Students work like astroparticle physicists with Cosmic@Web

Philipp Lindenau, Carolin Schwerdt
and Michael Walter

ICRC 2021
37th International Cosmic Ray Conference
July 12th – 23rd, 20211
Online – Berlin, Germany

TECHNISCHE UNIVERSITÄT DRESDEN

DESY.

NETZWERK TEILCHENWELT

Netzwerk Teilchenwelt

- Network of researchers, students an teachers
- 30 universities/researchlabs and CERN
- Joint outreach activities in particle physics and astroparticle physics and since 2020 also nuclear and hadronphysics

www.teilchenwelt.de

Goals of Cosmic@Web

Goals of Cosmic@Web

- Enabling authentic scientific work for young people
- Independent of access to a detector for cosmic particles
- Without coding knowledge
- Still connected to physics curricula

Goals of Cosmic@Web

- Enabling authentic scientific work for young people
- Independent of access to a detector for cosmic particles
- Without coding knowledge
- Still connected to physics curricula

→Development of a web-based graphical interface for the analysis of real experimental data from a global network of detectors

Goals of Cosmic@Web

- Enabling authentic scientific work for young people
- Independent of access to a detector for cosmic particles
- Without coding knowledge
- Still connected to physics curricula

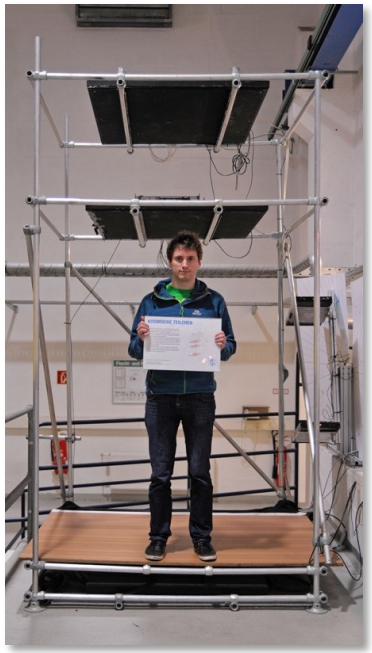
Experiments

9 experiments to study cosmic particles:

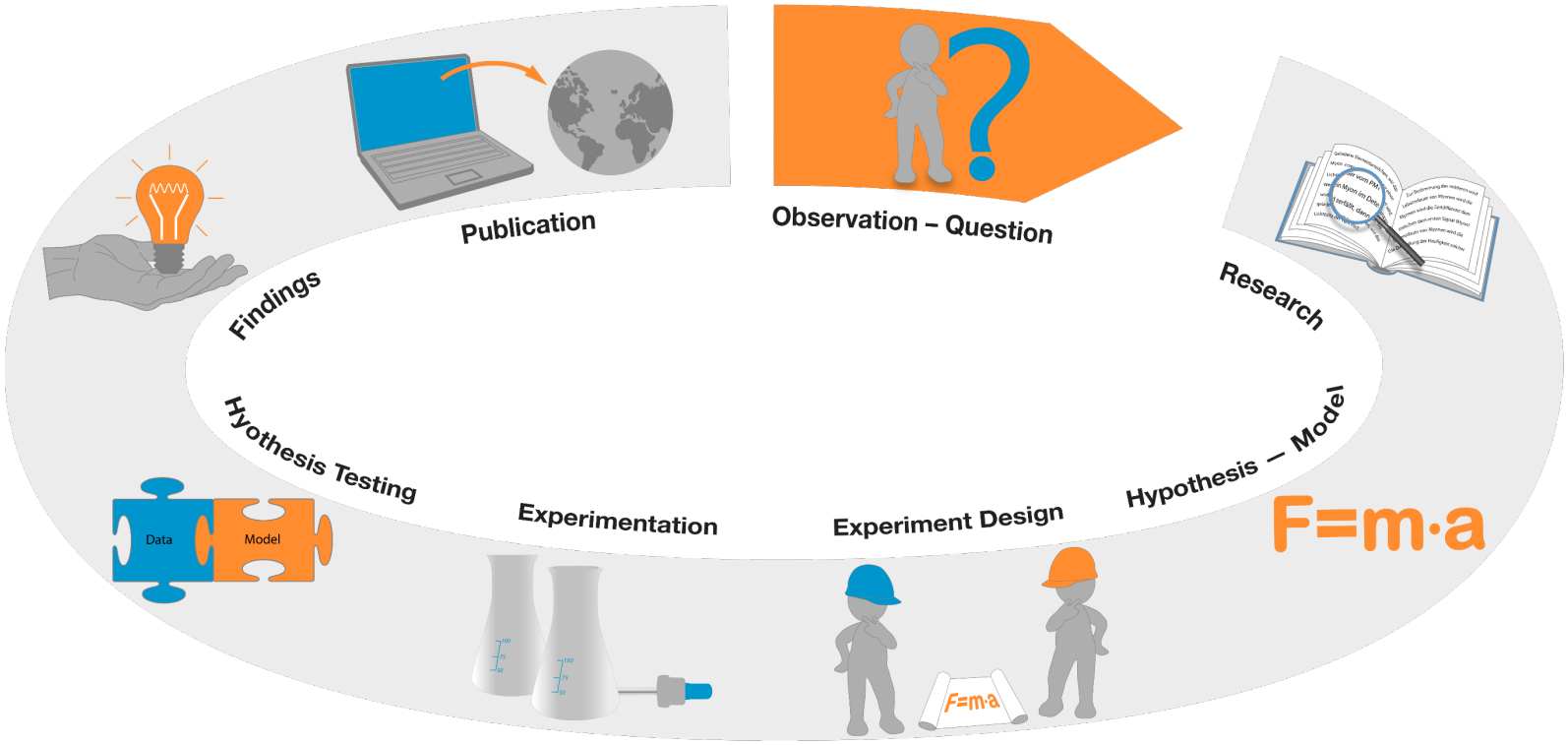
- Muon lifetime and velocity
- Rate as a function of latitude
- Rate in Germany, Armenia and Antarctica
- Rate in dependence of cosmic weather


Source: AWI


Source: AWI

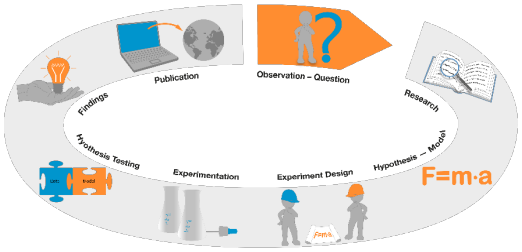


Students work scientifically



cosmic.desy.de

Students work scientifically



High school students have used Cosmic@Web:

- During internships at research institutes
- For special activities as a part of their high school degree
- To compare own measurements with Cosmic@Web data
- For the preparation of a technical paper
- For projects on programming and software development
- While participating in the International Cosmic Day
- During workshops

Cosmic@Web workshop

- Digital workshop (90 to 120 minutes)
- Enable students and teachers to get started with Cosmic@Web
- Show how to analyze data with Cosmic@Web
- Generating sample hypotheses and ideas to test them
- Give an idea how to conduct further research

Cosmic@Web workshop

- Digital workshop (90 to 120 minutes)
- Enable students and teachers to get started with Cosmic@Web
- Show how to analyze data with Cosmic@Web
- Generating sample hypotheses and ideas to test them
- Give an idea how to conduct further research

→ Focus on Polarstern data


Source: AWI

Analyzing Polarstern data

1. Execution of the Cosmic@Web tutorial

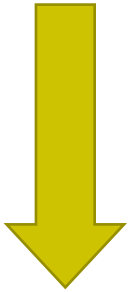
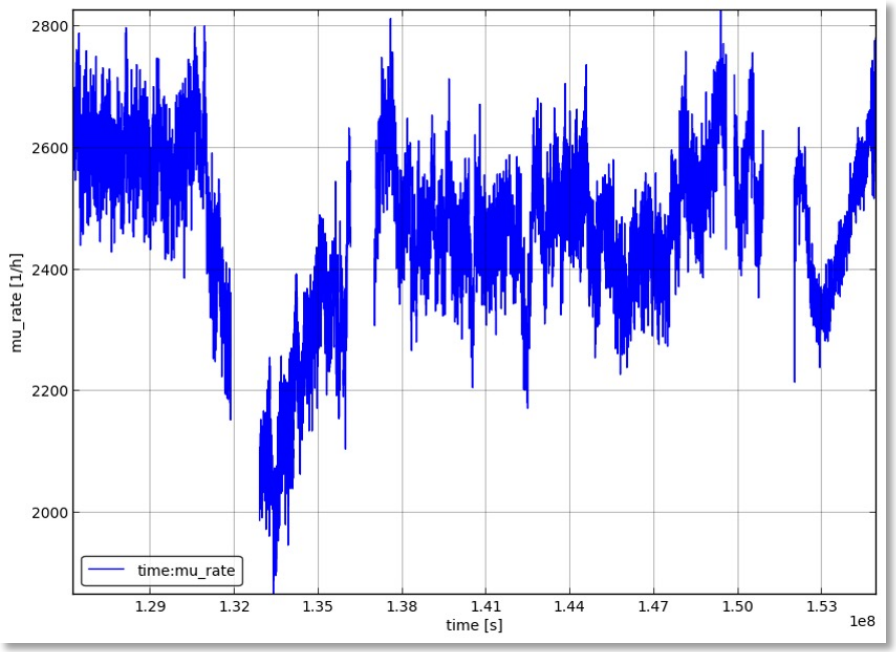


Diagram of the muon rate at the Polarstern as a function of time during one year

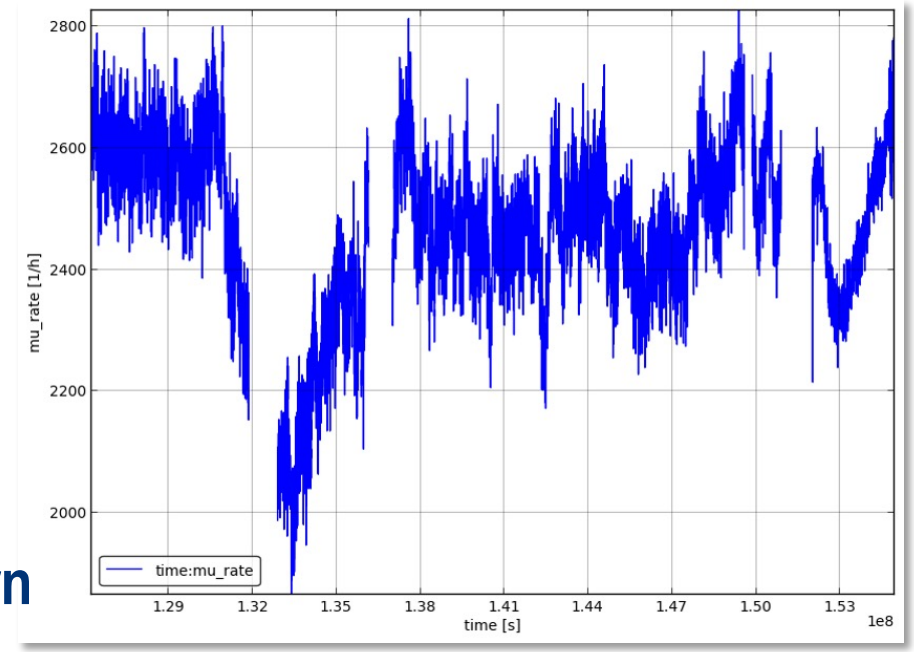
Analyzing Polarstern data

- After tutorial: discussion and hypothesis generation
- Not judged or discussed indvidually at this point



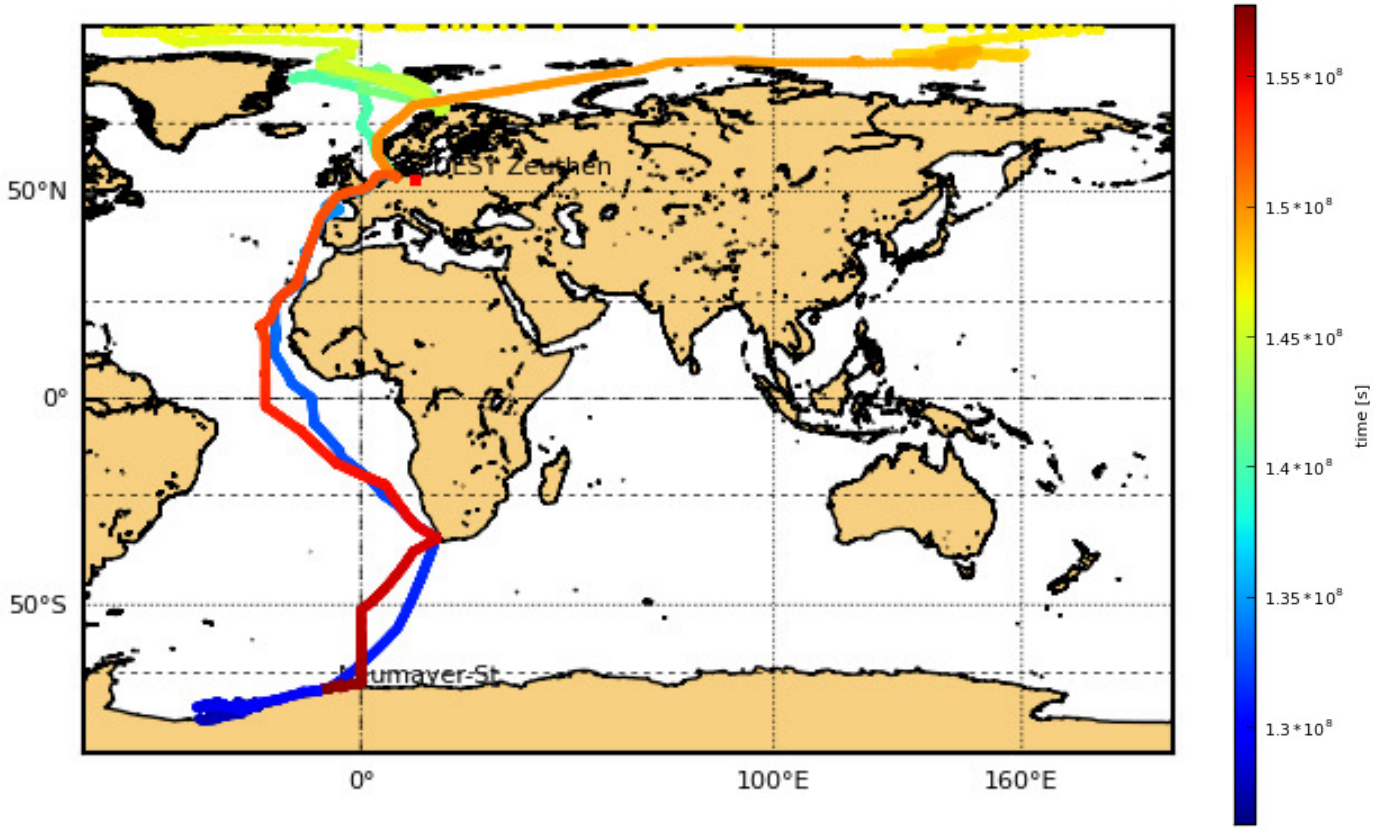
Analyzing Polarstern data

- After tutorial: discussion and hypothesis generation
- Not judged or discussed indvidually at this point
- Some sample hypotheses to explain the fluctuation of the muon rate:
  - Influence of the solar activity
  - Sun-to-Earth distance
  - Seasons of the year
  - Influence of ocean waves
  - Day-night cycle
  - **Position of the Polarstern**



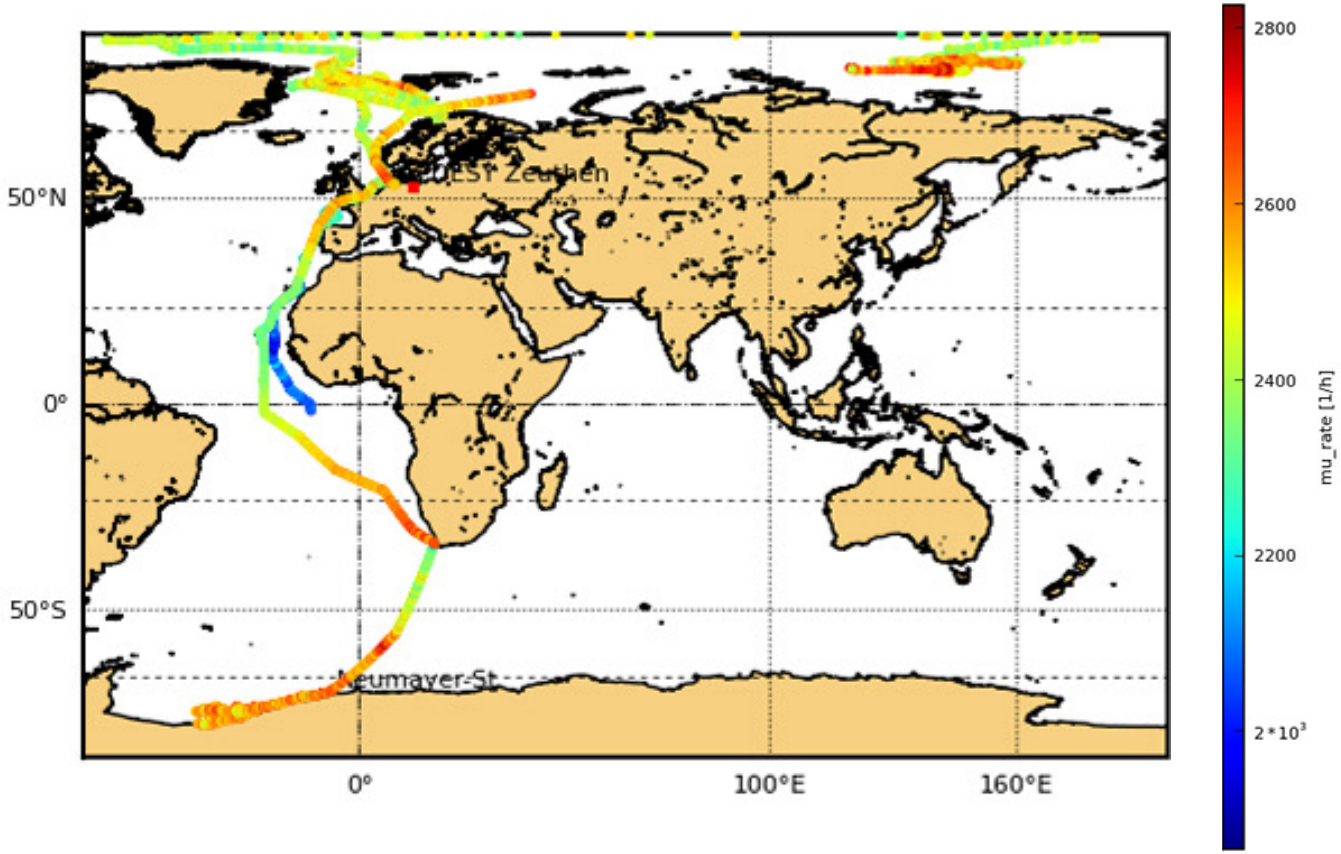
Investigating the location-hypothesis

- Position in dependence of time



Investigating the location-hypothesis

- Muon rate in dependence of position



Students‘ and teachers‘ feedback

- Hands-on work interesting
- Participants want to conduct further research
- Teachers see Cosmic@Web as suitable for in-class use
- More details in our proceedings

Conclusion

Cosmic@Web

- is a suitable tool to engage learners with research questions in astroparticle physics.
- can be used individually with particularly interested students.

Conclusion

Cosmic@Web

- is a suitable tool to engage learners with research questions in astroparticle physics.
- can be used individually with particularly interested students.
- **is an ideal way for you to get (further) involved in outreach activities!**

Thank you for your attention.

Contact

Carolin Schwerdt
carolin.schwerdt@desy.de

Philipp Lindenau
philipp.lindenau@tu-dresden.de

PROJEKTLEITUNG

TECHNISCHE UNIVERSITÄT DRESDEN

PARTNER

CERN

DESY.

SCHIRMHERRSCHAFT

DPG

FÖRDERER

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

Dr. Hans Riegel-Stiftung

ICRC 2021

NETZWERK TEILCHENWELT

Find us at the *Presenter Forum* for discussion.

16. July 2021: 18:00 - 19:30 (Berlin Time)

19. July 2021: 12:00 - 13:30 (Berlin Time)