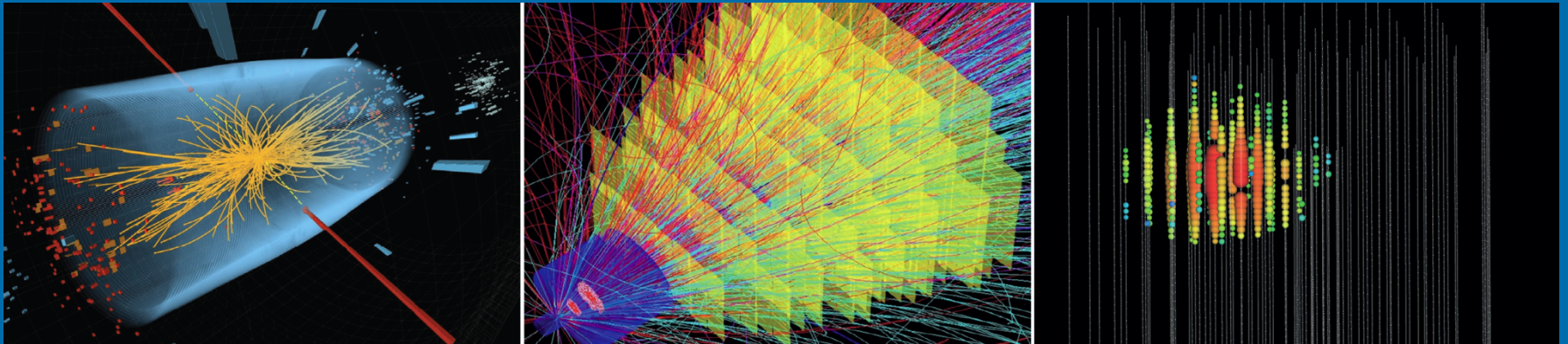
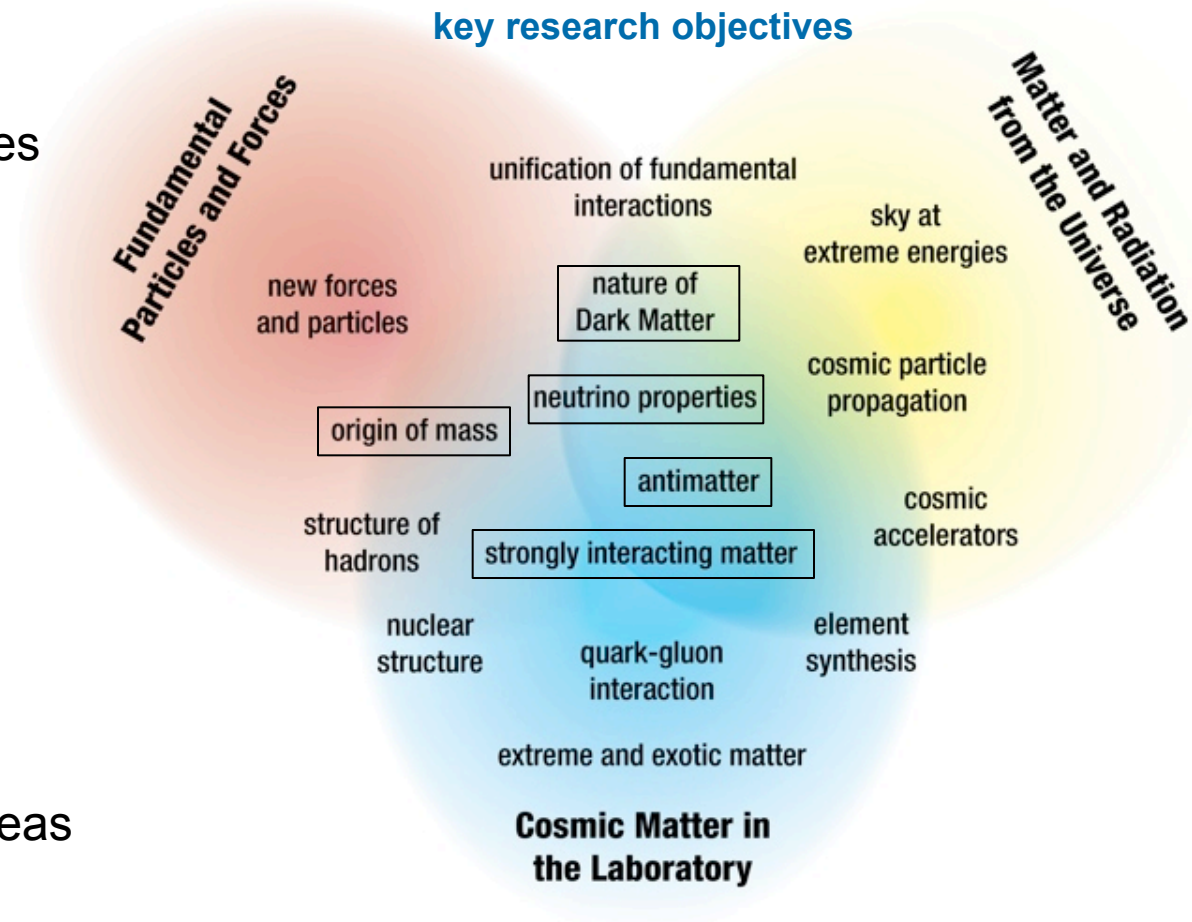


Cross-topic interactions



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
 - facilitate common activities

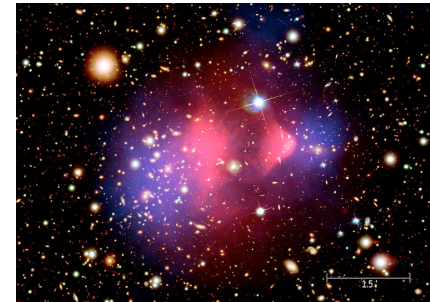


- following slides: **examples** for specific overlap

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
 - implications for cosmology, connection with matter-antimatter asymmetry, gravitational waves
 - 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>

DESY
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>

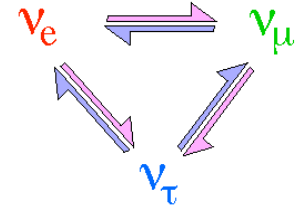
HELMHOLTZ ASSOCIATION
Alliance for Astroparticle Physics

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Neutrino properties

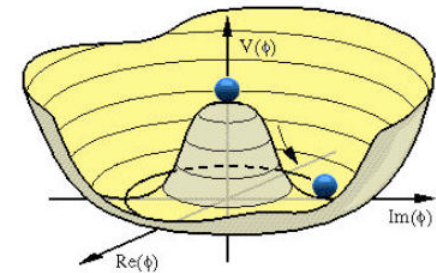


- determination of mass scale and mass hierarchy
 - Dirac vs. Majorana, CP violation
 - model independent results from KATRIN, PINGU
 - combine with model dependent constraints from cosmology and ν -less double β decay experiments
- models of new physics
 - mass generation:
Higgs mechanism and Majorana mass terms
 - heavy neutrinos and unification of forces
 - cosmological implications: leptogenesis
- nuclear physics:
 - neutrinos in supernova dynamics and in nucleosynthesis

The origin of mass

mass generation by
supersymmetry breaking

electroweak symmetry breaking
mass generation by Higgs mechanism

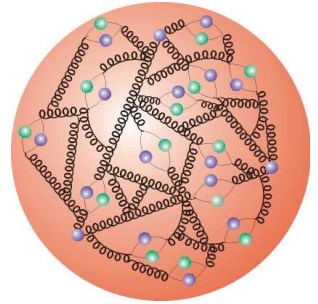


composite Higgs models:
Higgs as bound state
similar to pion in QCD

neutrino masses
Higgs mechanism and
Majorana mass terms

hadron masses
binding energy of strong interactions
chiral symmetry breaking

Strongly interacting matter



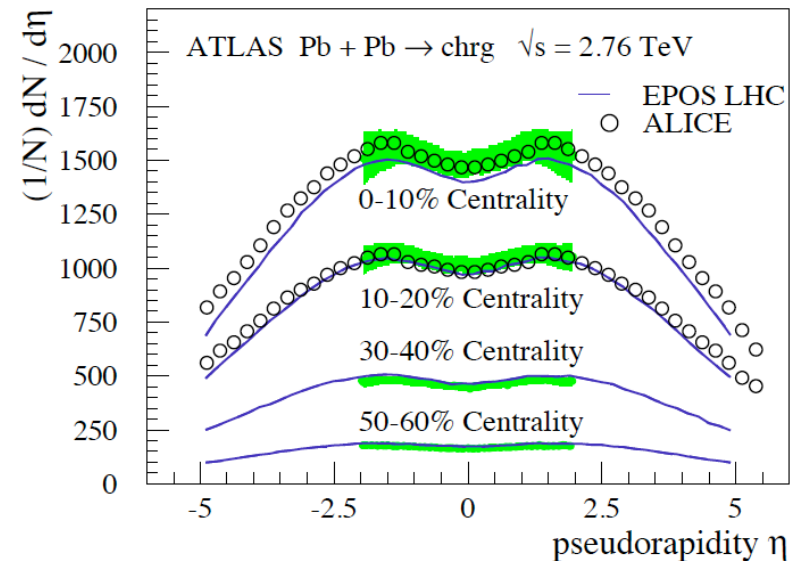
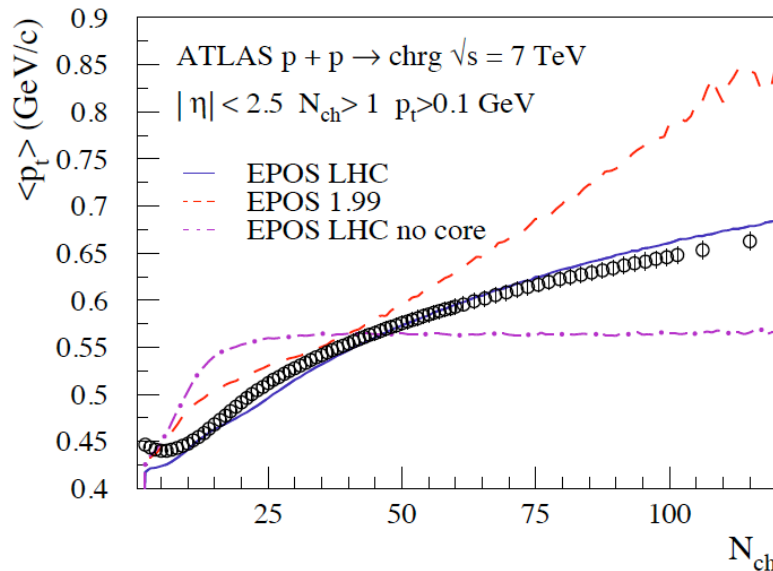
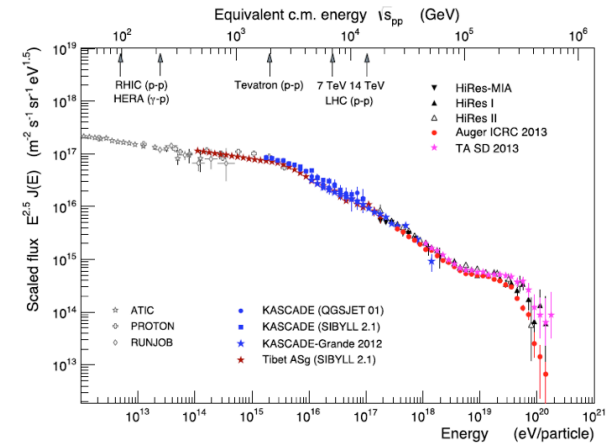
connections in various domains

- 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

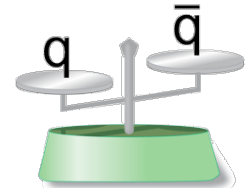
high-energy scattering of hadrons

- LHC and ultrahigh energy cosmic rays
 - combine data over a vast energy range
 - develop theory and models
- KIT/DESY collaboration in tuning Monte-Carlo generators



T. Pierog et al, June 2013

Antimatter

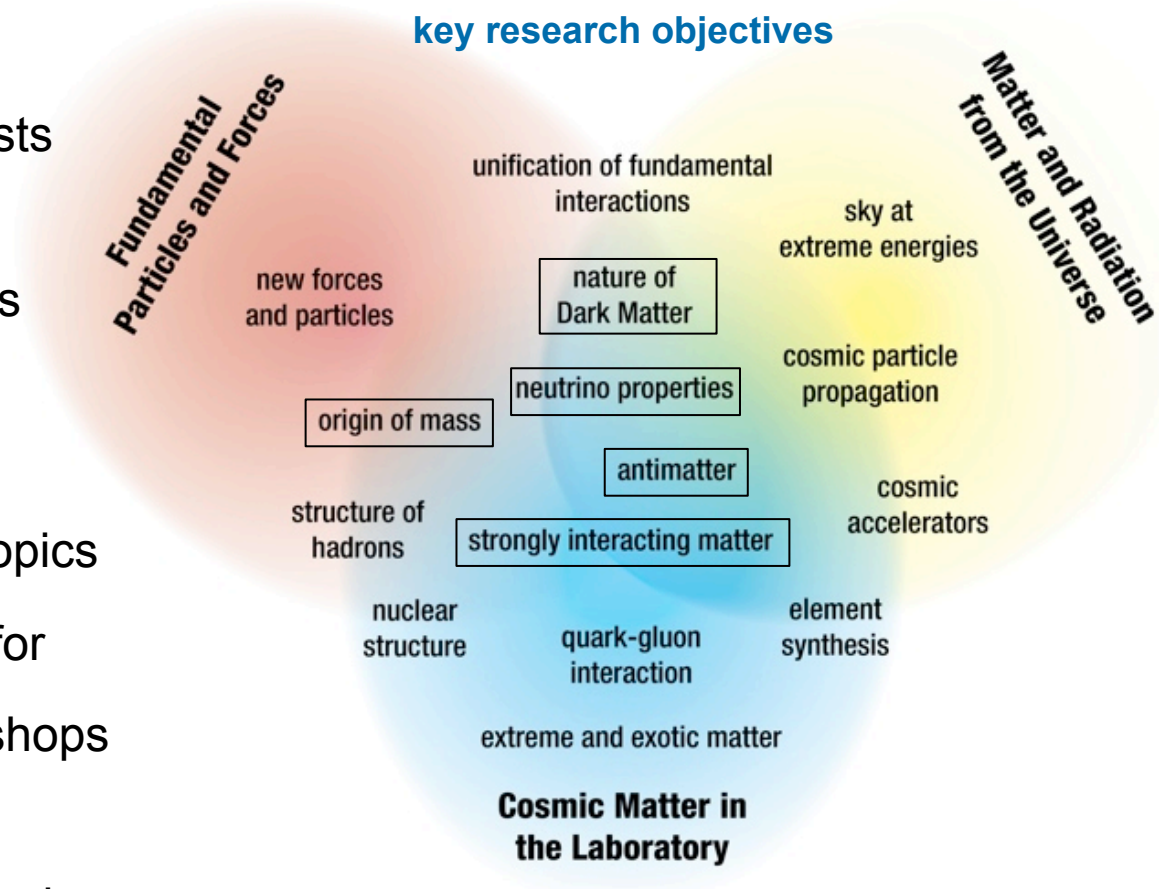


- observed matter-antimatter asymmetry of Universe requires **violation of CP symmetry**
beyond amount provided by CKM mechanism in SM
- search for CP violation
 - flavor changing: B meson decays → Belle II
 - flavor conserving: electric dipole moments → JEDI
 - ▶ complementary constraints, much needed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



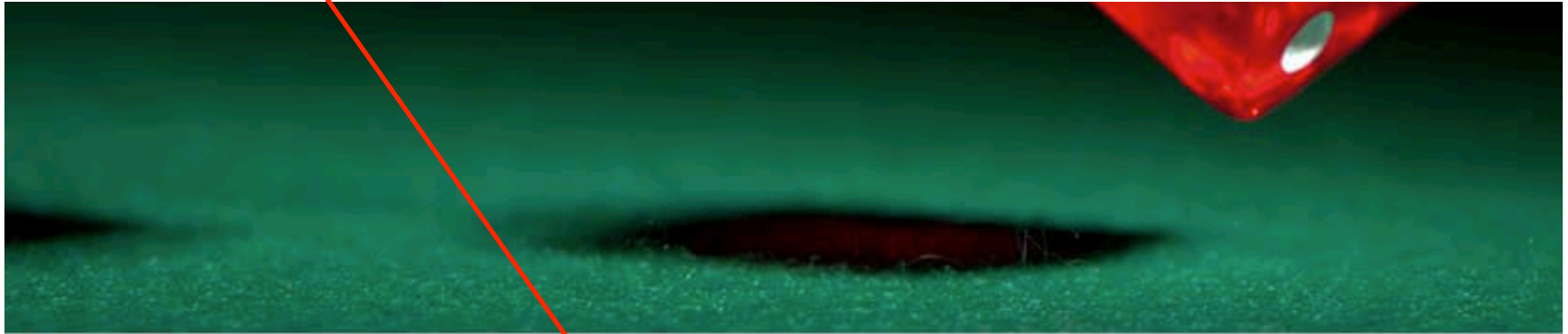
Fostering common activities

- 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



Common education events

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 at all career levels. The programme comprises lectures and exercises on important Monte Carlo based statistics and data analysis methods.

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