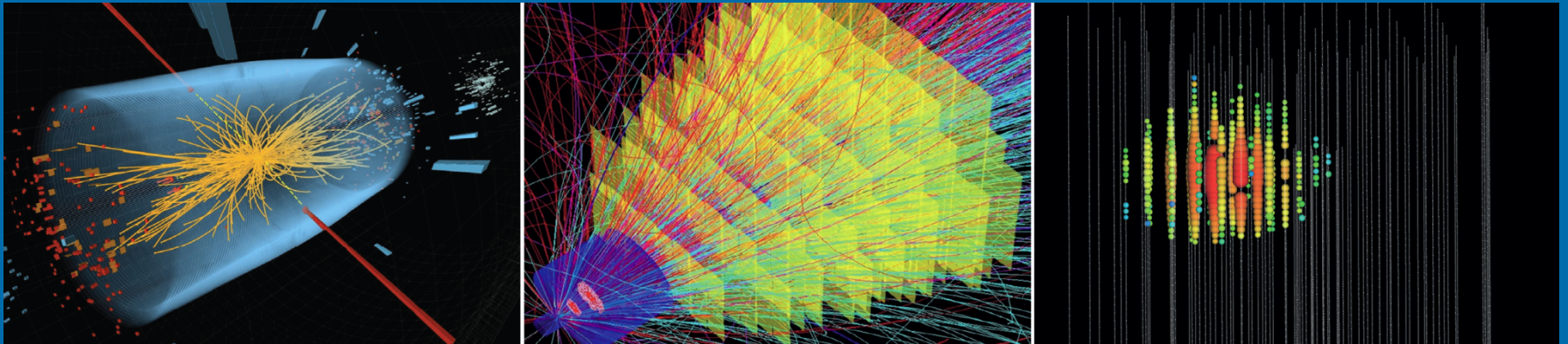
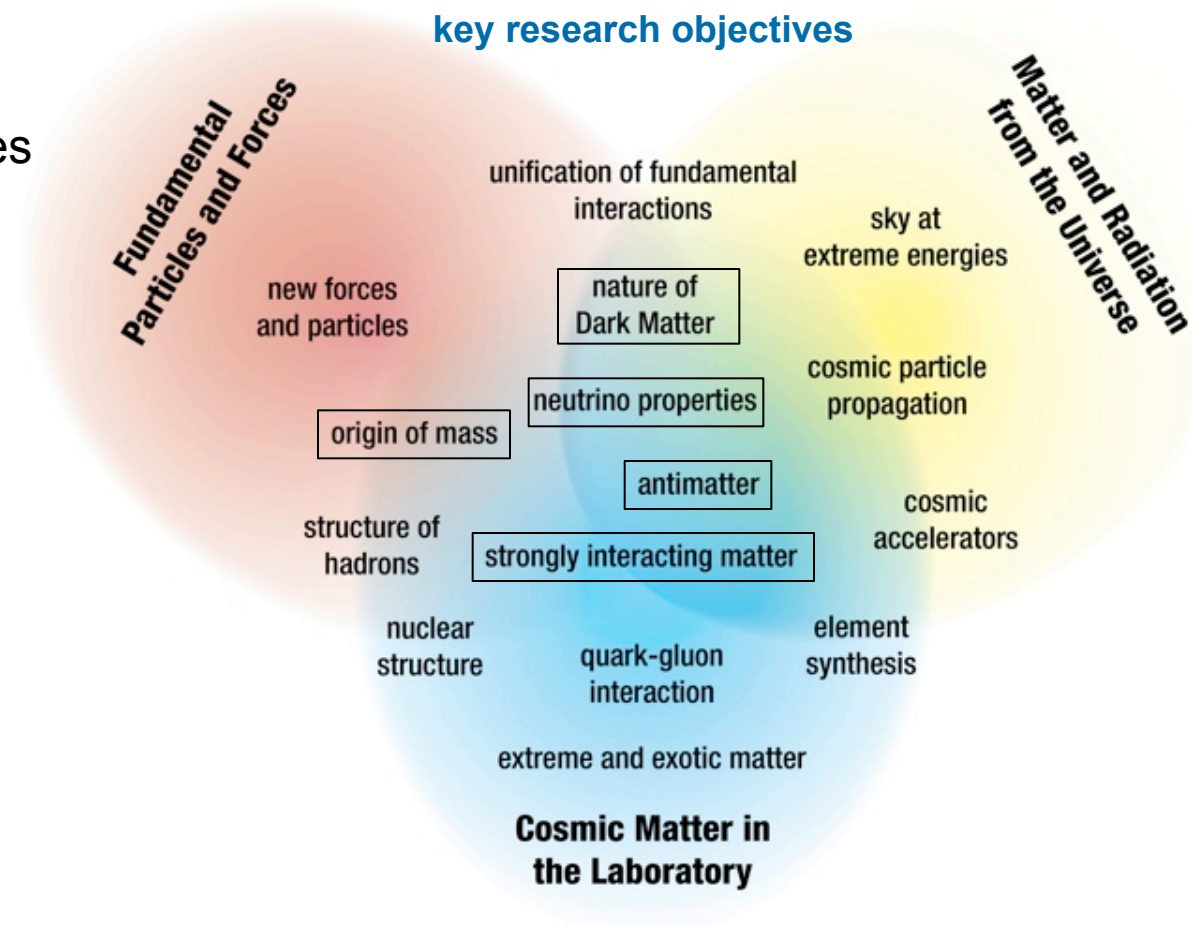


Cross-topic interactions



Overlap between programme topics

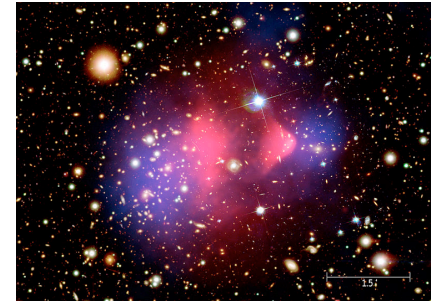
- several scientific objectives shared between topics
- from complementary approaches or methods to concrete overlap and potential for collaboration
- aims
 - identify overlap
 - regularly exchange ideas and results
 - encourage common activities



- following slides: **examples** for specific overlap

Dark matter

combine all available information from



- searches in
 - direct detection → EDELWEISS, EURECA
 - dark matter annihilation or decay
 - γ telescopes → CTA
 - cosmic rays → AMS 02
 - ν telescopes → IceCube/DeepCore, PINGU
 - production → LHC, ILC
 - missing energy, invisible Higgs decays, displaced vertices
 - dark matter in models of new physics (e.g. supersymmetry)
 - implications for cosmology, connections with gravitational waves and matter-antimatter asymmetry
 - axions and axion-like particles (ALPs)
theoretical motivation (string theory) and new detection ideas

Dark matter

joint topical workshop

Helmholtz Alliance for Astroparticle Physics

Dark Matter: A Light Move

Mission: to explore and gather ideas about searching for Dark Matter candidates with sub-eV masses, most prominently the axion and other weakly interacting slim particles (WISPs).

Program:

- Theoretical motivation for WISPy cold dark matter
- Evidence of dark matter and peculiar features of WISPy candidates
- Current axion dark matter experiments
- Prospects for new experiments (cavities, dish antenna searches...)
- Experimental techniques and challenges (low background detectors, magnetic fields...)

Scientific coordination:

Igor Irastorza, U. Zaragoza	Andrei Lobanov, MPIFR
Jörg Jäckel, U. Heidelberg	Andreas Ringwald, DESY
Axel Lindner, DESY	
Babette Döbrich, DESY (chair)	Javier Redondo, MPP&LMU (chair)
babette.doebrich@desy.de	redondo@mpp.mpg.de

DESY Hamburg
June 17-18, 2013

<http://indico.desy.de/event/dm-light-move>

The Helmholtz Alliance for Astroparticle Physics supports Equal Opportunities

www.hap-astroparticle.org

lectures

Helmholtz Alliance for Astroparticle Physics

HAP Workshop 2014
on data analysis for indirect dark matter searches

Topics

- Experimental status of dark matter detection
- Supersymmetry
- Dark matter particle physics and codes
- N-body simulations
- Astrophysics and J-factor calculation
- Foregrounds
- Complementarity of LHC, direct and indirect searches
- Statistics for dark matter searches

March 10-13, 2014
in Berlin (Adlershof)

Organizing committee:
Markus Ackermann (DESY), Rolf Bühler (DESY),
Klaus Eitel (KIT), Lutz Köpke (JGU Mainz),
Gernot Maier (DESY), Ullrich Schwanke (HU Berlin)

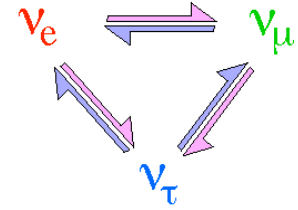
 <https://indico.desy.de/event/hap-indirectDM>

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Neutrino properties



- determination of mass scale and mass hierarchy

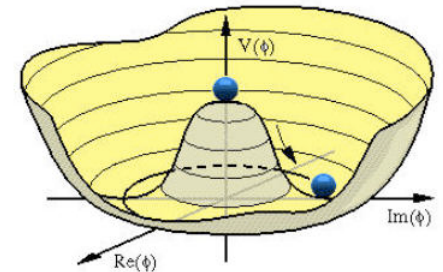
Dirac vs. Majorana, CP violation

- model independent results from KATRIN, PINGU
 - combine with model dependent constraints from cosmology and ν -less double β decay experiments
- models of new physics
 - mass generation:
Higgs mechanism and Majorana mass terms
 - heavy neutrinos and unification of forces
 - heavy neutrinos and cosmology: leptogenesis
- neutrino induced nuclear reactions
 - supernova dynamics and nucleosynthesis

The origin of mass

mass generation by
supersymmetry breaking

electroweak symmetry breaking
mass generation by Higgs mechanism

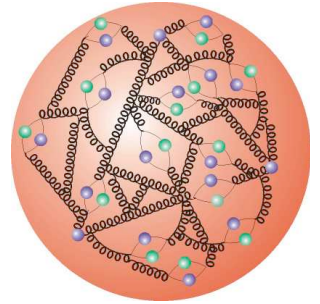


composite Higgs models:
Higgs as bound state
similar to pion in QCD

neutrino masses
Higgs mechanism and
Majorana mass terms

hadron masses
binding energy of strong interaction
broken chiral symmetry

Strongly interacting matter



connections in various domains

- hadron structure:
probed in complementary ways at LHC and at PANDA
 - common theoretical tools, e.g. effective field theories
 - lattice gauge theory:
collaborate on physics, methods, technology
 - generation of gauge field configurations: HIM and DESY
 - simulation lab: algorithms, community support: FZJ and DESY
- ↙ ↘
- high-performance computing**
- methods from string theory applied to quark-gluon plasma

Strongly interacting matter

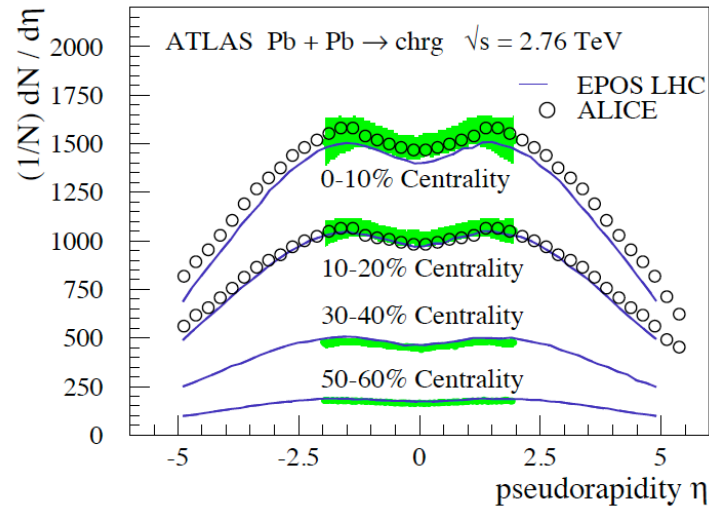
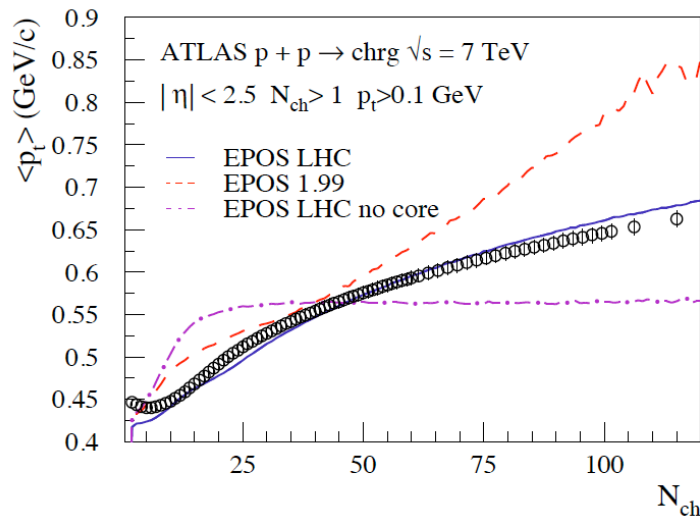
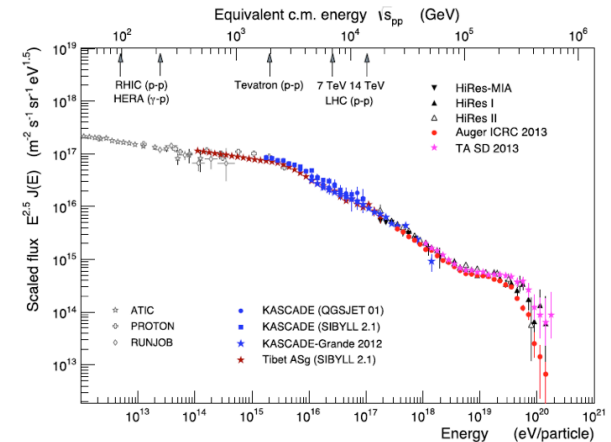
high-energy scattering of hadrons

- LHC and ultrahigh energy cosmic rays

LHC: detailed event information, cosmic rays: huge energy range

→ develop theory and models

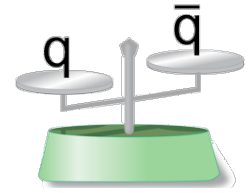
- KIT/DESY collaboration in tuning Monte-Carlo generators



- Young Investigator Group working in Auger and CMS

T. Pierog et al, June 2013

Antimatter

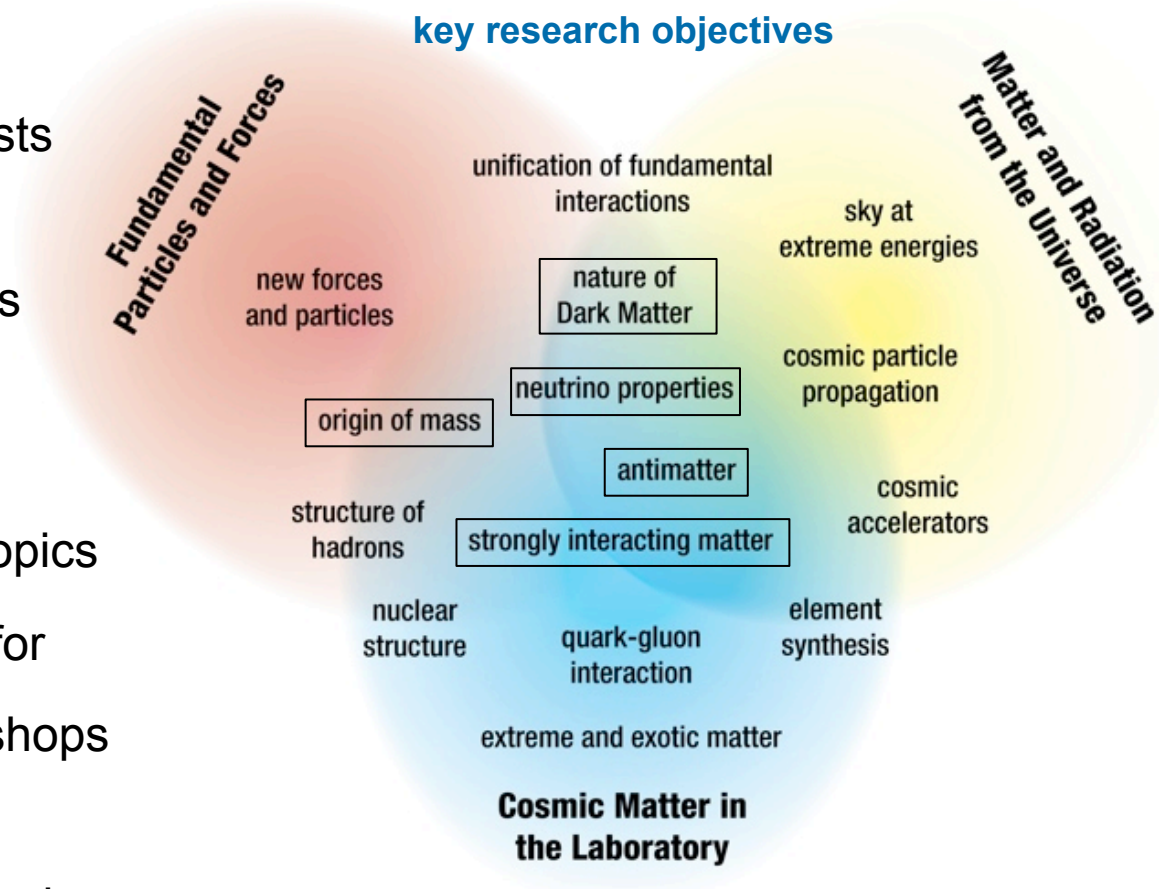


- observed matter-antimatter asymmetry of Universe requires **violation of CP symmetry**
beyond amount provided by CKM mechanism in SM
- search for CP violation
 - flavor changing: B meson decays → Belle II
 - flavor conserving: electric dipole moments → JEDI
 - ▶ complementary constraints
much needed since generic models contain
plethora of CP violating parameters

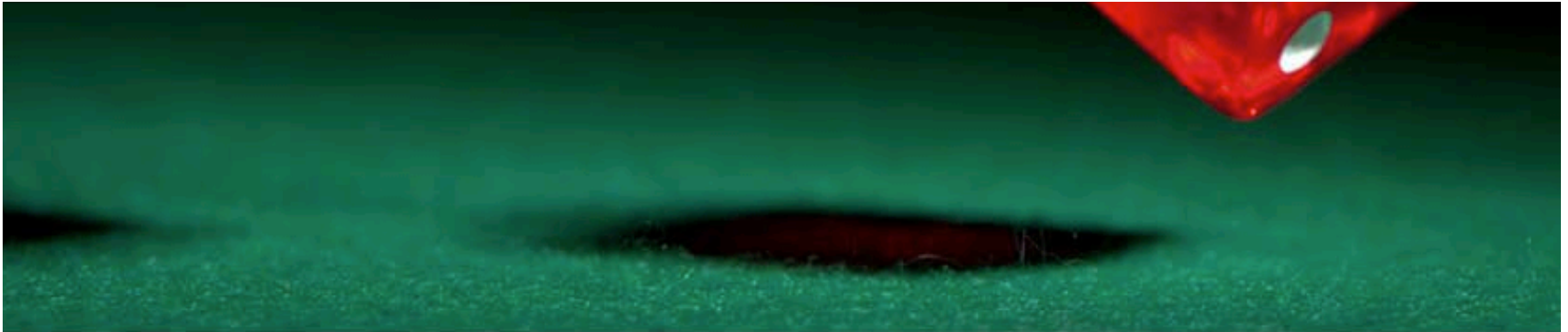


Fostering common activities

- annual meeting for scientists from all three topics
- dedicated parallel sessions on overlap areas
- ▶ for each have nominated convenors from relevant topics
- will help identify potential for
 - common topical workshops and education events
 - collaboration on research projects



Cross-topic education: an example



School on

Monte Carlo Methods in Advanced Statistics Applications and Data Analysis

18-22 November 2013, München

Topics:

- Basics of statistics and probability, random numbers and the Monte Carlo method
- Bayesian reasoning
- Information field theory
- Markov chain Monte Carlos
- Sampling and clustering
- Population Monte Carlo
- Nested sampling

This school - the first one commonly organised by the three Helmholtz Alliances Terascale, HAP and EMMI and the Max Planck IMPRS EPP School - addresses physicists from particle physics, astro-particle physics and hadrons & nuclei

Organisers: Allen Caldwell (MPI Munich), Kevin Kröninger (U Göttingen), Kai Schweda (GSI), Ralf Ulrich (KIT), Thomas Schörner-Sadenius (DESY), Frank Steffen (MPI Munich)

Registration deadline: 11 November 2012, Registration fee: 50 €

Registration and more information at:

www.terascale.de/mcstats2013

Cross-topic education: more examples



School on Concepts of Modern

Amplitude Analysis Techniques

Summerschool, September 18-26, 2013
Flecken-Zechlin, Germany

Amplitude analysis is a mandatory tool to study few-particle decays, since the resulting spectra (Dalitz plots and generalizations thereof) in general contain very rich structures. These structures teach us a lot about the spectrum of hadrons and their intrinsic properties to unveil e.g. the mystery of strong binding and the question of a much richer spectrum than only conventional mesons and baryons. But the physics opportunities reach much beyond this. Any observable appearing in interference effects of hadron production and decay will be accessible this way, which opens the door to electroweak physics and physics beyond the standard model.

For the analysis of precision experiments at PANDA, BESIII, LHCb, JLab 12 GeV, COMPASS, BaBar and Belle II, the Helmholtz Institute Mainz is organizing a two week advanced course covering Techniques of Amplitude Analysis, aimed at advanced doctoral students and postdoctoral researchers in hadron and particle physics. This school is especially dedicated to experimentalists.

Confirmed Lecturers
Boris Grube, Munich
José Peláez, Madrid
Klaus Peters, Darmstadt
Michael Pennington, JLab
Stefan Scherer, Mainz
Adam Szczepaniak, Bloomington

Concepts
Mathematical Tools
Dynamical Aspects
Practical Application
Training

Organizing Committee
Miriam Fritsch
Klaus Götzen
Klaus Peters

students from
PANDA, BES III, ..., ATLAS, CMS

Helmholtz Alliance for Astroparticle Physics

HAP Dark Matter 2013

From astronomical observations to astroparticle theory

Joint workshop Astroparticle Theory and Dark Universe

Topics:

- Astronomical observations
 - galactic dynamics, gravitational lensing and structure formation
- Experimental searches
 - direct, indirect and at the LHC
- Particle candidates
 - from neutrinos to axions, scalars, and SUSY
- Numerical tools
 - combined fits and precision calculations



Scientific coordination:

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Hörsaal S1 (Schlossplatz 2), Universität Münster
February 18-20, 2013



<http://indico.desy.de/event/hap-DM>



The Helmholtz Alliance for Astroparticle Physics
supports Equal Opportunities

www.hap-astroparticle.org

students and lecturers from
astroparticle and particle physics