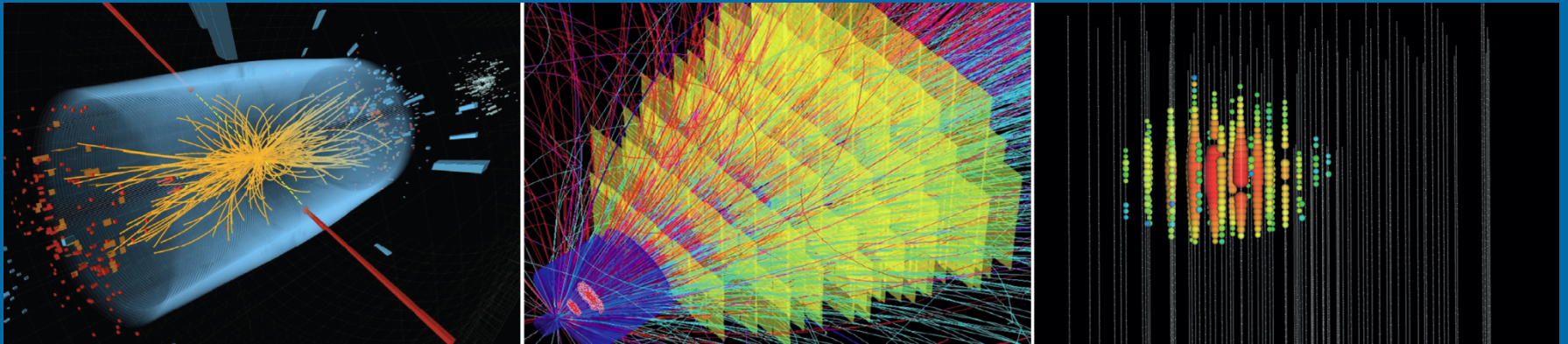
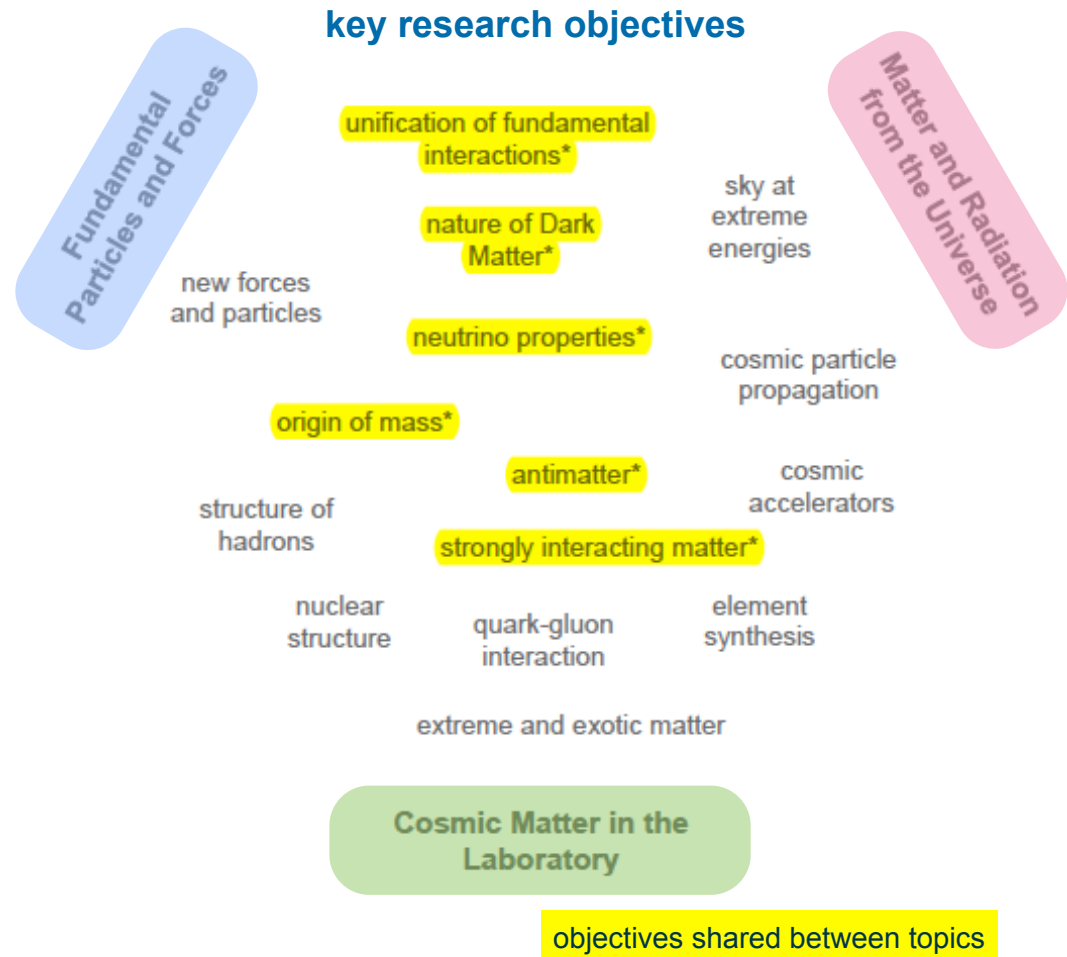


Cross-topic interactions



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
 - dark matter annihilation or decay
 - γ telescopes → CTA
 - cosmic rays → AMS 02
 - ν telescopes → IceCube/DeepCore, PINGU
 - production → LHC, ILC
- dark matter in models of new physics
 - supersymmetry
 - 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



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) babette.doebrich@desy.de	Javier Redondo, MPP&LMU (chair) 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



Composition and Processing: Roger Smoot, Image Data: ESO, WISE, NASA, Hubble Heritage Project, NASA (STScI/ESA)

example for common activity:
joint topical workshop of
astroparticle and particle physics
communities

The nature of neutrinos

- 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

The origin of mass

dynamics of 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

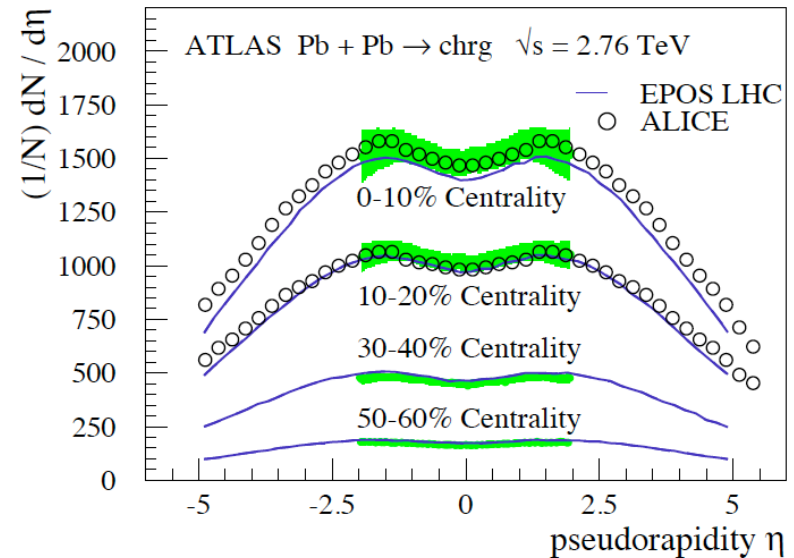
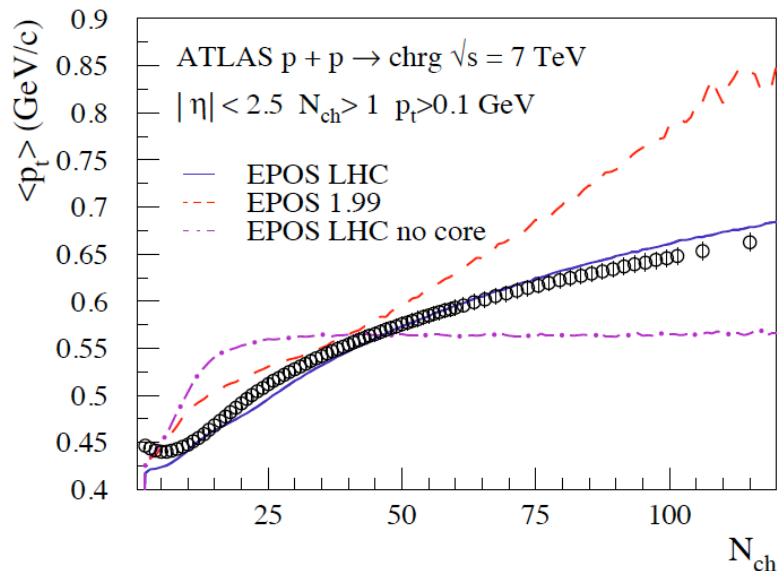
connections in various domains

- hadron structure:
complementary aspects studied at LHC and at PANDA
- string theory methods
applied to quark-gluon plasma
- common methods:
 - lattice gauge theory: groups at DESY and HIM
collaborate on generation of gauge configurations
 - use of effective field theories

Strongly interacting matter

connections in various domains

- high-energy scattering of hadrons:
 - LHC and ultrahigh energy cosmic rays
 - KIT/DESY collaboration in tuning Monte-Carlo generators
 - mutual benefit for both communities



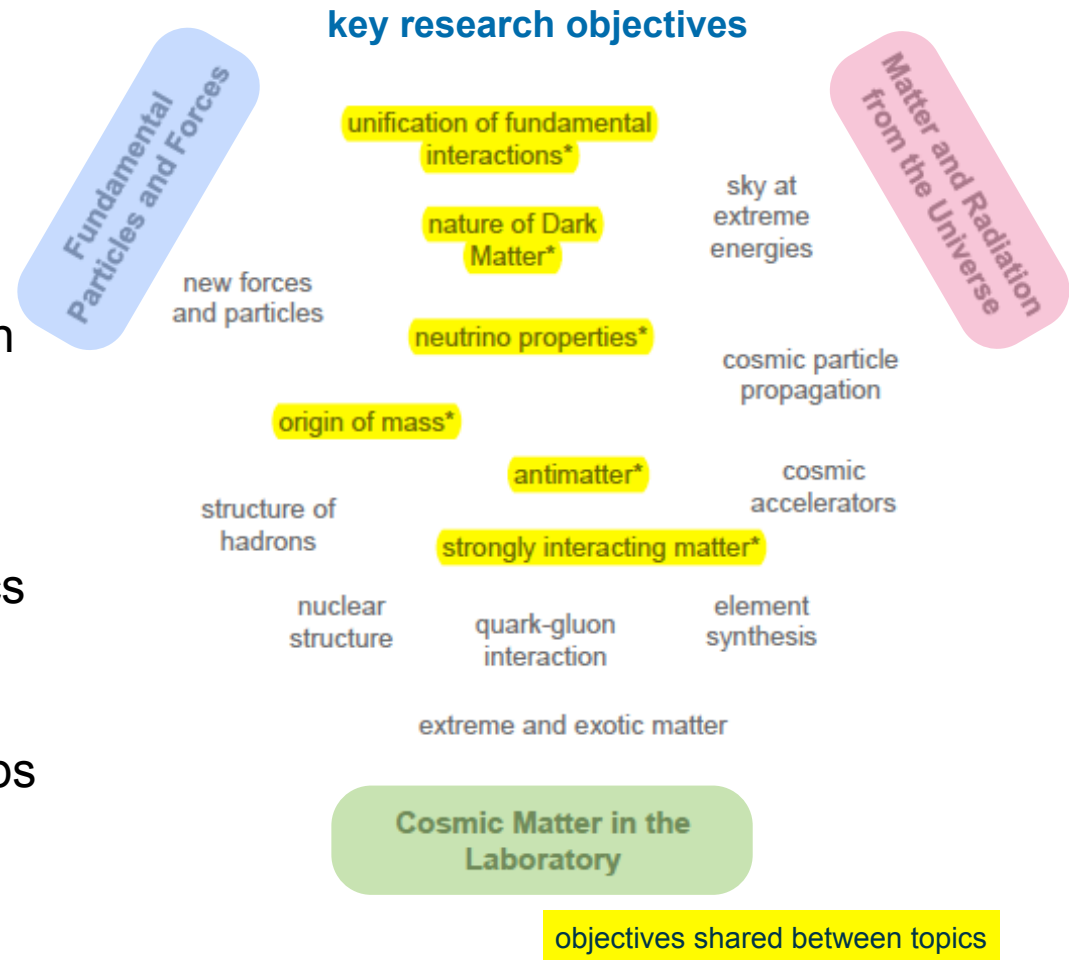
Pierog et al, preprint DESY-13-125

Antimatter

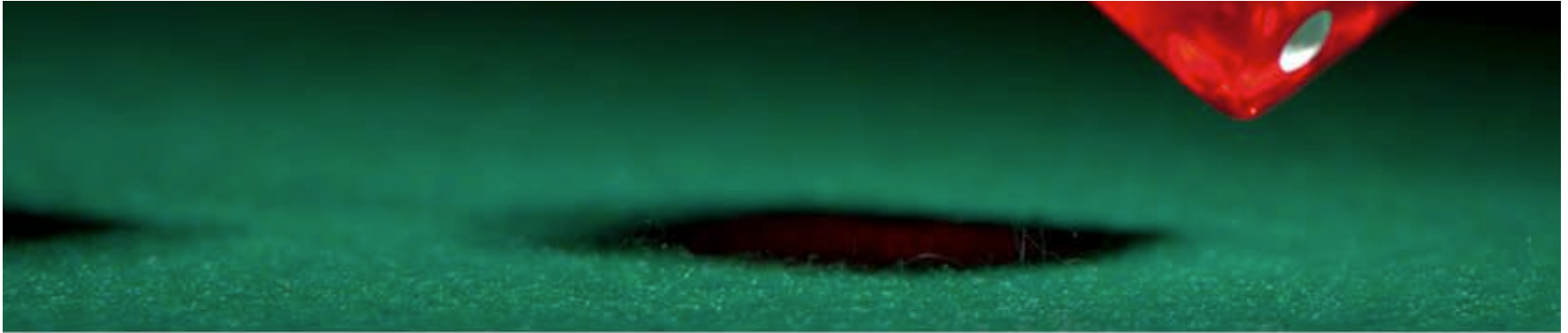
- baryon-antimatter asymmetry of Universe requires **violation of CP symmetry**
beyond amount provided by CKM mechanism in SM
- search for CP violation
 - flavor changing: B meson decays → Belle II
 - flavor conserving: electric dipole moments → JEDI
 - ▶ complementary constraints, much needed
since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



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