

Project KONTAKT

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Funding of LHC research in Germany

- ▶ Next funding period: 2019 - 2021
- ▶ Framework program ErUM (Exploration of Universe and Matter)
- ▶ Outreach is integral component of research!
- ▶ 4 fields of action within ErUM
 - Large-scale research equipment
 - Cross-linking
 - Young talents in STEM
 - Knowledge transfer and participation



MINT-Nachwuchs

- Nachwuchs für MINT-Fächer faszinieren.
- Wissenschaftlichen Nachwuchs qualifizieren.
- Karriereperspektiven schaffen.

Transfer und Partizipation

- Wissenstransfer von Forschung in Wirtschaft und Gesellschaft anregen.
- Dialog zwischen Forschung und Bürgerinnen und Bürgern intensivieren.

How we fit into this

- ▶ **KONTAKT = KO**mmunikation, Nachwuchsgewinnung und **Teil**habe der **Allgemeinheit** an Erkenntnissen auf dem Gebiet der **Klein**sten **Teil**chen
 - Build on and extend existing frameworks (**Netzwerk Teilchenwelt**)
 - Intensified cooperation with other professional players in the areas of communication, participation and recruitment of new talents
 - More topics/contents from other fields of physics of the smallest particles
 - Other target groups
- ▶ Application submitted in Nov 2017
- ▶ Positive signals for approval



naturwissenschaftlichen Unterricht hinausgehenden Beschäftigung mit den MINT-Fächern an.

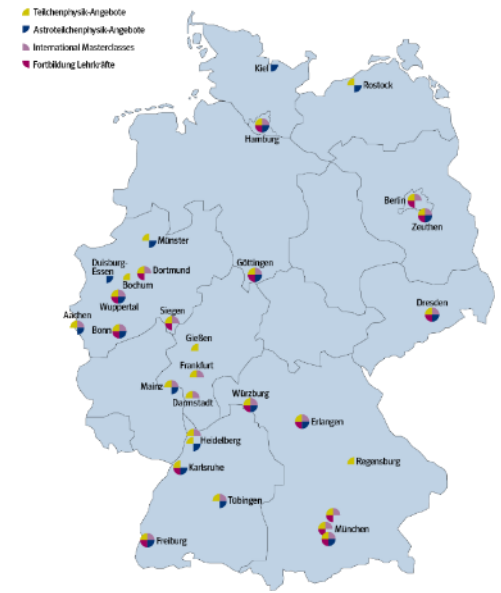
Ältere Schülerinnen und Schüler können in verschiedenen Formaten an aktueller Forschung teilhaben. Im vom Forschungsministerium geförderten Projekt „Netzwerk Teilchenwelt“ analysieren junge Menschen Originaldatensätze aus den Forschungsfeldern der Teilchenphysik. Dabei werden sie von erfahrenen Forscherinnen und Forschern unterstützt. Auch Aufenthalte am CERN sind für besonders engagierte Jugendliche Teil des Projekts. Der Wettbewerb „Beamline for Schools“ lädt Schulklassen dazu ein, eigene Experimente zu entwickeln und diese am CERN umzusetzen. Schülergruppen testeten bereits, ob sich eine Webcam als Detektor für Teilchen eignet. Andere Teams haben selbstgezüchtete Kristalle verwendet, um Teilchen nachzuweisen, oder begaben sich mit Experimenten zur Relativitätstheorie auf Einsteins Spuren.

Das Bundesforschungsministerium ermutigt Forscherinnen und Forscher, solche Initiativen verstärkt auf den Weg zu bringen.

[www.bmbf.de/pub/Erforschung_von
Universum_und_Materie.pdf](http://www.bmbf.de/pub/Erforschung_von_Universum_und_Materie.pdf) p23

Netzwerk Teilchenwelt

- ▶ Started in 2010
- ▶ 30 universities/research labs + CERN
- ▶ Network between scientists, high school students (15-19 y.) and teachers
- ▶ Multi-stage program, per year working with original data and/or particle detectors
 - 4000 high school students
 - 250 in advanced levels
 - 60 at CERN workshops
 - 10 research projects at CERN, 8 research projects at labs
 - 300 teachers (training, CERN Workshops, teaching material)
- ▶ Project team: TU Dresden / DESY at Zeuthen / CERN



Basic Program: Particle Physics Masterclass

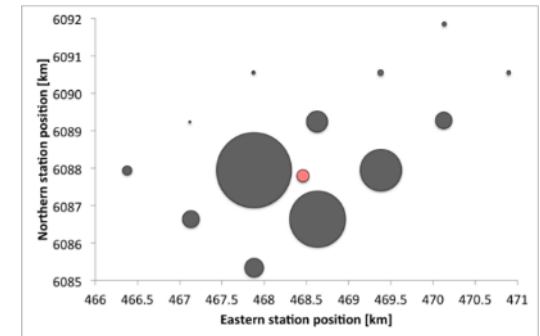
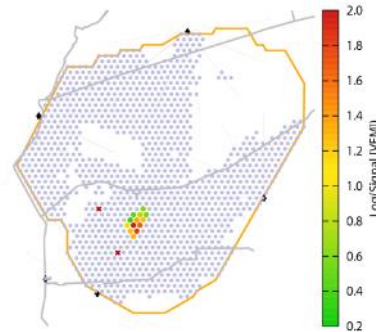
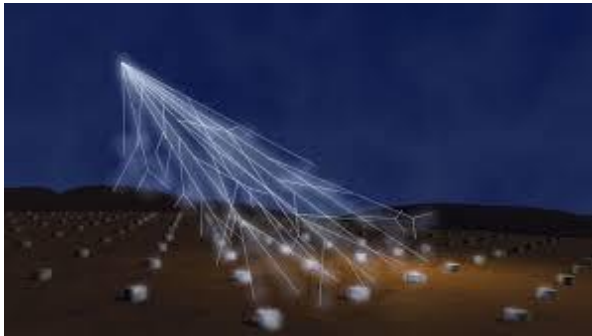
- ▶ High school students = scientist for one day
- ▶ Project days at schools, school labs, museum...
- ▶ Anywhere in Germany, ca. 120 x per year
- ▶ Guidance by young scientists
- ▶ Introductory presentations and activities
- ▶ Measurements with real data from LHC experiments

- <http://atlas.physicsmasterclasses.org/de/index.htm>
- <http://cms.physicsmasterclasses.org/cmsde.html>
- <http://www-alice.gsi.de/masterclass/>
- <http://www.physicsmasterclasses.org/exercises/ALICE/MasterClassWebpage.html>
- <http://lhcb-public.web.cern.ch/lhcb-public/en/LHCb-outreach/masterclasses/en/>

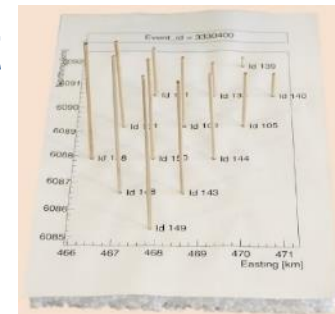


Auger Masterclass

- ▶ One day program for school classes
- ▶ Reconstruction of cosmic air shower and arrival direction



- ▶ Data analyses with Microsoft Excel or other spreadsheet programs
- ▶ Developed by Uni Wuppertal, Uni Erlangen-Nürnberg and DESY
- ▶ Hands-on: Building a model of shower front

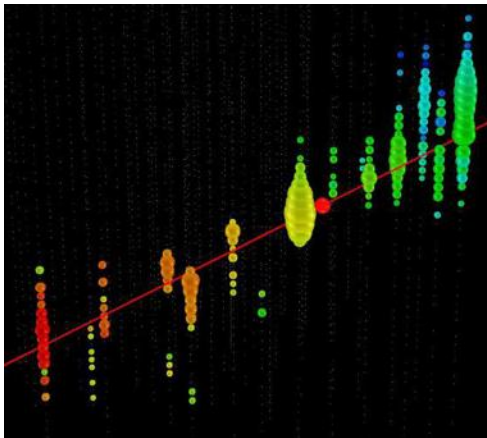




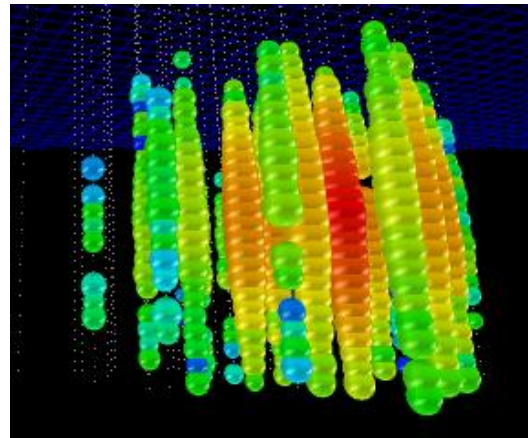
ICECUBE MASTERCLASS

AN AUTHENTIC ASTROPHYSICS RESEARCH EXPERIENCE

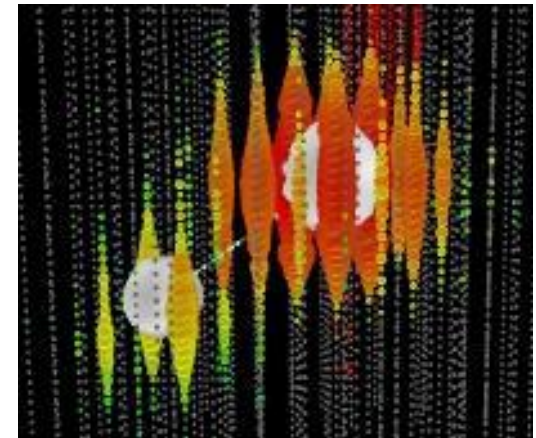
- ▶ <https://masterclass.icecube.wisc.edu/de>
- ▶ Filter neutrinos and distinguish signatures



muon neutrino (data)



electron neutrino (data)



tau neutrino (simulation)

Astroparticle Detector Projects

- ▶ Particle detectors for own measurements
 - Scintillation counter (CosMO)
 - Cherenkov counter (Kamiokannen)
 - Various research tasks: Detector understanding, investigation of physical phenomena
- ▶ Data sets on online learning platform Cosmic@Web
 - 8 different experiments, web interface for data analysis, accompanying material
- ▶ Concepts for project days, project weeks, research weeks, teacher training courses, teaching material
- ▶ 19 out of 30 universities/research labs in Netzwerk Teilchenwelt



CERN Programs + Research Work

- ▶ 60 students in two annual workshops (4 days)
<https://indico.cern.ch/event/688029/>
- ▶ 10 students in project weeks (2 weeks)
<https://indico.cern.ch/event/723232/>
 - own research projects, e.g. Medipix detector, CLOUD, ATLAS trigger system, lifetime of the B-meson, search for supersymmetry and dark matter, NA62, CP violation, beam simulation...
 - Right now 5 students at CERN!



Young Scientists as Key Players

- ▶ ~ 170 Facilitators (Vermittler/innen)
- ▶ PhD and Master students
- ▶ Guiding Masterclasses
- ▶ Supervision of student research projects
- ▶ Reimbursement of expenses + travel costs
- ▶ 2-day advanced training in science communication, didactics, and presentation techniques
- ▶ Practice in communication techniques as a "soft skill" for own career



Promoting Young Talents through the Fellow Program

- ▶ Alumni of NTW, mainly alumni of CERN workshops
 - Now often studying physics or shortly before that
 - Interested in particle and astroparticle physics
- ▶ Fellow program launched in 2017
- ▶ Currently about 130 people
- ▶ Aim: increase connection with local research groups



Fellow Meeting 2017 Hamburg



Fellow Meeting 2018 Dresden

Win-win-Situation

▶ Research labs

- Highly motivated students interested in particle physics as future members of the research groups
- Support for scientific activities (SHK, conferences)
- Support for outreach activities (Long Night of Science, exhibitions, Open Day, Masterclasses, etc.)

▶ Fellows

- Close connection to research groups
- Further technical training, e.g. Fellow Physics School in March 2019
- Networking beyond local university



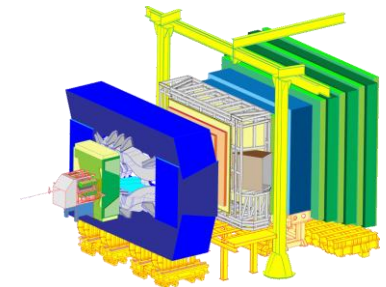
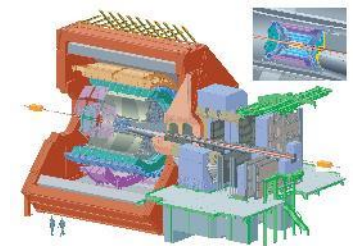
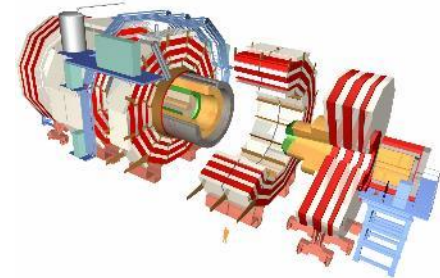
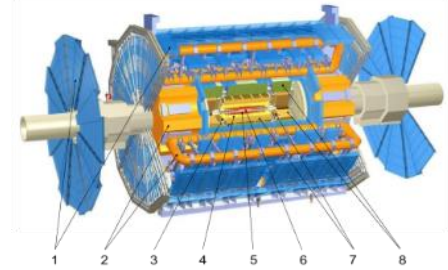
TeVPA Conference 2018 Berlin



Dark Matter Day 2017 RWTH Aachen

Currently: Pilot Project „Outreach“

- ▶ Duration: 02/2017 – 12/2018
- ▶ Use structures and programs of **Netzwerk Teilchenwelt**
- ▶ Cross-sectional activity, all 4 FSPs involved
- ▶ „Cutting-edge research, knowledge sharing and recruitment of young talents from one source “
 - Dissemination of cutting-edge research
 - Ensure public participation
 - Training and recruiting of young talents
- ▶ Steered by a 7-member Supervisory Board
- ▶ New: Targetting additional groups („Fellows“) at research labs and universities



KONTAKT: 6 Work Packages

→ General public

- Long Night of Science, Open Days, Highlights der Physik, ...
- Virtual Reality Systems **NEW**
- Mobile exhibition module **NEW**

→ Scientists

- Training in science communication (Workshop zur Vermittlung von HEP)
- Portraits „Teilchenjäger“
- Media training **NEW**

→ High school students

- Data analysis and detectors (Masterclasses, CERN programs, research projects)
- Nuclear and hadron physics **NEW**

→ Journalists

- Support for press offices of the institutes
- Expanding media work
- Journalist trip to CERN **NEW**

→ Students / Fellows

- Internships, SHK, hospitations, regulars' tables, Fellow meeting
- Fellow School **NEW**

→ Project team and Institutes

- Wiki, data base, materials
- Internal and external communication
- Integration of new groups / sites

Summary

- ▶ Outreach and knowledge transfer in Germany via structured program since 2010 (Netzwerk Teilchenwelt, www.teilchenwelt.de), aiming at high school students and teachers
- ▶ Since 2017 cross-sectional activity of all German LHC-groups (FSP)
- ▶ From 2019 on new funding period, 4 fields of action, among them:
 - Young talents in STEM
 - Knowledge transfer and participation→ **Outreach is integral component of research!**

- ▶ New project **KONTAKT**
 - Building on and extending existing frameworks (**Netzwerk Teilchenwelt**)
 - Intensified cooperation with other professional players in the areas of communication, participation and recruitment of new talents
 - More topics/contents from other fields of physics of the smallest particles
 - Other target groups

More activities: Backup slides

PROJEKTLEITUNG



PARTNER



SCHIRMHERRSCHAFT



FÖRDERER

GEFÖRDERT VOM



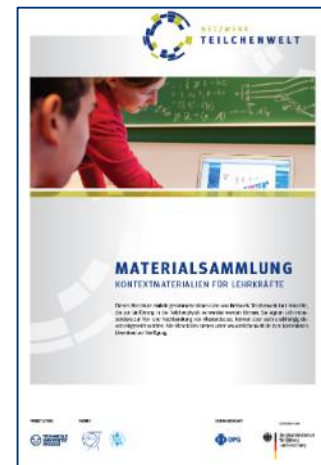
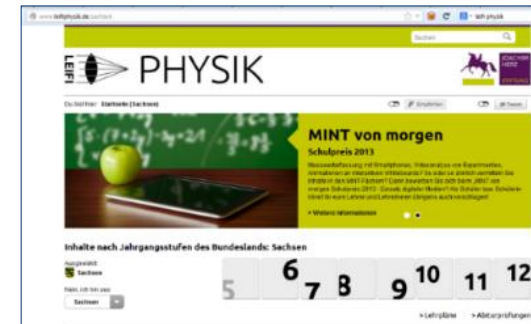
DR. HANS RIEGEL-STIFTUNG



NETZWERK
TEILCHENWELT

More Activities: Material Development

- ▶ Teaching material (4 volumes), funded by Joachim Herz Stiftung www.teilchenwelt.de/tp
- ▶ Portal Leifi Physik: Chapter on particle physics www.leifiphysik.de/themenbereiche/teilchenphysik
- ▶ Particle profiles
- ▶ Context material



Teacher Training

Teacher training at universities and research labs, e.g. KIT, DESY ...

Forschung trifft Schule
funded by:



- ▶ 2-day training for teachers
 - Introduction to particle physics, 6 trainings p.a.
- ▶ 3-day training for teachers (Fachleiter)
 - Elevated level, once per year
- ▶ Summer School at CERN
 - 6 days, once per year

www.teilchenwelt.de/angebote/lehrerfortbildungen-forschung-trifft-schule/

