Karlsruher Institut für Technologie

# Welcome and News from KSETA

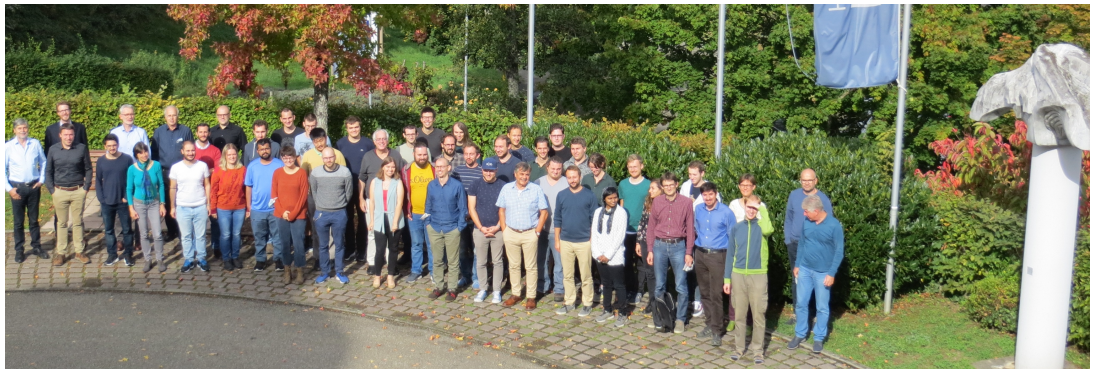
Ulrich Nierste

**14 March 2022**

# Welcome to the 9th KSETA Plenary Workshop

- This event is an important tradition of KSETA
- Like a „General Assembly“ of all members of KSETA, with all doctoral researchers and all principal investigators
- Opportunity for discussion with external speakers
- Talks and posters by fellows
- Poster award
- Social event

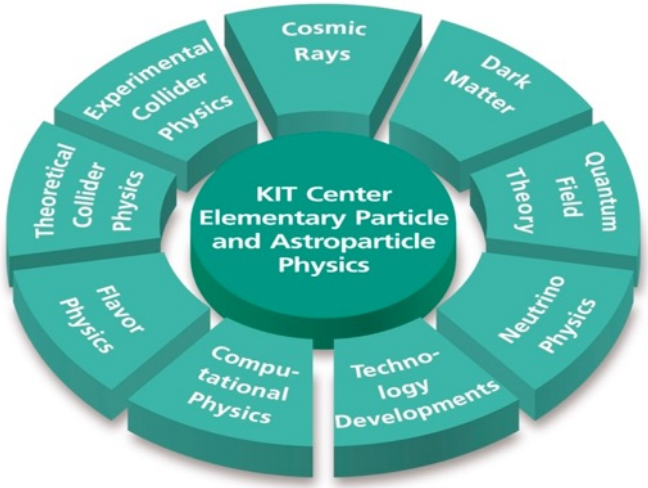
KSETA Poster Award 2020



8th KSETA Plenary Workshop 2021 with only 60 people on site

# KIT Center Elementaryparticle and Astroparticle Physics (KCETA)


- One out of eight KIT centers
- 11 institutes
- ~ 400 people
  - 24 professors
  - 2 young scientist groups
- 4 KIT Departments
- 4 out of 5 KIT Divisions, mainly Division V, *Physics and Mathematics*

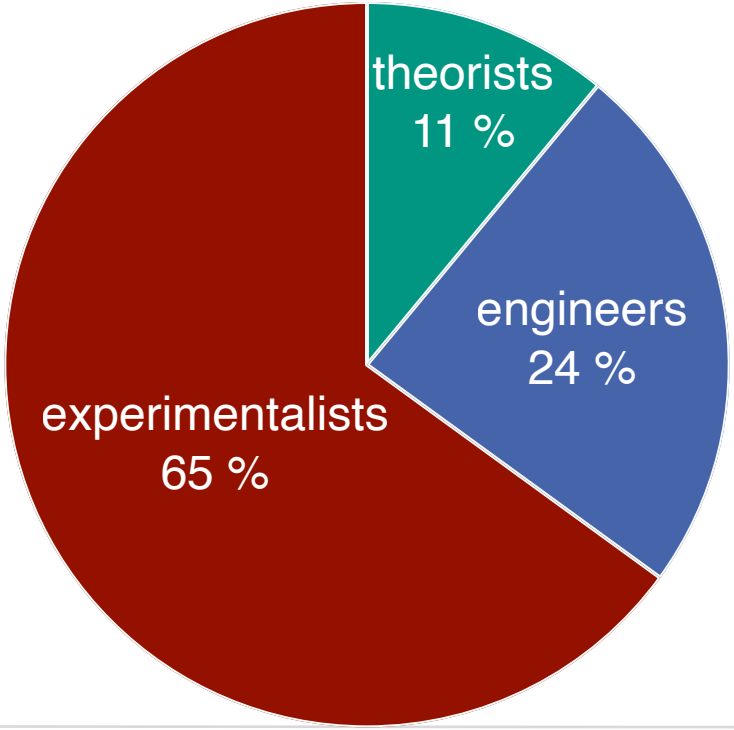



Institute for Experimental Particle Physics (ETP)
Institute for Theoretical Particle Physics (TTP)
Institute for Theoretical Physics (ITP)
Institute for Astroparticle Physics (IAP)
Institute for Data Processing and Electronics (IPE)
Institute for Technical Physics (ITeP)

Steinbuch Centre for Computing (SCC)
Institute for Micro- and Nanoelectronic Systems (IMS)
Institute for Information Processing Technologies (ITIV)
Institute for Technical Thermodynamic and Refrigeration (ITTK)
Institute for Accelerator Physics and Technology (IBPT)

# *Karlsruhe School of Elementary Particle and Astroparticle Physics: Science and Technology (KSETA)*

- KSETA is the doctoral school of KCETA
- 43 scientists (principal investigators)
- Funding by the German Excellence Initiative Nov 2012 — Oct 2019 with 1.5 M€ per year
- Since 2019 funding by local ministry (MWK) and KIT with 590 T€ per year
- All doctoral fellows receive tangible means, and have access to courses, workshops



# Additional funds

- Graduate School Scholarship Program (GSSP) grant of DAAD
  - two stipends have started in 2021
  - two stipends will start in 2022

  - new application pending for stipends for 2023/2024, expect decision in June 2022

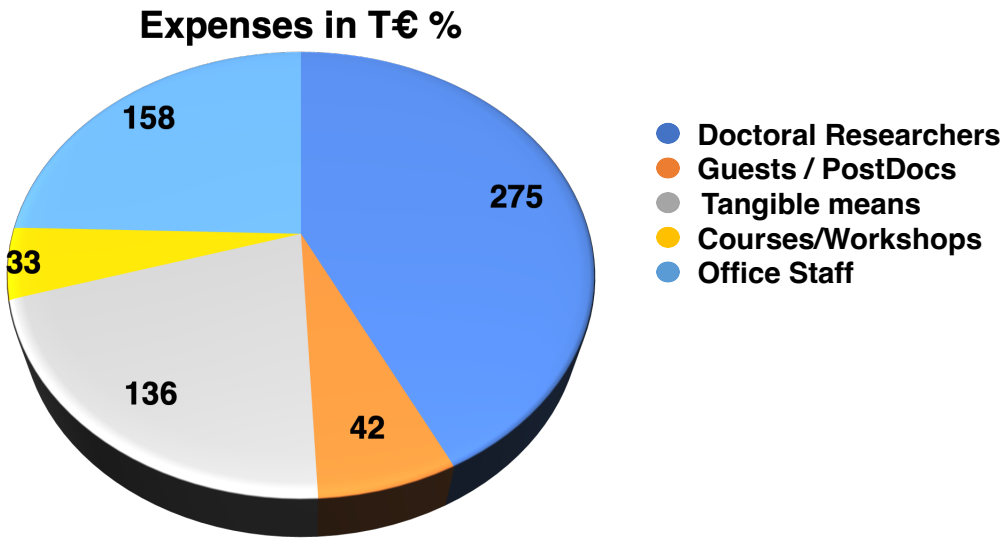
# KSETA in figures

More statistics (by December 2021):

- all KSETA Fellows 104
- directly paid by KSETA 6
- DAAD: 6
- international: 43 %
- female: 20 %

Graduated Fellows

- in 2021: 29
- in total since Nov 2012: 267
- PhD not completed: 28 (10 %)



# New KSETA Fellows since October 2021

Tista Mukherjee

Tobias Schulz

Hiu Sze (Vera) Wu

Genrich Zeller

Simon Kraft

Luca Scomparin

# KSETA congratulates.....

Martin Gabelmann

Marie Johanne Oehler

Luis Eduardo Ardila Perez

Jan-Ole Gosewisch

Alexander Droll

Tobias Boltz

Maximilian Reininghaus

Gaia Silli

Rudolf Schimassek

Fabian Block

Philip Keicher

Vladimir Lenok

Martin Schimassek

Jonas Kellerer

Maximilian Stadelmaier

Florian von Cube

Isabel Astrid Goos Bosco

Felix Metzner

**...to their succesful graduation**

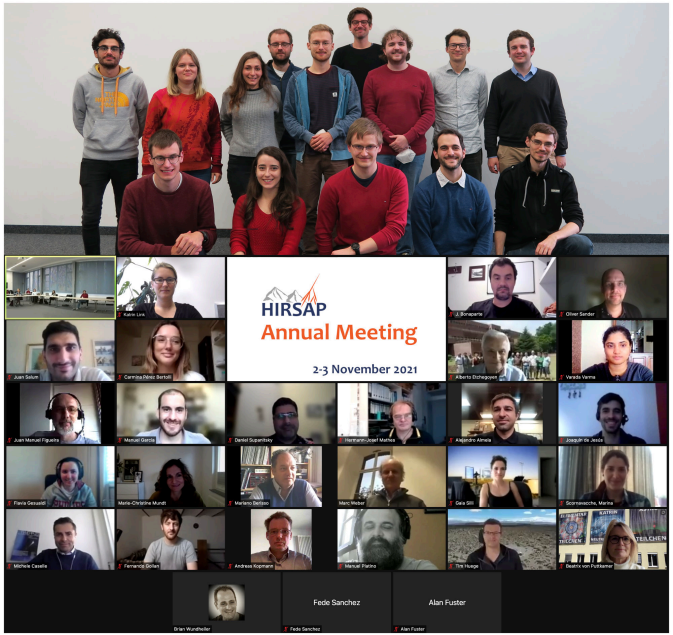
# Internships 2021 (DAAD-*IAESTE program*)

- Internships for IIT Bombay students: visits postponed to November-December 2021 (one month)
- Projects:
  - Cosmic Ray Technology for IceCube, IAP, supervised by Andrea Haungs and Thomas Huber

  - Observing the high-energy Cosmic Rays with IceCube, IAP, supervised by Andreas Haungs and Paras Koundal
  - Data-Intensive cloud infrastructure for future control systems, IPE, supervised by Jalal Mostafa and Suren Chilingaryan

# Helmholtz International Research School on Astroparticle Physics and Enabling Technologies (HIRSAP)

- The annual **HIRSAP Workshop 2021** took place on November 2 – 3, 2021 in hybrid format
- This is the main meeting where all doctoral students present their work and discuss with their supervisors
- The program was complemented by lectures and highlight talks given by James Matthews and Sebastian Kempf




- The **evaluation** on December3, 2021 was successful. The panel considered the achievements of the research school HIRSAP to be very impressive. They recognized several outstanding strengths:

# Successful Mid-term Evaluation

HIRSAP
Helmholtz International Research School for Astroparticle Physics

Karlsruher Institut für Technologie

Evaluation report HIRS-0009: „…Overall, the panel considered the achievements of the research school HIRSAP to be **very impressive**. They recognized several outstanding strengths…"

## HIRSAP in pictures

## HIRSAP in numbers

| AR | DE | AR/DE | IT | AR/PL | AR/IT | US | NL | BR | IN | ES |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 9 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Doctoral researchers**
- 30 in total over time
- 8 received already PhD
- 22 currently enrolled

| | KIT | UNSAM |
|---|---|---|
| DDAp | 6 | 10 |
| DDEIT | 5 | 1 |

**Diversity & equity**
- 36% female
- 23% not from AR or DE


**Science output**
- 23 journal publications
- 20 ICRC presentations
- 18 talks at national workshops
- 33 Auger internal notes

**Training measures HIRSAP**
- 13 specialized lectures
- 5 lecture courses
- language courses

**Training measures KSETA**
- 15 courses in 2019
- 10 courses in 2020
- 14 courses in 2021

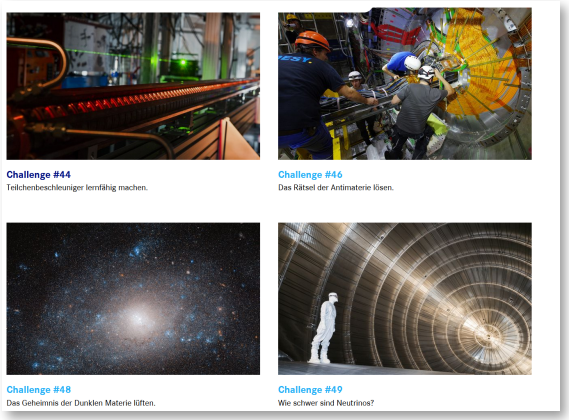
**Helmholtz measures**
- 3 career building

**Structural measures**
- 2 double-doctoral degree programs
- 13 meetings of Academic Committee
- 4 plenary workshops
- 64 joint seminars of doctoral researchers
- Website and wiki pages

27

# 200th birthday of Hermann von Helmholtz

Anlässlich des 200. Geburtstags hat die Helmholtz-Gemeinschaft unter dem Motto **„200 Jahre Helmholtz – Inspired by challenges“** die große wissenschaftliche Herausforderungen unserer Zeit – die Challenges, an denen unsere Forscherinnen und Forscher tagtäglich arbeiten, für die breite Öffentlichkeit präsentiert.
**https://www.helmholtz200.de/helmholtz-heute/challenge-200/**




Im Helmholtz-Forschungsbereich *Materie* ist KCETA in allen drei Programmen (*Materie und Universum, Von Materie zu Materialien und Leben* sowie *Materie und Technologien*) vertreten:

Challenge #10: Teilchenbeschleuniger tausendmal kleiner bauen, als sie heute sind
Challenge #40: Die Puzzlestücke der Astrophysik zusammenfügen
Challenge #42: Die Weltformel aufspüren
Challenge #44: Teilchenbeschleuniger lernfähig machen
Challenge #46: Das Rätsel der Antimaterie lösen
Challenge #48: Das Geheimnis der Dunklen Materie lüften
Challenge #49: Wie schwer sind Neutrinos?
Challenge #50: Den Ursprung kosmischer Beschleuniger entschlüsseln
Challenge #71: Mit Gravitationswellen den Kosmos besser verstehen

# KATRIN's "valentine's special"


**Watch the webinar (DE) at**
https://youtu.be/yIE5LN7ool0

BNN BADISCHE NEUESTE NACHRICHTEN

## Erfolg in der Teilchenphysik: KIT-Forscher wiegen das leichteste bekannte Teilchen des Universums

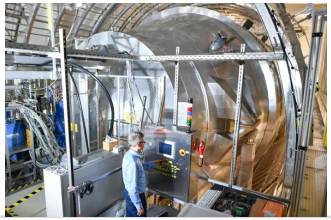
Leicht, aber oho: Vor nicht einmal 100 Jahren erahnten Physiker die Existenz sogenannter Neutrinos. Doch diese Elementarteilchen sind kaum zu erwischen, geschweige denn zu vermessen. Nun sind Forscher des KIT in Karlsruhe zumindest beim Gewicht einen Schritt weiter.


**"Breaking Lab": 77k views**

Karlsruhe Institute of Technology


SCIENTIFIC AMERICAN

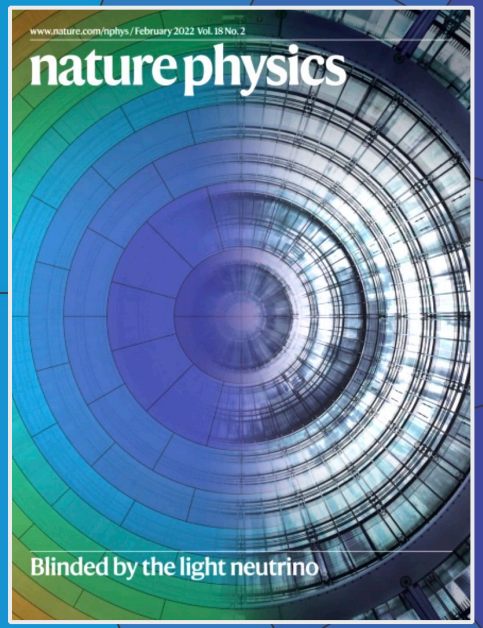
## How Light Is a Neutrino? The Answer Is Closer Than Ever



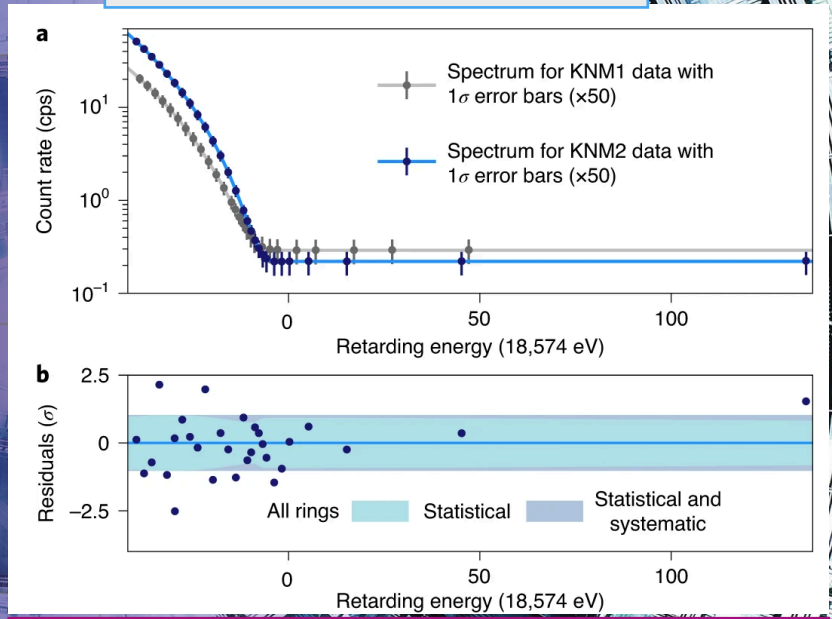
# “Direct neutrino-mass measurement with sub-electronvolt sensitivity”

Nat. Phys. 18 (2022) 160

**m($\nu$) < 0.8 eV (90% CL)**

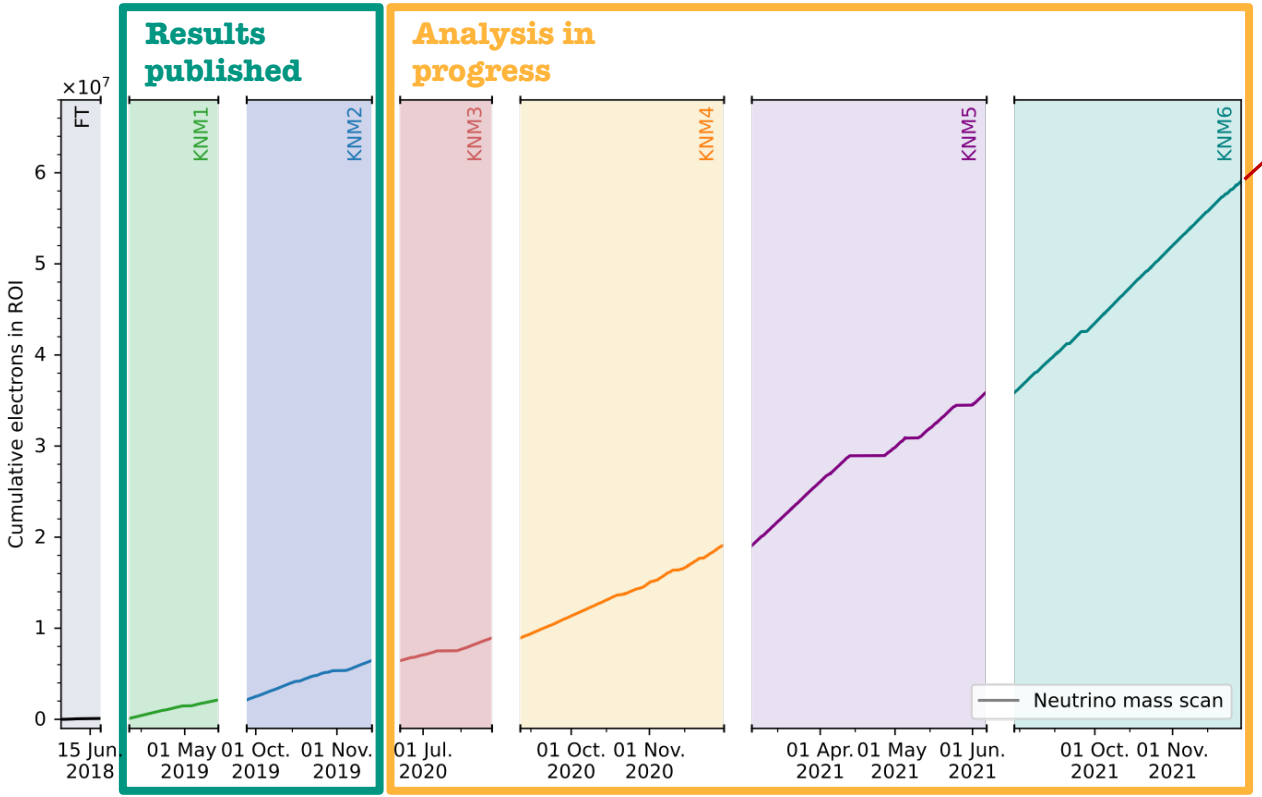



Cover artwork:
Leo Köllenberger / KSETA




**Wealth of contributions** by **many KSETA fellows & postdocs** to data-taking, analysis, detailed understanding of systematics, … !

# KATRIN's continued hunt for the neutrino mass

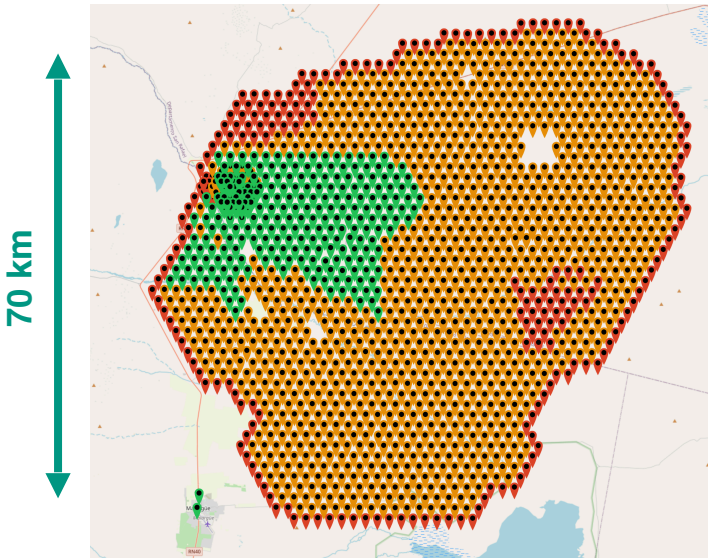


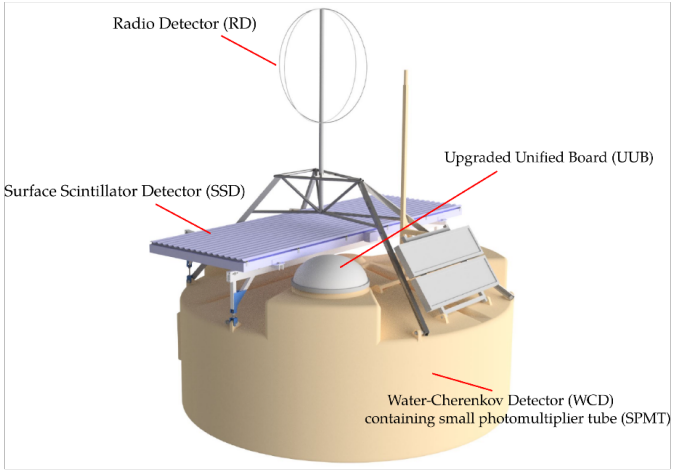

Preparations for next measurements under way!


Only a small part of the data has been analysed so far.

# Pierre Auger Observatory – AugerPrime deployment

- Almost all Scintillation Surface Detectors are deployed in accessible areas ~1450/1510 (despite COVID19)
- *New Electronics board (UUB)* deployment will last til mid 2023

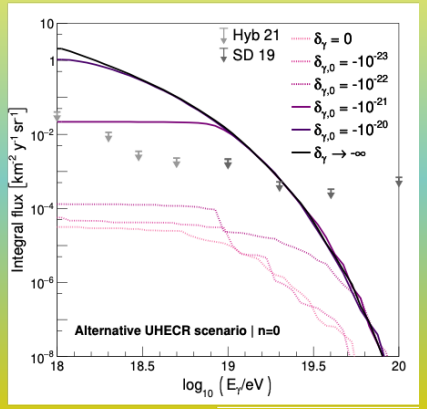


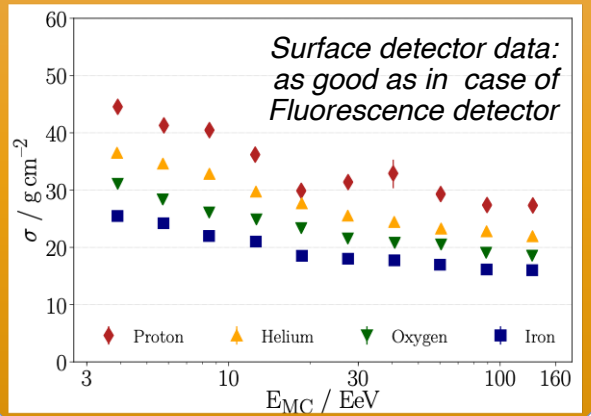

# Pierre Auger Observatory – Detecting CR with unprecedented statistics and accuracy

- Despite focusing on the completion of AugerPrime
- Plethora of new analysis approaches underway, inter alia
  - testing Lorenz invariance violation by photon searches (JCAP01(2022)023)
  - using DNNs to estimate $X_{max}$ by surface detectors only (2021 JINST 16 P07019)
  - determining the energy spectrum down to $10^{17}$ eV using surface detector only (Eur. Phys. J. C (2021) 81)

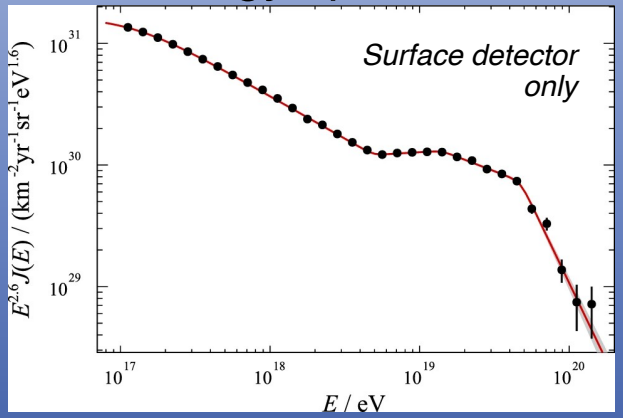
## Limits on LIV




## $X_{max}$ resolution (DNNs)




## Energy spectrum



# CMS Tracker Upgrade: From Modules to “Ladders“

Integration tests with silicon detector modules built at KIT carried out at IPHC Strasbourg.

KSETA fellow Lea Stockmeier and KSETA alumnus Stefan Maier with Clement Haas and Laurent Gross

# ITP highlights

3 conference papers at ACAT 2021

**20th International Workshop on Advanced Computing and Analysis Techniques in Physics Research**


- **Jannis Lang** (PhD student ITP/KSETA) *SMEFT truncation effects in Higgs boson pair production at NLO QCD*
- **Vitaly Magerya** (Postdoc ITP) *Expansion by regions & Monte Carlo integration with pySecDec*
- **Chaitanya Paranjape** (Indian summer student (ITP/online)), GH (ITP), Stephen Jones (Durham)

  *The Higgs plus three-gluon amplitude at one loop with pySecDec*

# IceCube organized international machine learning workshop

- Organized by Frank Schröder (KIT and Delaware) in January 2022
- Strong participation from KIT (IceCube group) ➔ https://events.icecube.wisc.edu/event/141/
- e.g. Paras Koundal
- ➔ IceCube enters a new era of reconstruction and analysis procedures


Slide from contribution by Paras Koundal

# Julius-Wess Award 2021

## Mark B. Wise

## California Institute of Technology

…for groundbreaking academic achievements in the field of theoretical particle physics, particularly the development of modern effective field theories for flavour physics…


Award ceremony on November 5, 2021 in AudiMax
80 participants
Laudation: Ulrich Nierste
Scientific talk: Martin Beneke (TUM)

Award lectures: June 13-17, 2022

# Forthcoming

## DISCRETE 2022

conference on flavour, neutrino, BSM, precision physics

7-11 Nov 2022

in Kongresshaus Baden-Baden

## Deutsche Physikerinnentagung

24-27 Nov 2022

at KIT

# KSETA Topical Courses 2021

- March 1 – 12, 2021
- 6 courses (6 hours each)
- virtually

- October 4 – 15, 2021
- 8 courses (6 hours each)
- virtually

- Participants:
  spring: about 170
  autumn: about 200!

- Most interesting topic:
  Statistical methods in particle physics data analysis

- DEEPER: 1
- BROADER: 11
- BETTER: 2

# KSETA benefits

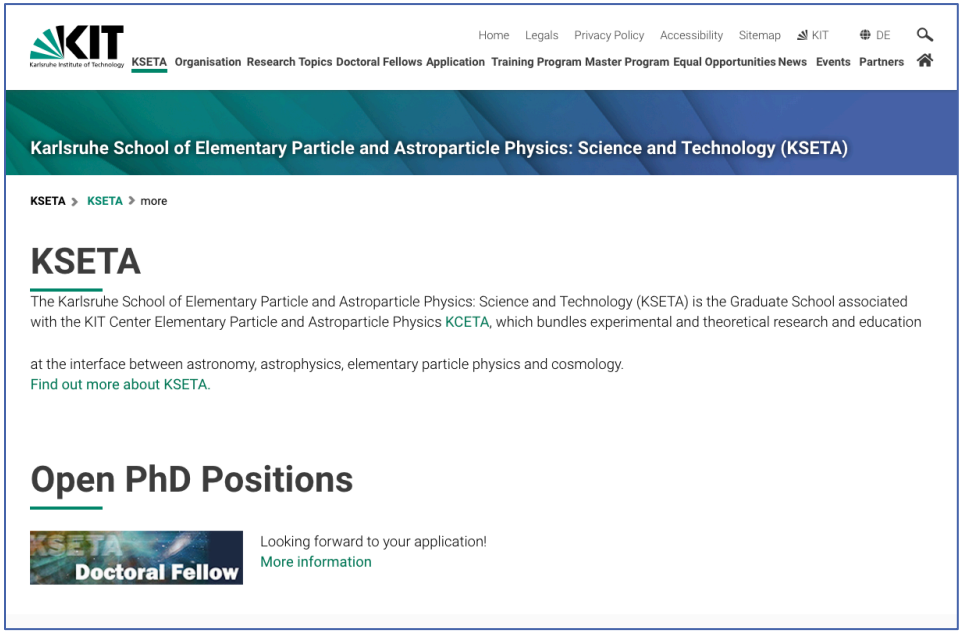
As a KSETA Fellow you benefit from....

- training program with topical courses, special lectures, workshops, guest scientists, foreign interns
- budget for conference travel and equipment,
- academic environment with ~120 Doctoral Fellows
- 10% of you are financed from KSETA sources (including GSSP stipends)
- possibility for short-term postdoc contract after graduation

# KSETA Webpage is very informative!

- News and events
- Equal Opportunity support
- Course registrations
- Information

www.kseta.kit.edu



# KSETA Fellows – rights and duties

- For your rights and duties please consult the KSETA Welcome Guide.


Important duties:

- attend a minimum number of 6 courses during your 3-year PhD studies,
- write your annual report,
- keep your personal web page up-to-date,
- list your publications in the files publications-reviewed.bib and publications-UNreviewed.bib.

- → We have reporting duties towards our funding agencies and must list the publications.

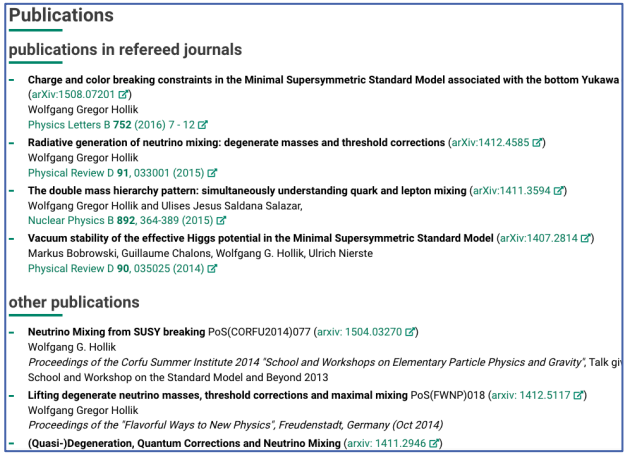
Don‘t delete KSETA emails without reading

# Web page and publications

Web pages and publication lists are a serious topic.

- Reviewers are likely to look at the web pages.
- Web pages contain all relevant information for all reporting.
- When we prepared the publication list for our 2019 reports, we observed that
  - many publications were missing
  - reviewed and unreviewed publications were not properly separated

- If possible, use INSPIRE BibTeX entries for your .bib files and include the DOI number for the reviewed papers.



**Publications**

**publications in refereed journals**

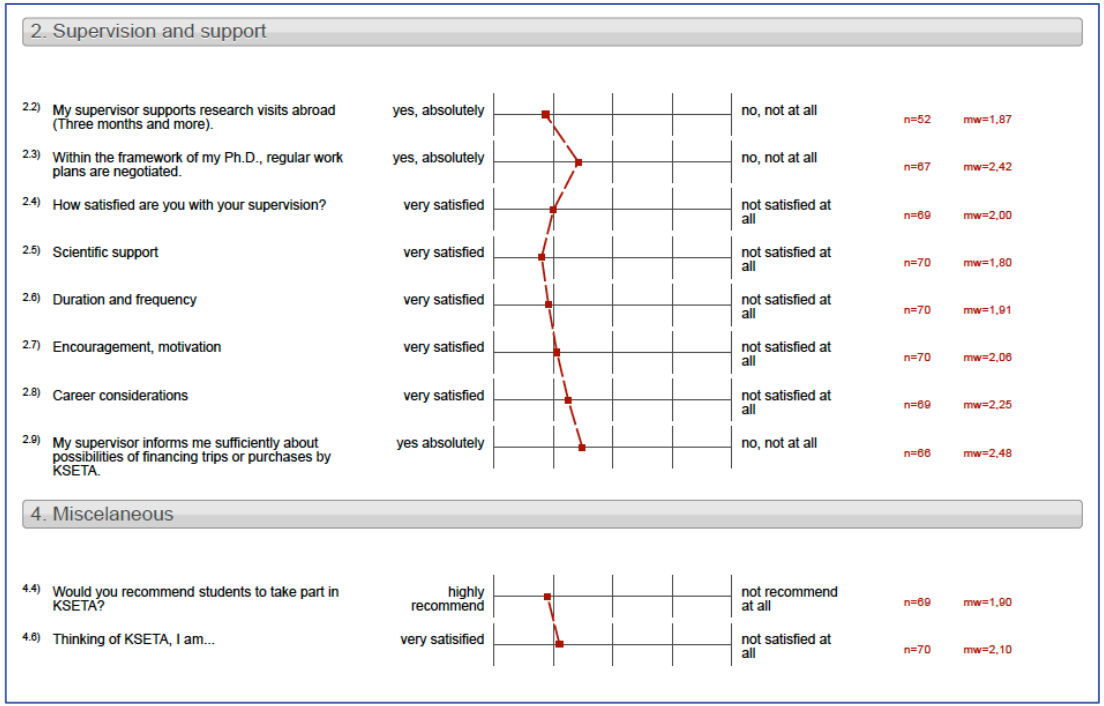
- **Charge and color breaking constraints in the Minimal Supersymmetric Standard Model associated with the bottom Yukawa** (arXiv:1508.07201)
  Wolfgang Gregor Hollik
  Physics Letters B **752** (2016) 7 - 12
- **Radiative generation of neutrino mixing: degenerate masses and threshold corrections** (arXiv:1412.4585)
  Wolfgang Gregor Hollik
  Physical Review D **91**, 033001 (2015)
- **The double mass hierarchy pattern: simultaneously understanding quark and lepton mixing** (arXiv:1411.3594)
  Wolfgang Gregor Hollik and Ulises Jesus Saldana Salazar,
  Nuclear Physics B **892**, 364-389 (2015)
- **Vacuum stability of the effective Higgs potential in the Minimal Supersymmetric Standard Model** (arXiv:1407.2814)
  Markus Bobrowski, Guillaume Chalons, Wolfgang G. Hollik, Ulrich Nierste
  Physical Review D **90**, 035025 (2014)

**other publications**

- **Neutrino Mixing from SUSY breaking** PoS(CORFU2014)077 (arxiv: 1504.03270)
  Wolfgang G. Hollik
  *Proceedings of the Corfu Summer Institute 2014 "School and Workshops on Elementary Particle Physics and Gravity"*, Talk gi
  School and Workshop on the Standard Model and Beyond 2013
- **Lifting degenerate neutrino masses, threshold corrections and maximal mixing** PoS(FWNP)018 (arxiv: 1412.5117)
  Wolfgang Gregor Hollik
  *Proceedings of the "Flavorful Ways to New Physics", Freudenstadt, Germany (Oct 2014)*
- **(Quasi-)Degeneration, Quantum Corrections and Neutrino Mixing** (arxiv: 1411.2946)

# KSETA Evaluation at the workshop 2021

- 70 completed questionnaires, despite electronic query!!
- Thank you
- Nearly all aspects rated better by 0.1 or 0.2 points compared to last year



# Enjoy your stay