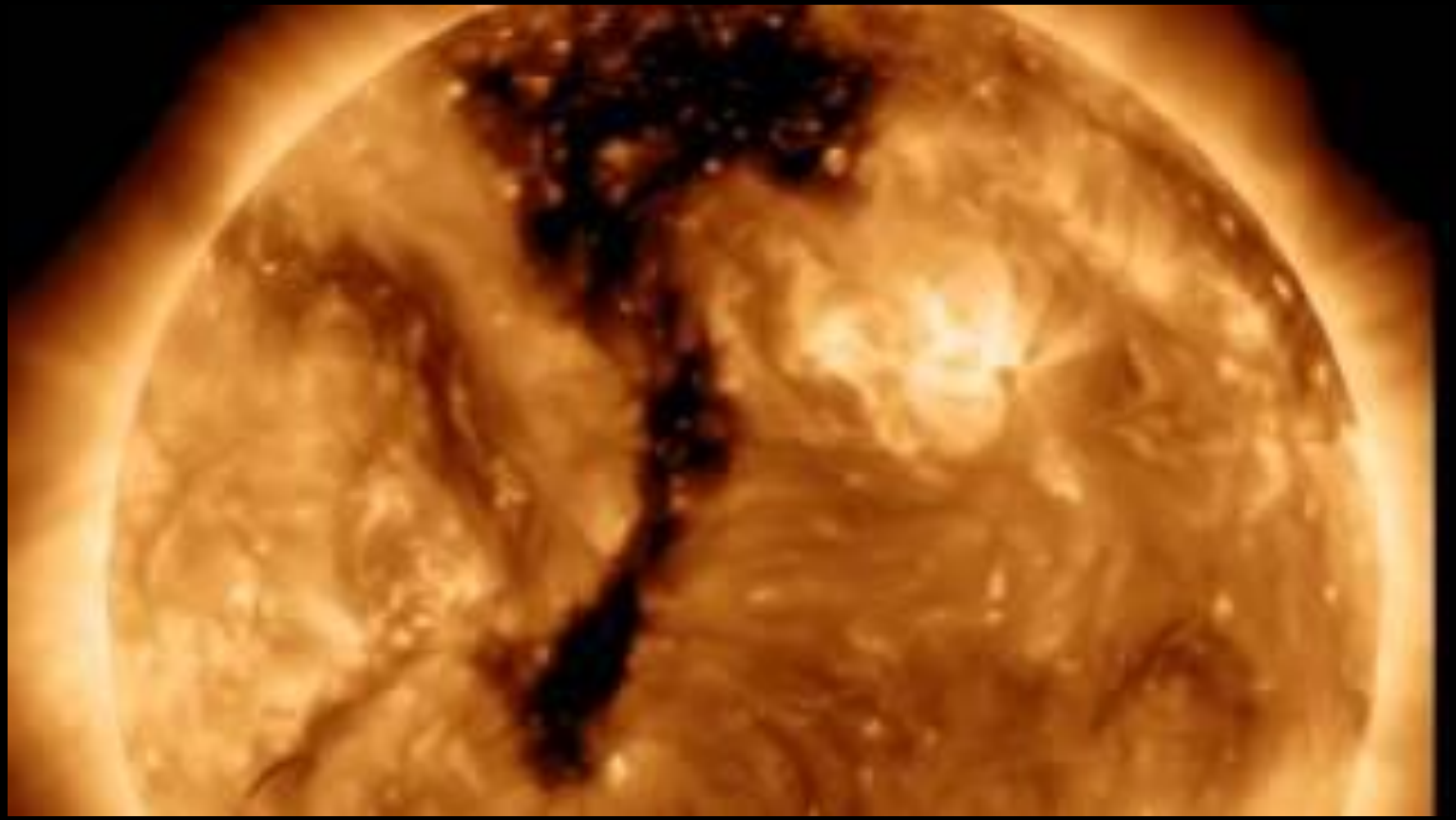
SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE



SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE



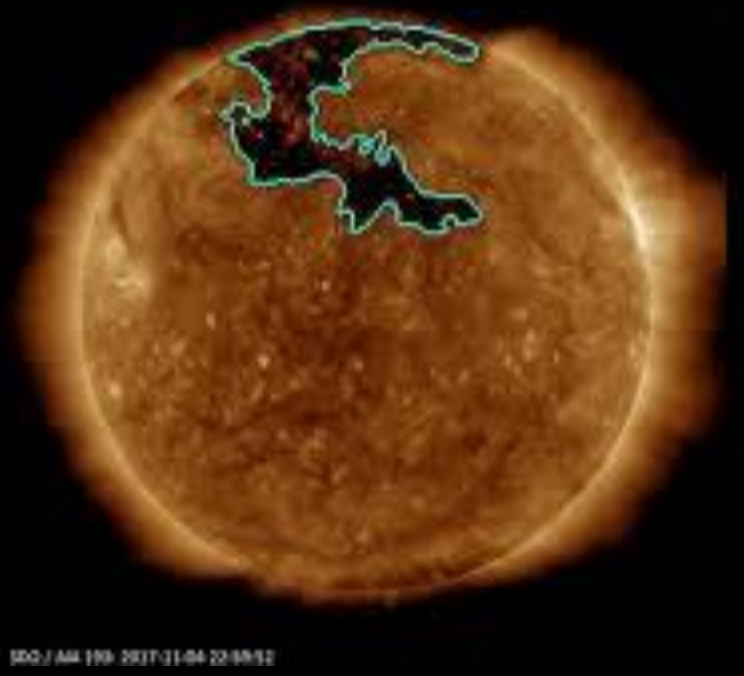
SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

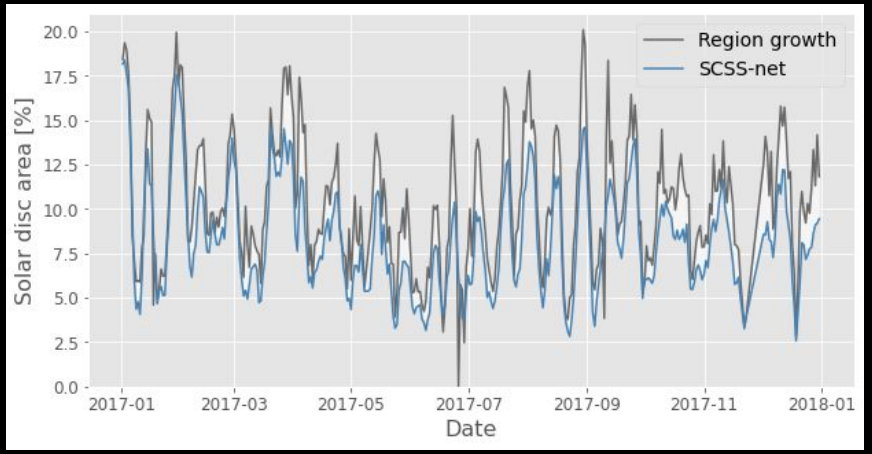


How to automate Space Science: Step I.

- ➔ Construct detector for space phenomena
- ➔ Eliminate all obstacles for observations (put it to Space)
- ➔ Ensure continuous data acquisition
- ➔ Transfer, calibrate, and store data
- ➔ Create interface for data access

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE





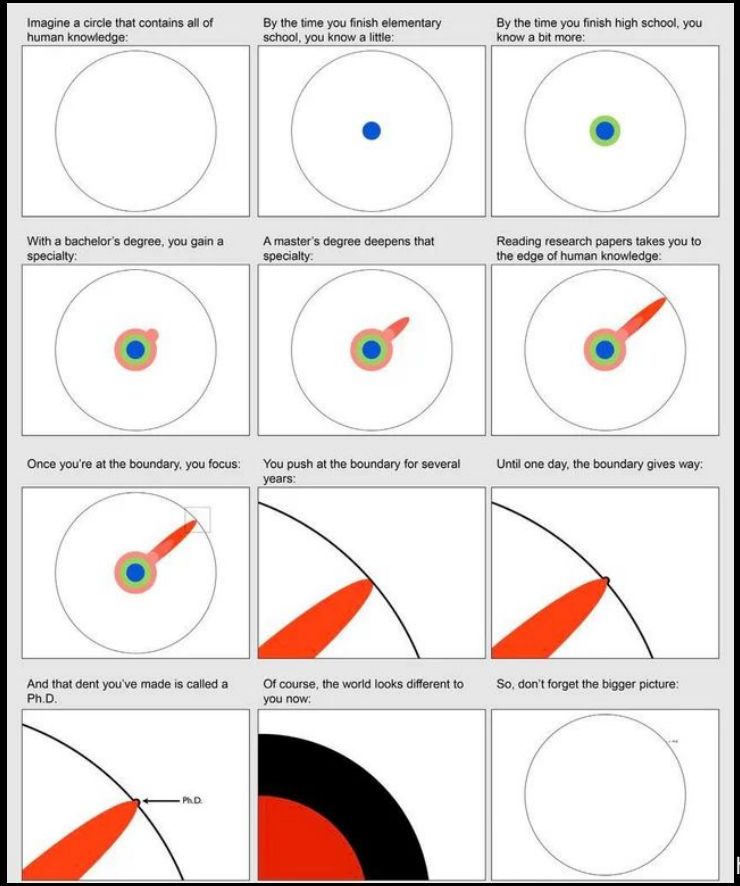
SPACE PHENOMENA → DATA → **INFORMATION** → KNOWLEDGE

https://github.com/space-lab-sk/scss-net

How to automate Space Science: Step II.

- ➔ Create examples of desired information (i.e. labels)
- ➔ Train reliable Machine Learning (ML) model
- ➔ Use ML model for whole dataset
- ➔ Extract the information

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE



https://www.reddit.com/

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

SI What is the connection between Solar Coronal holes and Aurora occurrence?

Solar coronal holes are not directly connected to the occurrence of auroras, but they can have an indirect effect on the intensity and frequency of auroras.

Coronal holes are areas on the sun's surface where the magnetic field is open, allowing high-speed solar wind to flow out into space. This solar wind carries charged particles, such as electrons and protons, which can interact with Earth's magnetic field when they reach our planet.

When the solar wind interacts with Earth's magnetic field, it can cause disturbances in the magnetosphere, the region around Earth where the magnetic field is strong enough to affect charged particles. These disturbances can lead to geomagnetic storms, which can enhance the auroral activity.

However, the occurrence and intensity of geomagnetic storms and auroras depend on various factors, such as the strength and direction of the solar wind, the orientation of the interplanetary magnetic field, and the state of Earth's magnetosphere. So while coronal holes may contribute to the solar wind that can enhance auroral activity, they are not the sole factor in determining when and where auroras occur.

How to automate Space Science: Step III.

- ➔ Use Google and Open AI
- ➔ Human intelligence is irreplaceable (for now :))

Mathematicians

Space scientists

Data scientists

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

Engineers

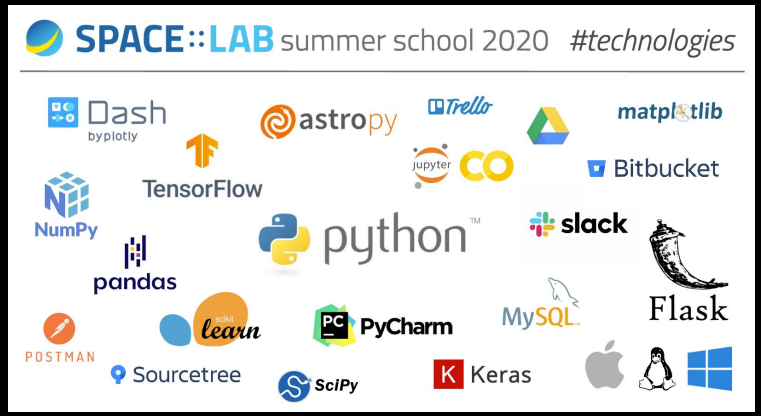
Physicists

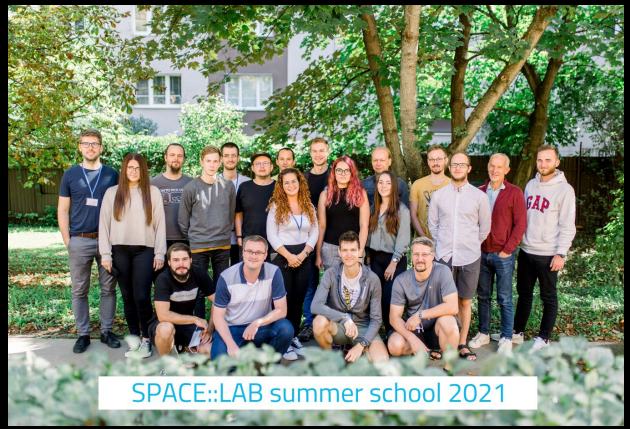
Informaticians

SPACE::LAB summer school

Interconnection of Space and IT community

- 2019: Machine learning and Space data
- 2020: Develop your own virtual observatory
- 2021: Space, Cloud & Deep learning
- 2022: Merging Space & IT
- 2023:





How to automate space science?

SPACE PHENOMENA → DATA → INFORMATION → KNOWLEDGE

- Digitalize Space phenomena
- Employ Data-driven approach
- Join Human and Artificial Intelligence

Follow us:

SPACE::LAB

Spätná väzba:

UNIVERZITA PAVLA JOZEFA ŠAFÁRIKA V KOŠICIACH

MLMU KOSICE

dam.science.upjs.sk