Netzwerk Teilchenwelt
An outreach network in Germany

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High School Students and the Large Hadron Collider

► Students get in contact e.g. via CERN visits or International Masterclasses.
► They meet physicists and learn about topics of current research and the organization and process of research.
► Most students at least enjoy these events, some might even want to become (particle) physicists.
► How can we continue to motivate the interested students, after the one-off event?
Multi-talented student

Future HEP scientist

?
Multi-step program for high school students

Masterclasses (@schools, real data from ATLAS, CMS, LHCb, ALICE, ALICE)

Active engagement, detector project

4d CERN workshops

own research projects

Number of students/y

3500
250
60
15

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Own research projects: examples

- Deep Learning Models for Energy Estimation in CMS HGCAL L1 Trigger (Felix Hansen)
- First data classification at the InGrid detector at the CAST experiment using deep learning (Caroline Kohl)
- The AWAKE experiment (Björn Dörschel)
- The effects of radiation on the CMS pixel detector (Katharina Ploog)
- Machine-learning based identification of highly collimated electron pairs from boosted Z boson decays (Sophia Veneris)

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Facilitators

- 150 PhD and Master students are engaged in Netzwerk Teilchenwelt. They guide Masterclasses and supervise students’ research projects.
- Facilitators get reimbursement of expenses and travel cost.
- Netzwerk Teilchenwelt offers a 2d training course on communication, didactics, and presentation techniques (important skills also for own career!).
- As role models, they influence students’ career-related aspirations and choices.
Fellow program to promote young talents

► 180 people, 50% female (program launched in 2017)

► Mainly alumni of CERN workshops
  ▪ Now often studying physics or shortly before that
  ▪ Interested in particle and astroparticle physics

► Local offers: Internships, excursions, invitation to outreach events, colloquia, regulars’ table etc.

► Central offers: Fellow physics school (pwd „intro“), Fellow meeting, national physics conference attendance

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German landscape of experimental (Astro) Particle Physics

- Netzwerk Teilchenwelt founded in 2010
- 30 research labs / universities
- Each research lab focuses on its experiments and activities
- Project team: TU Dresden / DESY@Zeuthen / CERN
- Hubs at: Univ. Bonn / Univ. Mainz / Univ. Münster
Central Coordination @ TU Dresden provides:

### Structure
- Data base (people, schools, events)
- Event calendar
- Wiki

### Material
- Detector sets
- DIY cloud chamber sets
- Context material
- Kit for facilitator (shirt, bag)
Central Coordination @ TU Dresden provides:

**Organisation**
- Fellow physics school
- Fellow meeting
- Training for facilitators

**Communication**
- Website
- Social Media
- Newsletter
- Mailings

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Teachers as multipliers

► Development of material
  ▪ Teaching material for schools (4 volumes) www.teilchenwelt.de/tp
  ▪ Portal Leifi Physik: Chapter on particle physics www.leifiphysik.de/themenbereiche/teilchenphysik
  ▪ Particle profile cards
  ▪ Context material

► Teacher training „Forschung trifft Schule“, funded by:
  www.teilchenwelt.de/angebote/lehrerfortbildungen-forschung-trifft-schule/

► 2-day training for teachers
  ▪ Introduction to particle physics, 6 trainings p.a.

► Summer School at CERN
  ▪ 6 days, once per year
Activities in the current funding period

► Continue and consolidate existing programs
► Reach out to more target groups
  ▪ General public
  ▪ Journalists
► More topics from other fields of physics of the smallest particles
  ▪ Hadron and nuclear physics

► KONTAKT: Kommunikation, Nachwuchsgewinnung und Teilhabe der Allgemeinheit an Erkenntnissen auf dem Gebiet der Kleinsten Teilchen
► Funded as integral part of research within the German research framework program ErUM
► Netzwerk Teilchenwelt + Weltmaschine have joined forces

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German LHC information point for the public and media since 2008

Excellent contact to the press
- Press material, media library
- Facts and figures

Central event organization
- Journalist Days, Press Spokesperson Day
- Tag der Weltmaschine
- Media training for scientists

Mobile exhibition
- Shown in 43 research labs
New target groups: the „uninterested“ general public and journalists

► VR headsets
  ▪ Apps from various experiments (LHC, also Belle II, IceCube)
  ▪ loan to Netzwerk Teilchenwelt research labs, central maintenance

► Mobile exhibition modul
  ▪ Setup in <1h
  ▪ Tour stops planned in shopping malls and railway stations
  ▪ reaches groups that are less likely to access science

► Journalist trip to CERN
  ▪ + media training for scientists…
More topics from other fields of physics of the smallest particles

► Hadron and nuclear physics
  - Hadron therapy Masterclass
  - Belle II Masterclass
  - PANDA Masterclass
  - Scattering experiments Masterclass
  - exhibits
  - 1 week Summer course for high school students
  - Fellow detector school
Summary

► Germany has a nationwide network for outreach and promotion of young talent, which comprises 30 research labs and universities.

► High school students can engage in a wide range of activities, from Masterclasses and detector projects to programs at CERN and own research projects.

► A Fellow program bridges the gap between high school and research groups.

► The central project coordination provides structures, material, organisation and communication for all research labs.

► Regional hubs foster the integration of further research topics from hadron and nuclear physics and provide regional support.

► Netzwerk Teilchenwelt is funded as integral part of research.
Any questions?

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