Netzwerk Teilchenwelt

Coordinated Outreach and Recruitment of Young Talents in Germany
Masterclasses in Germany

Concept of a Masterclass

- Designed for high school students
- Introductory lectures
- Hands-on measurement with data from experiments
- Students’ activities and results lead them to fundamental insights in this field

1-day events at schools, museums, school labs, research labs, or universities

160 Masterclasses in 2019

W = single Masterclass
Netzwerk Teilchenwelt

- 30 universities/research labs + CERN
- Joint outreach in particle physics and astroparticle physics, since 2020 also for nuclear and hadron physics
  - Bundle existing activities
  - Share structure and programs
  - High visibility and impact

RECFA evaluation 2014 for Germany
"The Committee considers that the German activities are exemplary and constitute a highly professional way of raising public interest in science and would like to congratulate the German community on its achievements in this regard."

- Project team: TU Dresden / DESY@Zeuthen / CERN
- Hubs at: Bonn / Mainz / Münster
Multi-step program for high school students

- Masterclasses
- Active engagement, detector project
- 4d CERN workshops
- Own research projects

Number of students/year:
- 3500
- 250
- 60
- 15

© Juliana Socher
© Netzwerk Teilchenwelt
© Netzwerk Teilchenwelt
© Michael Hoch

28.07.2020
Uta Bilow, TU Dresden
Offers for High School Students

Basic program

► Masterclasses: Measurements with real data
  - ATLAS (2x), CMS, LHCb, ALICE (2x)
  - Pierre-Auger-Observatory
  - IceCube
  - Cosmic@Web with 9 experiments
  - More from hadron and nuclear physics on p.15

► Own measurements with particle detectors
  - Scintillation counter (CosMO)
  - Cherenkov counter (Kamiokannen)
  - Various research tasks: Detector understanding, investigation of physical phenomena

► Each research lab/university focuses on their experiments and activities
Own research projects

► 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)
Fellow program to promote young talents

- 190 people, 50% female (program launched in 2017)
- Mainly alumni of CERN workshops
  - Now often studying physics or shortly before that (pie chart)
- Local offers: Internships, excursions, invitation to outreach events, colloquia, regulars’ table etc.
- Central offers: Fellow physics school (pwd „intro“), national physics conference attendance etc.
- Close connection between highly motivated students and research groups
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 training courses on communication, didactics, and presentation techniques (important skills also for own career!).

- As role models, they influence students´ career-related aspirations and choices.
Teachers as multipliers

► Development of material
- **Teaching material for schools**, 4 volumes (>20k printed, >35k downloaded)
- **Portal Leifi Physik**: Chapter on particle physics
- **Particle profile cards**
- **GeoGebra Analysis of Bubble Chamber images**
- **Context material**

► **Teacher training** „Forschung trifft Schule“, funded by:
- 2-day training: Introduction to particle physics, 6 trainings p.a.
- Summer School at CERN: 6 days, once per year
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
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

28.07.2020

Uta Bilow, TU Dresden
Weltmaschine
www.weltmaschine.de

► 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: journalists and the „uninterested“ general public

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

► Interactive mobile exhibition modul
  ▪ Setup in <1h
  ▪ Tour stops planned across Germany
  ▪ in shopping malls, town squares, and near 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 (under development)
  - Scattering experiments Masterclass
  - exhibits
  - 1 week Summer course for high school students
  - Detector school for fellows
COVID-19 and Netzwerk Teilchenwelt

► Lockdown! Now: Restart with online offers and adapted concepts

► **Masterclass@home**
  - Masterclasses delivered online to groups of individual students
  - Lectures + data analysis spread over two afternoons

► **Fellow online seminar**
  - „Neutrino afternoon“: Introductory talk, virtual tour at KATRIN, demonstration of neutrino pendulum and lecture on neutrino oscillations

► **Virtual Fellow Meetings** (social activity)

► **Online-Seminar on science communication for facilitators**
  - Planned for Oct 2020

► **Teacher training@home „From collision to discovery“**
  - 1 afternoon, 5 h
Summary

► Germany has a nationwide network for outreach and recruitment 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.
Thank you for listening!

https://www.instagram.com/netzwerkteilchenwelt/
https://www.facebook.com/netzwerkteilchenwelt
mail@teilchenwelt.de

www.teilchenwelt.de