This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008324 (ChETEC-INFRA).

WP7: Dissemination, Outreach, Innovation

ChETEC-INFRA 5th General Assembly
Dresden, 17.-18.9.2025

Uta Bilow, TU Dresden

The general picture

PhD students, Postdocs

Educate young generation of scientists

High school students

Inspire next generation

Research communities

Foster synergies and coherence

Project results

Civic Society

Raise awareness

Industry

Promote collaboration

National funding authorities

Enhance visibility of potential of the research field

Uta Bilow, TU Dresden, uta.bilow@tu-dresden.de, chetec-infra.eu

Outline: 4 Tasks in WP7

Task 7.1 Nuclear Astrophysics Masterclasses (TUD)

Task 7.2 Nuclear Astrophysics Scientific Schools (GANIL/HZDR)

Task 7.3 Nuclear, Astronomy, and Astrophysics Conference Outreach (HZDR)

Task 7.4 Research-Industry Days (UNIPD)

plus some extra activity…

Task 7.1 Nuclear Astrophysics Masterclasses

Proven tool in HEP outreach, also in other disciplines

Concept of a Masterclass:

- **High school students** (15-19 y) step in the shoes of a scientist
- **Lectures**, lab tour or virtual visit (video), interactive elements (worksheets, games)
- **Hands-on activity** with real data from an experiment
- At a research institute / university or at school
- Masterclass is usually led by young scientists

Scientist for a day	Authentic experience	Nature of Science
• Close to current research • Own hands-on activities • insight into work	• Real scientific data • Use of relevant methods and tools • Discussion with scientists	• Comparisons between experiment and theory • Limits of knowledge

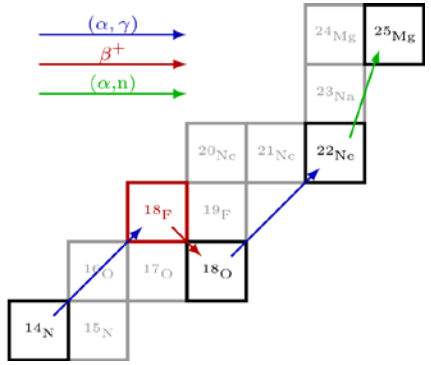
Masterclass 1: A Journey through the Elements

Topic: Nuclear reaction measurements from Dresden Felsenkeller Lab

Research task: Data analysis of $^{14}\mathrm{N}(\alpha,\gamma)^{18}\mathrm{F}$

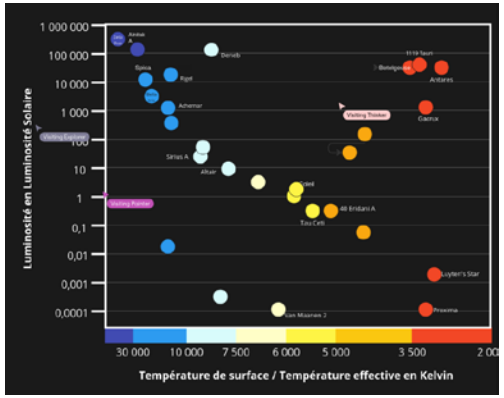
- Start of reaction chain taking place in red giant stars towards the end of helium burning
- One of the main neutron sources for s-processes
- Data from Felsenkeller underground lab in Dresden

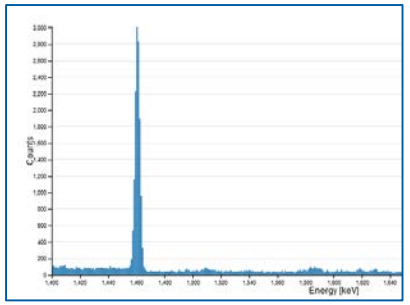
Research question: Where do the neutrons come from?



Content:

- Gamma spectroscopy
- Term diagram
- Concept of background
- Cross section & reaction rate





Uta Bilow, TU Dresden, uta.bilow@tu-dresden.de, chetec-infra.eu

Masterclass 2: Fingerprints of the Stars

Topic: Stellar spectra from Andreas Korn

Research tasks:

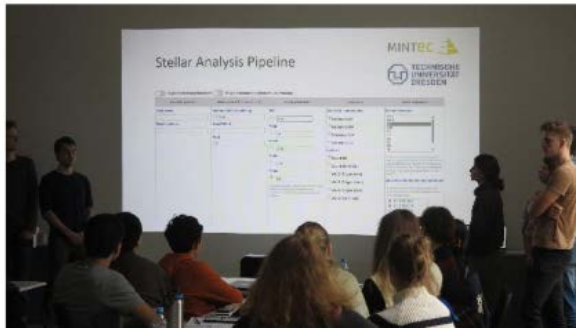
- Analysis of lithium abundances
  - determine stellar parameters
  - calculate elemental abundances
  - reconstruct the cosmological lithium problem

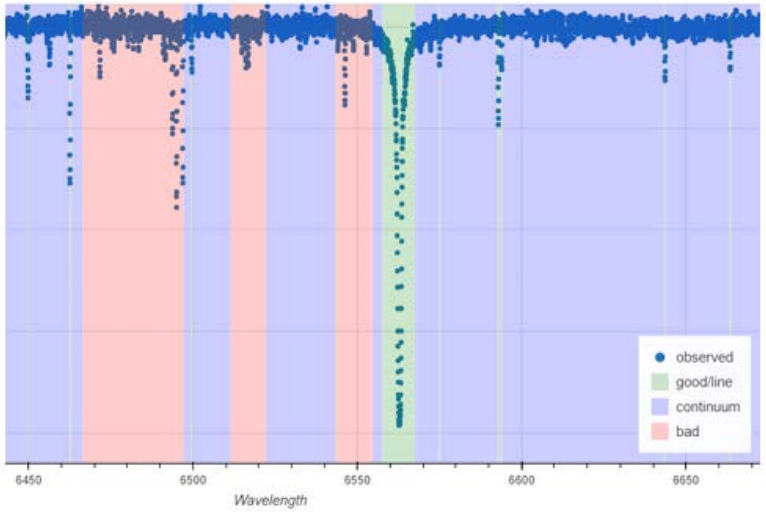
Content:

- Evolution of stars
- Formation and abundance of chemical elements
- Big Bang & Primordial nucleosynthesis

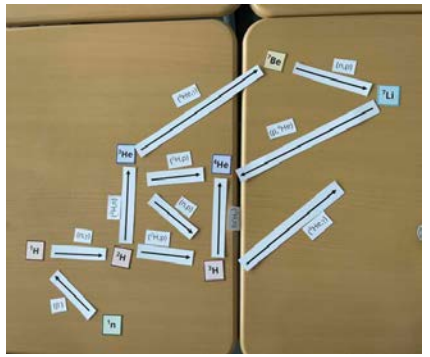
Hands-on: Stellar Analysis Pipeline tool “webSME” by Johannes Puschnig
http://pipeline.chetec-infra.eu/

Masterclass at TU Dresden (Astrophysics Camp)





Input spectrum in WebSME

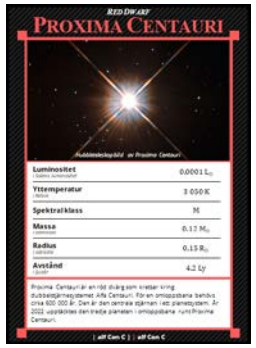


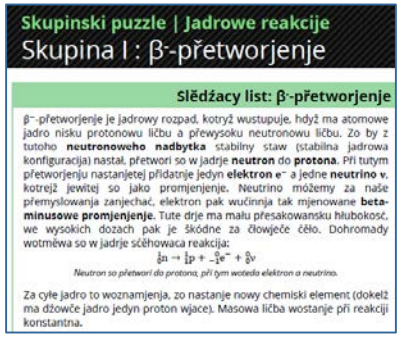
Dissemination of NAP Masterclasses

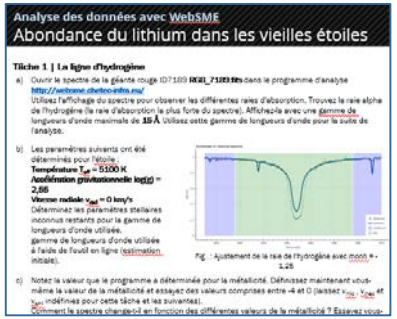
Both NAP Masterclasses

- ✓ PhD project of Hannes Nitsche
- ✓ Available at https://www.chetec-infra.eu/masterclasses/
- ✓ All material in 11 different languages (consortium)
  - Bulgarian
  - Czech
  - English
  - French
  - German
  - Hungarian
  - Italian
  - Lithuanian
  - Romanian
  - Spanish
  - Swedish

  plus Upper Sorbian





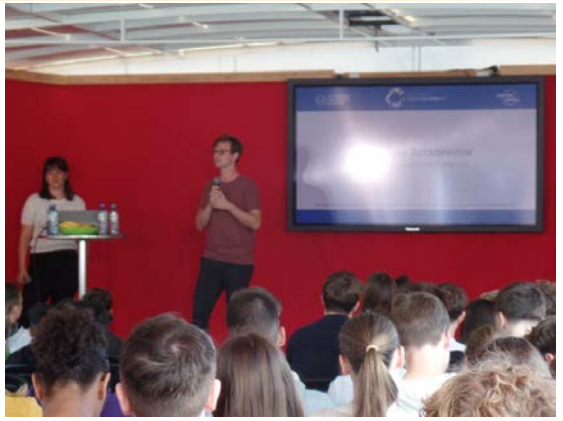


- Initially developed and tested in German and English
- Masterclass 1: volunteers (consortium members) translated
- Masterclass 2: DeepL, volunteers have checked translations

Usage of NAP Masterclasses

34 Masterclasses (27 x DE, 3 x AT, 2 x FR, 2 x TR)

Various occasions / various places
- school visit (1 day)
- activity on MS Wissenschaft
- 4d camp
- ...

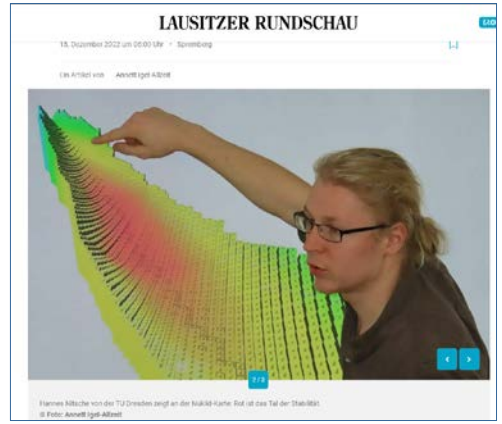


MS Wissenschaft / Vienna

Contact form
on website for German and Austrian teachers

NAP MC in Germany,
team: Hannes + 5 facilitator in Dresden, 1 in Bonn

Report website school



Report newspaper

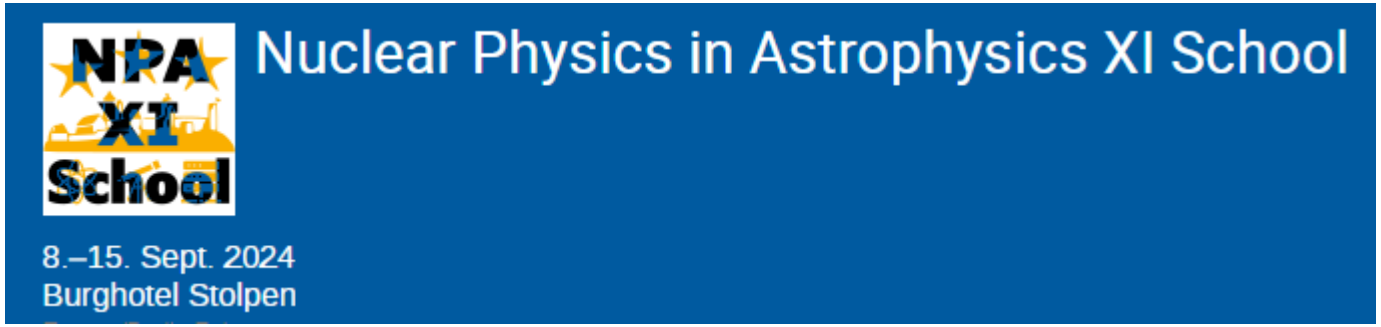
MINT-EC Camp on Astrophysics

05.-08.05.2025 at TU Dresden

- 24 high school students from MINT-EC schools*, 50% girls
- Introductory lectures, hands-on data analysis (Fingerprints of the Stars)
- Students working in groups of 4
- Final day: presentation of results and scientific methods/background
- Felsenkeller visit
- social activities, e.g. guided tour at TU Dresden, Sightseeing, Neustadt ....
- 2. edition, first camp was in 10/2023

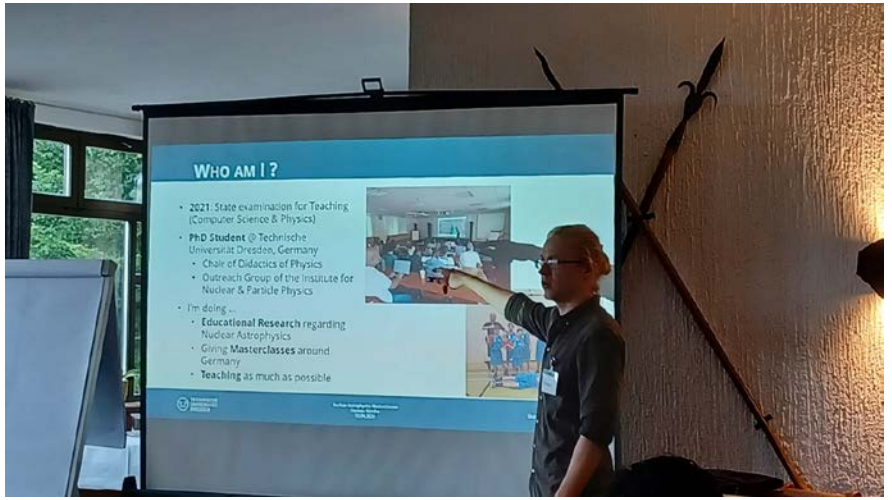
* MINT-EC: network of certified *STEM excellence school* in Germany

NAP Masterclasses Training



[Nuclear Physics in Astrophysics XI School]

- 25 PhD students
- 1 training day
- Introduction to Masterclass material
- Doing the Masterclass from a student´s perspective (+ reflection)
- Own hands-on activities
- Additional background info on outreach and science communication (methods, tools...)



Masterclass training day at NPA XI school 09/24

Uta Bilow, TU Dresden, uta.bilow@tu-dresden.de, chetec-infra.eu

Outreach to community

DPG spring conference, Dresden, 03/2023
A New Nuclear Astrophysics Masterclass

XVIII Int. Conference on Topics in Astroparticle and Underground Physics, Vienna, 08/2023
Nuclear Astrophysics Masterclasses - A Journey through the Elements

IPPOG meeting, CERN, 11/2023
How Nuclear Astrophysics Masterclasses can benefit from Gamification Elements

DPG spring conference, Gießen, 03/2024
Nuclear Astrophysics Masterclasses

World Conference on Physics Education, Warsaw, 08/2024
Nuclear astrophysics masterclasses as an interest-promoting learning environment

NPA XI Conference, Dresden, 09/2024
Nuclear Astrophysics Masterclasses - Fingerprints of the Stars

Outcome and impact of Masterclasses

In Germany, Masterclasses are (only) the first level in a multi-stage program for interested high school students.

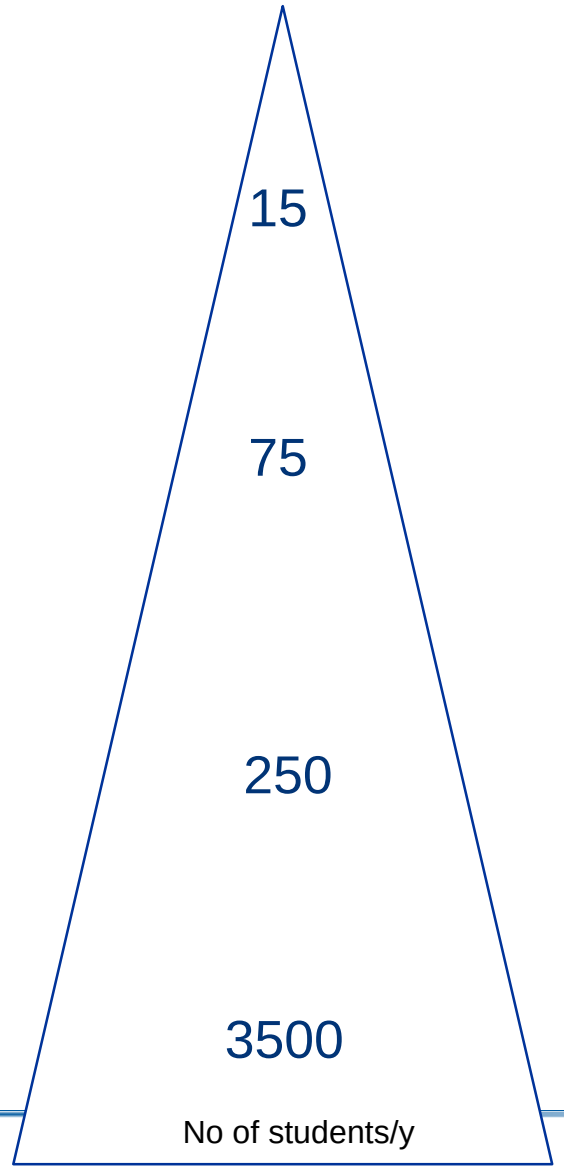
NETZWERK TEILCHENWELT

research projects at institutes or CERN

CERN workshops, Particle physics academy in Mainz

Active engagement, detector projects

Masterclasses



Outcome and impact of Masterclasses

In Germany, Masterclasses are (only) the first level in a multi-stage program for interested high school students.

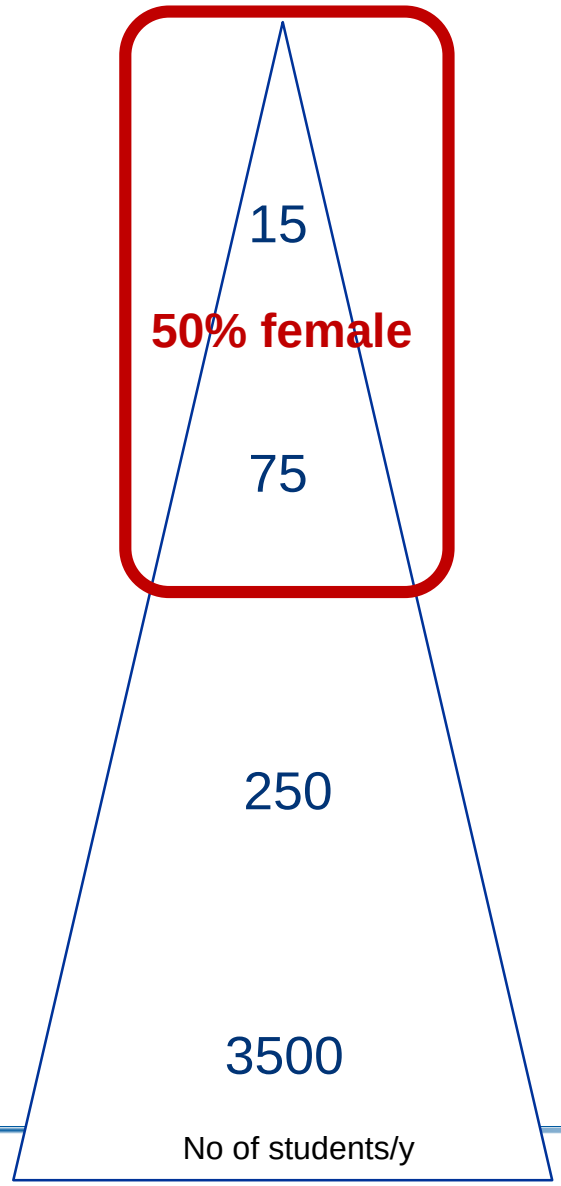
NETZWERK TEILCHENWELT

research projects at institutes or CERN

CERN workshops, Particle physics academy in Mainz

Active engagement, detector projects

Masterclasses

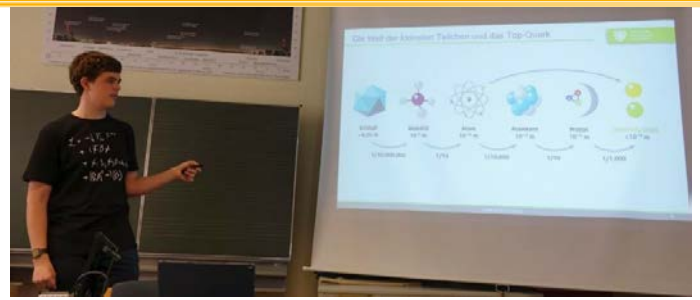


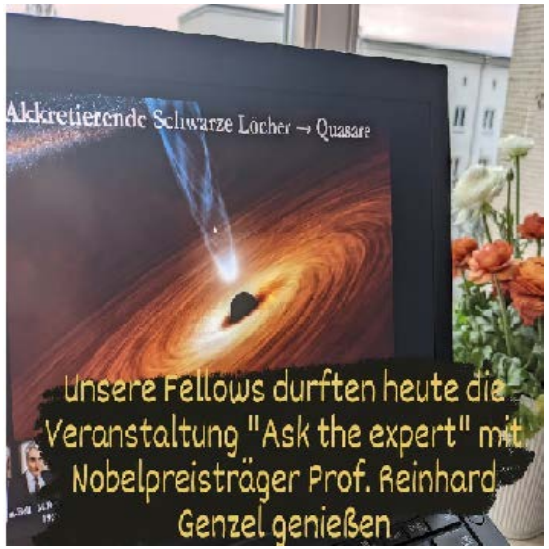
[Female share in physics exams 2023](#):

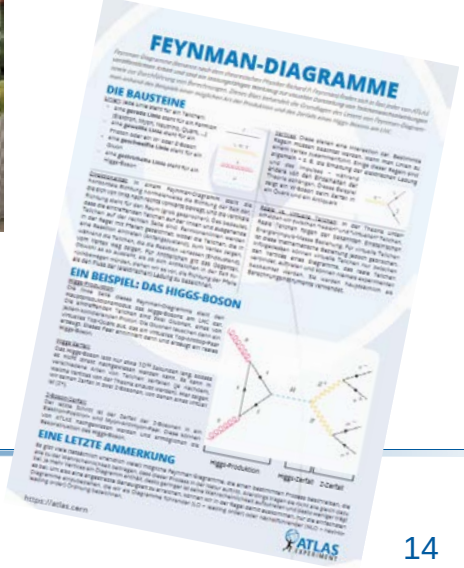
- 22% Bachelor
- 25% Master
- 22% PhD

Role model Lukas (21)

- At age 16: Particle Physics Masterclass
- Several internships at University of Wuppertal
- 2020 CERN Workshop
- 2021 own research project, 2 weeks at CERN, for competition “Jugend forscht” and graduation from high school (BeLL)
  - Single Top-Quark Production at LHC
- currently 6. Semester Bachelor Physics University of Wuppertal
- Co-Organiser "Ask the expert“, invited R. Genzel, R. Yogeshwar
- Youngest ATLAS shifter at CERN (ATLAS blog)
- active in ATLAS collaboration outreach: German Cheat Sheets/Fact Sheets







Influence of involvement on choice of study

Julia: *“My activities [in Netzwerk Teilchenwelt]* ***reinforced my desire*** *to study physics. It also gave me the motivation to* ***overcome the difficult initial phase*** *of my studies.”*

Julia attended a CERN workshop in 2010, studied Physics at TU Dresden, PhD at Leiden Institute of Physics, now PostDoc at University of Queensland

Maria: *“Netzwerk Teilchenwelt has* ***changed my study plans*** *in particular and given me the opportunity to get to know everyday modern research.”*

Maria attended a CERN workshop in 20103, obtained a Physics bachelor's degree from the University of Göttingen, a master's degree from Imperial College London; PhD at University of Oxford, now Chamberlain Fellow at Lawrence Berkeley National Lab.

Inspiring the next generation of scientists

38% of PhD students guiding Masterclasses (in Netzwerk Teilchenwelt) attended a Masterclass as a high school student

Result from survey 2024

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008324 (ChETEC-INFRA).

Task 7.2
Nuclear Astrophysics Scientific Schools

ChETEC-INFRA General Assembly, Dresden, September 18, 2025

Work Package 7 (Networking Activity 2): Dissemination, Outreach, Innovation

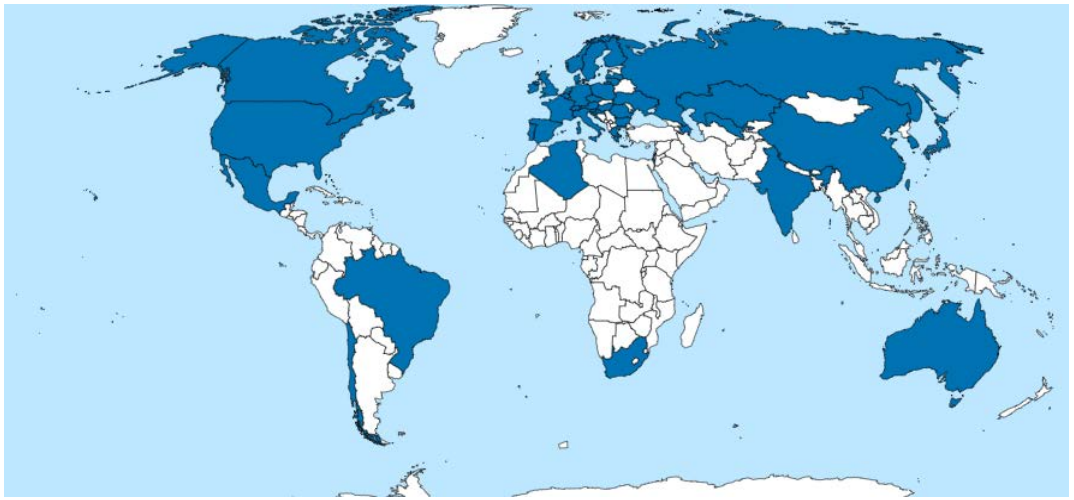
Slides by Konrad Schmidt

Uta Bilow, TU Dresden, uta.bilow@tu-dresden.de, chetec-infra.eu

ChETEC-INFRA Scientific Schools (12 x online)

Schools on **N**uclear **A**strophysics **Q**uestion**s** (**SNAQs**)

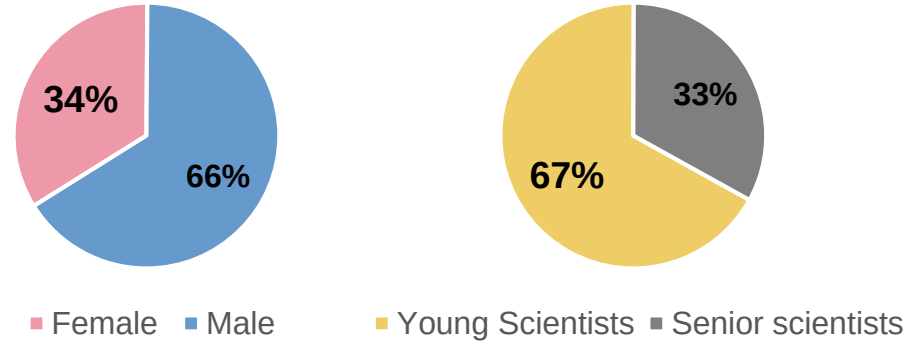
- **Online** format as response to COVID-19 pandemic
- from Feb 2021 to May 2022, **12 editions**
- **1243 participants**, 34% female, 67% young scientists



Countries of online participants in SNAQs

Concept:

- 2nd Wed each month
- Lectures by senior scientists
- Scientific talks by young researchers, acknowledged with SNAQs Scientific Talk Award
- Networking sessions in breakout rooms



ChETEC-INFRA Scientific Schools (1 – 4, in person)

(1) 29th Carpathian Summer School of Physics, August 2021

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	13	0	15	28
Male	0	17	0	33	50
Total	0	30	0	48	**78**

(2) 17th Russbach School on Nuclear Astrophysics, March 2022

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	3	10	5	11	29
Male	0	9	1	3	13
Total	3	19	6	14	**42**

(3) 11th European Summer School on Experimental Nuclear Astrophysics, June 2022

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	11	5	5	23
Male	5	12	8	25	50
Total	7	23	13	30	**73**

(4) 10th Nuclear Physics in Astrophysics School, August 2022

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	14	1	5	20
Male	0	14	4	7	25
Total	0	28	5	12	**45**

ChETEC-INFRA Scientific Schools (5 – 8, in person)

(5) 18th Russbach School on Nuclear Astrophysics, March 2023

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	3	15	2	9	29
Male	0	15	7	13	35
Total	3	30	9	22	**64**

(6) 1st i-process Nucleosynthesis School, May 2023

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	8	4	4	16
Male	1	10	6	4	21
Total	1	18	10	8	**37**

(7) 30th Carpathian Summer School of Physics, July 2023

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	1	2	1	10	14
Male	0	7	2	44	53
Total	1	9	3	54	**67**

(8) 1st ChETEC-INFRA Observational School (ChINOS), July 2023

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	4	2	2	10
Male	3	4	4	2	13
Total	5	8	6	4	**23**

Completed ChETEC-INFRA Scientific Schools (9 – 12, in person)

(9) 12th MESA Summer School at Konkoly, August 2023

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	1	21	4	2	28
Male	5	25	11	5	46
Total	6	46	15	7	**74**

(10) 17th Nuclei in the Cosmos School, September 2023

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	10	5	0	17
Male	5	14	10	12	41
Total	7	24	15	12	**58**

(11) n_TOF Nuclear Physics Winter School, January 2024

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	7	1	2	12
Male	4	21	5	16	46
Total	6	28	6	18	**58**

(12) 19th Russbach School on Nuclear Astrophysics, March 2024

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	7	2	9	20
Male	8	12	8	16	44
Total	10	19	10	25	**64**

ChETEC-INFRA Scientific Schools (13 – 16, in person)

(13) 12th European Summer School on Experimental Nuclear Astrophysics, June 2024

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	6	10	7	9	32
Male	11	15	13	15	54
Total	17	25	20	24	**86**

(14) AZURE2 R-Matrix Summer School, June 2024

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	6	0	1	9
Male	1	14	6	5	26
Total	3	20	6	6	**35**

(15) Nuclear Physics in Astrophysics XI School, September 2024

Supported by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	8	2	5	17
Male	1	12	0	5	18
Total	3	20	2	10	**35**

(16) PhyNuBE School, October 2024

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	11	0	8	19
Male	0	12	5	17	34
Total	0	23	5	25	**53**

ChETEC-INFRA Scientific Schools (17 – 20, in person)

(17) 61st Karpacz Winter School on Theoretical Physics, March 2025

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	2	10	3	7	22
Male	3	12	3	7	25
Total	5	22	6	14	**47**

(18) 20th Russbach School on Nuclear Astrophysics, March 2025

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	5	4	3	4	16
Male	1	9	6	19	35
Non-binary	0	1	0	0	1
Total	6	14	9	23	**52**

(19) Nuclei in the Cosmos School, June 2025

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	4	16	2	4	26
Male	2	16	1	9	28
Total	6	32	3	13	**54**

(20) 31st Carpathian Summer School of Physics, June 2025

Organized by ChETEC-INFRA

	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	9	1	14	24
Male	0	15	1	42	58
Total	0	24	2	56	**82**

ChETEC-INFRA Scientific Schools (#21, in person) and total

(21) 2nd ChETEC-INFRA Observational School (ChINOS), July 2025

Organized by ChETEC-INFRA

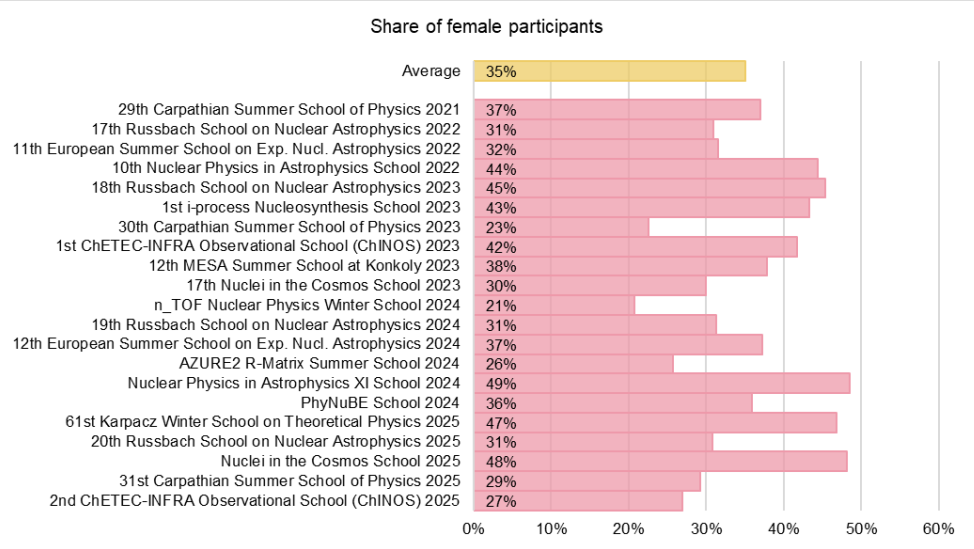
	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	0	3	1	3	7
Male	9	4	0	5	18
Non-binary	0	1	0	0	1
Total	9	8	1	8	**26**

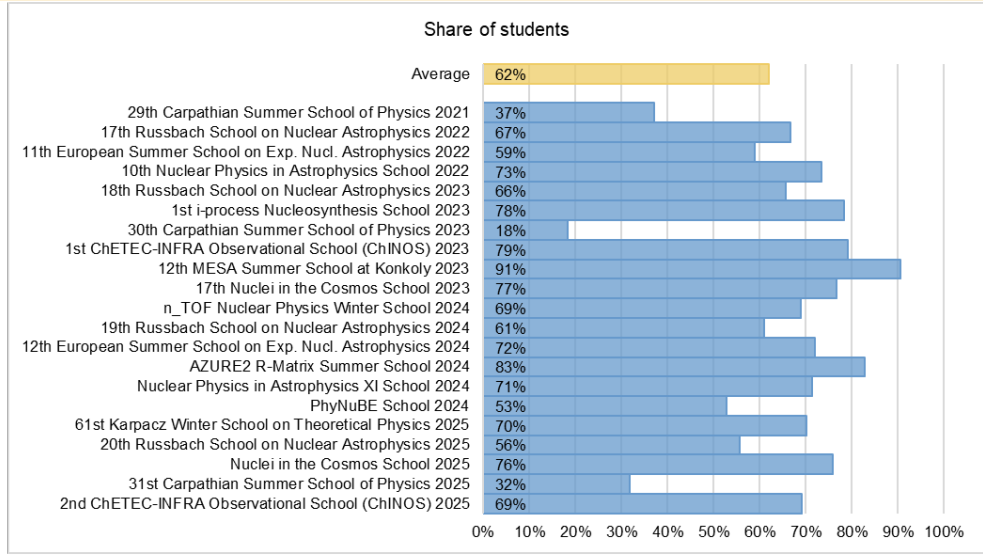
Taks 7.2 Nuclear Astrophysics Scientific Schools

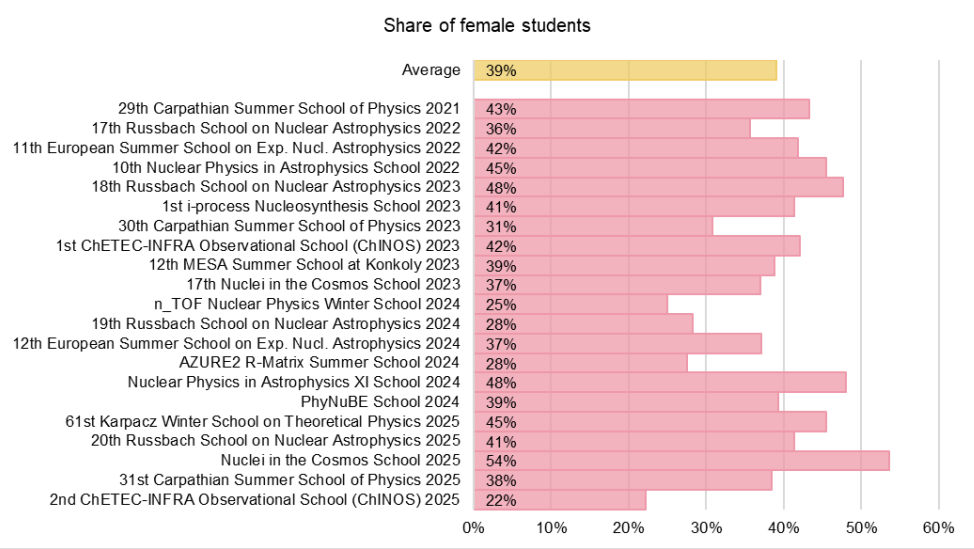
(Σ) All 21 in-person schools

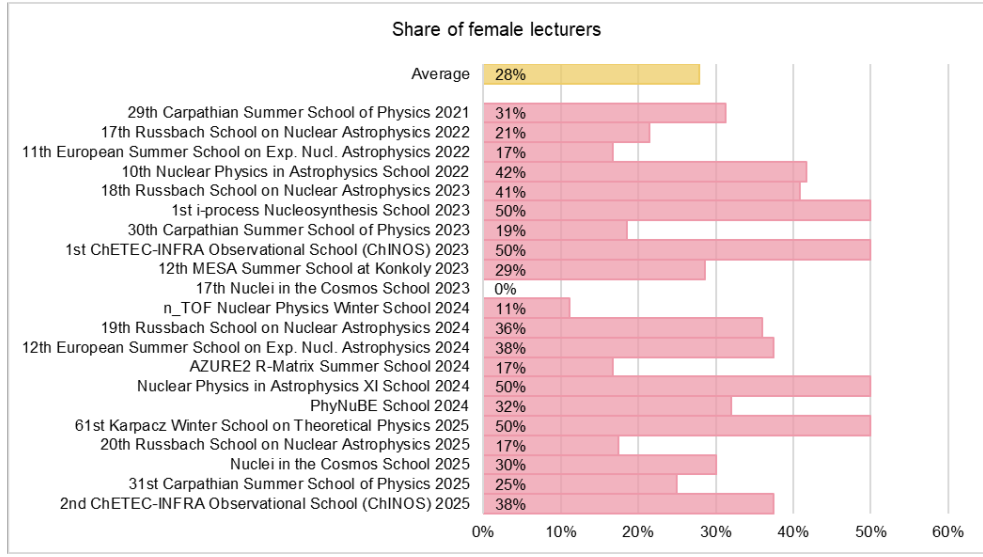
	Undergrad. Students	PhD students	Postdocs	Faculty /Staff	Total
Female	36	198	47	120	401
Male	62	270	105	310	747
Non-binary	0	2	0	0	2
Total	98	470	152	430	**1,150**

ChETEC-INFRA Scientific Schools – Gender statistics



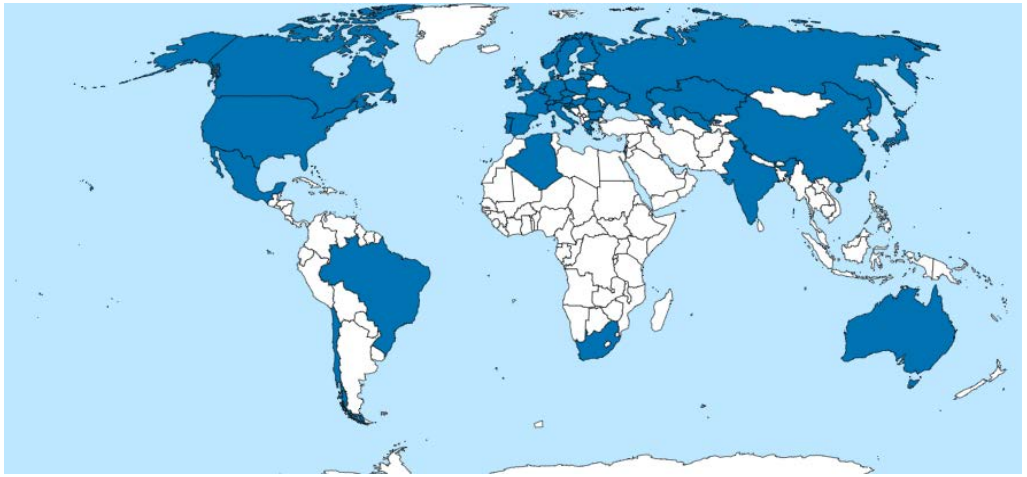






Summary

- SNAQs: launched 4 months before ChETEC-INFRA, delivering **12 editions** during the pandemic and reaching **1,243 participants**
- In-Person schools: **21 events** supported, attracting **1,150 participants**
- Funding of scientific schools is crucial to sustain education and community growth
  - Thanks to ChETEC-INFRA for financial support
  - **Thanks to all lecturers for their contributions.**
- Looking ahead: Continued support is essential to keep training opportunities alive beyond ChETEC-INFRA**.**



Task 7.2
Nuclear Astrophysics
Scientific Schools

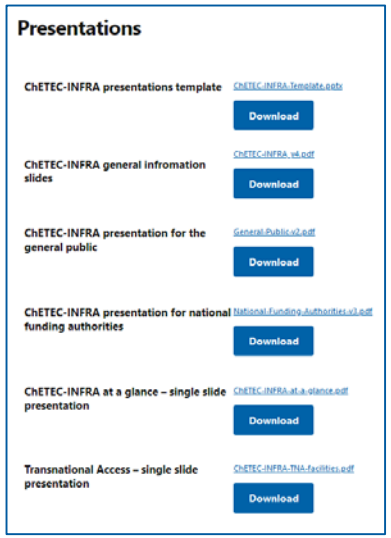
Task 7.3 Nuclear, Astronomy, and Astrophysics Conference Outreach

Roll-up banner, poster

Sets of slides / single slides

For various target groups, e.g.

- Research communities
- General public
- National funding authorities



https://www.chetec-infra.eu/about/presentations/

ChETEC-INFRA was **strongly presented** at:

- ✓ all schools
- ✓ Nuclear Physics in Astrophysics XI (2024, Dresden, Germany) https://events.hifis.net/event/540/)
- ✓ IReNA-CeNAM: Frontiers in Nuclear Astrophysics (2025, Athens, USA) https://sites.ohio.edu/cenam-2025/
- ✓ Nuclei in the Cosmos XVIII (2025, Girona, Spain) https://indico.icc.ub.edu/event/341/
- ✓ Spanish-German WE-Heraeus-Seminar (2025, Bad Honnef, Germany) https://www.we-heraeus-stiftung.de/veranstaltungen/interdisciplinary-physics-of-the-sun
- ✓ HELIUM25 - Helium burning and perspectives for underground labs (2025, Dresden, Germany) https://events.hifis.net/event/2207/
- Next presentation: European Nuclear Physics Conference (2025, Caen, France) https://indico.in2p3.fr/event/30430/

Task 7.4 Research-Industry Days

Partners: UNIPD, HZDR, INFN, TUD

Aim: industry outreach and innovation promotion activity, to achieve a model/standard industry day to be shared with other laboratories

Research-Industry Day at NDRA2022 (neutron detector school, Riva del Garda) with 50 PhD students and 15 lecturers

Innovation session at CELLAR community meeting (Dresden, Nov. 28-30, 2022)

Database with information about industrial partners for future projects

Name	Location	Description
ORTEC/AMETEK	US	ORTEC is an ir
Canberra/Mirion	Belgium, EU	The world's le
Berthold	Germany	Berthold Tech
Saint Gobain	France EU	High-quality S
Scionix	Netherlands, EU	Specialized in
Silena	Germany	
Hamamatsu	Japan	development
GE Reuter-Stokes	U.S.	We are an en monitoring, U
CAEN	Italy	CAEN SpA is a Standards for
Wiener	U.S.	W-IE-NE-R cra
Lecroy	U.S.	is a leading p
Tektronix		Tektronix des
BNC	U.S.	BNC manufac

Task 7.4 Research-Industry Days

Partners: UNIPD, HZDR, INFN, TUD

Aim: industry outreach and innovation promotion activity, to achieve a model/standard industry day to be shared with other laboratories

Research-Industry Day at NDRA2022 (neutron detector school, Riva del Garda) with 50 PhD students and 15 lecturers

Innovation session at CELLAR community meeting (Dresden, Nov. 28-30, 2022)

Database with information about industrial partners for future projects

Name	Location	Description
ORTEC/AMETEK	US	ORTEC is an ir
Canberra/Mirion	Belgium, EU	The world's le
Berthold	Germany	Berthold Tech
Saint Gobain	France EU	High-quality S
Scionix	Netherlands, EU	Specialized ir
Silena	Germany	
Hamamatsu	Japan	development
GE Reuter-Stokes	U.S.	We are an en monitoring, U
CAEN	Italy	CAEN SpA is a Standards for
Wiener	U.S.	W-IE-NE-R cra
Lecroy	U.S.	is a leading p
Tektronix		Tektronix des
BNC	U.S.	BNC manufac

Career Development Day
HELIUM25 workshop
(Dresden, July 2025)
Invited talk from Dr. Ruchi Garg

Stars on Earth - Inclusive Outreach Paths of Nuclear Astrophysics

UNIPD in collaboration with INFN, ChETEC-INFRA, HZDR, INFN, TUD

- broaden the target audience of scientific outreach activities
- development of inclusive communication methods, adopting techniques to make content accessible even to people with disabilities, especially those with visual and hearing impairments, who are rarely involved in outreach activities.
- creation of a tactile scale model of the new Ion Beam Facility Bellotti, located in the underground laboratories of Gran Sasso, to be accompanied by in-depth activities and multimedia materials.

- More info at https://www.dfa.unipd.it/stellesullaterra/

Stars on Earth - Inclusive Outreach Paths of Nuclear Astrophysics

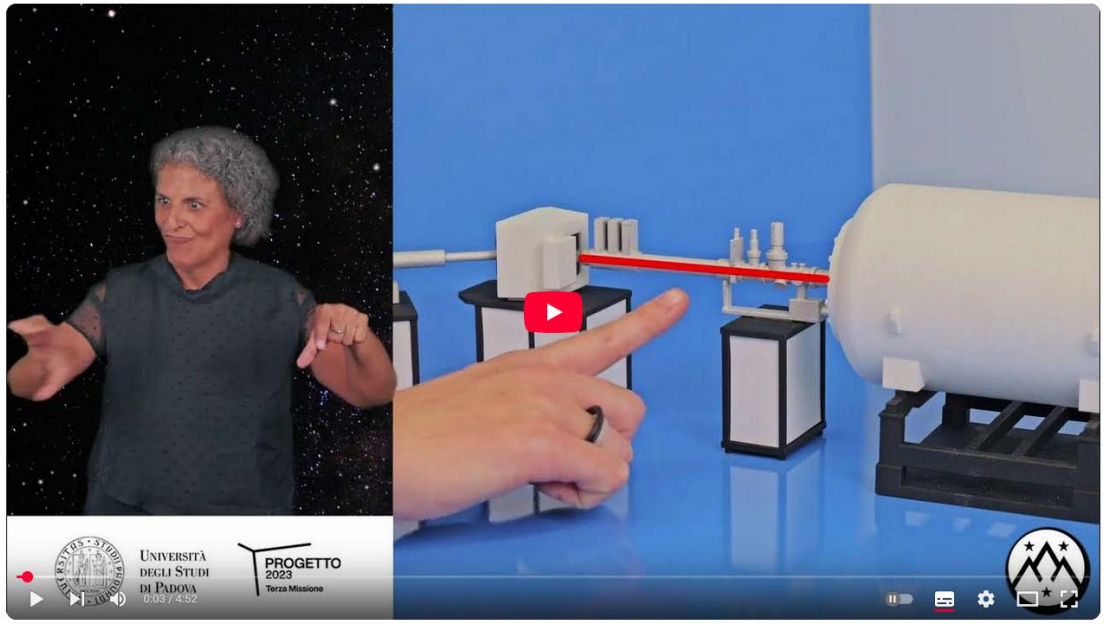
Workshop Dec 2023
http://www.dfa.unipd.it/en/third-mission/stars-on-earth/

Presentations, e.g. at Festival della Scienza, Oct 2024

Uta Bilow, TU Dresden, uta.bilow@tu-dresden.de, chetec-infra.eu

Stars on Earth - Inclusive Outreach Paths of Nuclear Astrophysics

5 videos with sign language
for people with hearing impairments
https://www.dfa.unipd.it/stellesullaterra/video/



Stelle sulla Terra - Acceleratore e linea di fascio

Deliverables and Milestone in WP7

Deliverables

- ✓ D7.1 Two **presentations** targeting Nat. Funding Authorities and the general public, available on ChETEC-INFRA webpage
- ✓ D7.2 **Report** on **new NPA school plans** to EB
- ✓ D7.3 **Report** to GA on comprehensive **plan of nuclear astrophysics schools** over the duration of the project
- ✓ D7.4 First **Masterclass** made available to multipliers in 11 different languages
- ✓ D7.5 **Report** to GA on organization and participants of **scientific schools** in the first two years (04/2023)
- ✓ D7.6 **Report** on first **model industry day** to the GA and publication on project web page (04/2023)
- ✓ D7.7 **Second Masterclass** made available to multipliers in 11 different languages (10/2024)

Milestone

- ✓ M6 (04/2023) First Nuclear Astrophysics **Masterclass** used by the first 100 high school students

Summary

Task 7.1 Nuclear Astrophysics Masterclasses

- 2 Masterclasses, available in English + 11 more languages
- All material on ChETEC-INFRA website

Task 7.2 Nuclear Astrophysics Scientific Schools

- 21 schools successfully completed, 1143 participants
- Another 1243 participants in SNAQs (online, 12 editions)

Task 7.3 Nuclear, Astronomy, and Astrophysics Conference Outreach

- Via slides, poster, roll-up banner
- At all schools and relevant conferences

Task 7.4 Research-Industry Days

- Model Day at NDRA2022, followed by more events
- Database with information about industrial partners for future projects

Thanks to everyone involved!

It was a great pleasure

to collaborate with the ChETEC-INFRA community

and to get to know so many nice people ☺