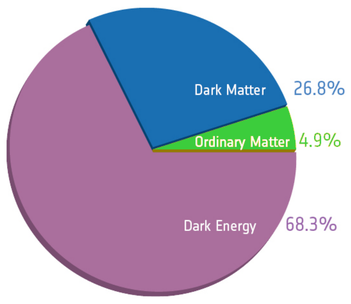
Astroparticle Physics – AG Schumann

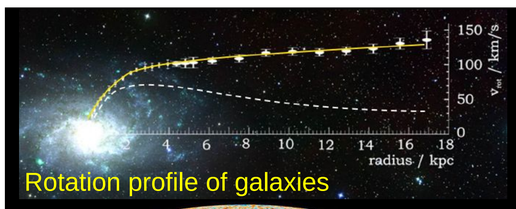
Dark Matter – Astroparticle Physics

Dark Matter is a fundamental constituent of the Universe and 5× more abundant than “ordinary” matter.
It dominates structure formation and is thus shaped the Universe as we observe it today.
We conduct experimental searches for Dark Matter. Since the expected signal rate is very small, dedicated low-background experiments and methods are required.

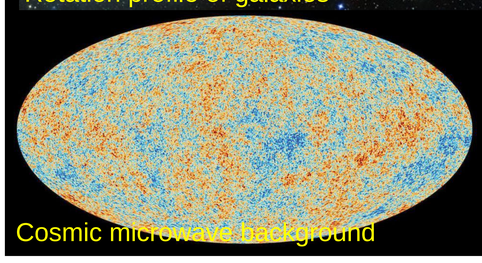
Dark Matter in Universe

- 95% of the Universe is dark
  = emits/absorbs no light
  = we don’t know, what it is
- 27% of the Universe is Dark Matter
  → dominates structure formation



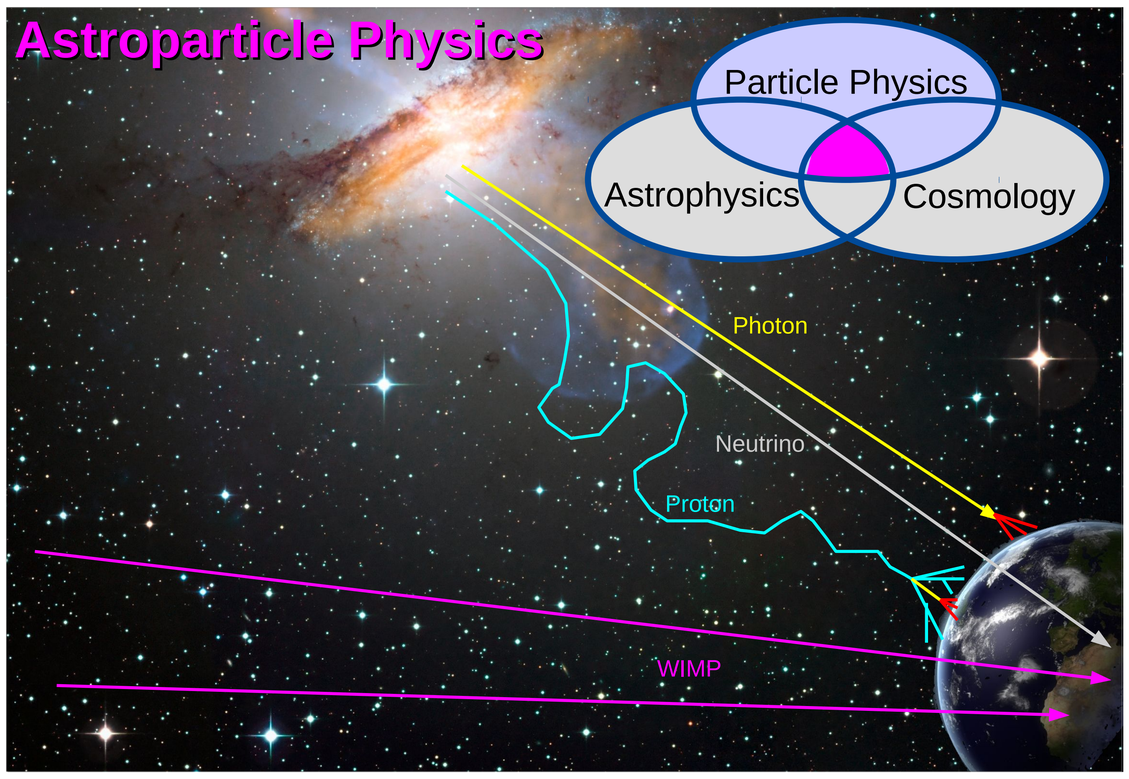


Rotation profile of galaxies


Cosmic microwave background

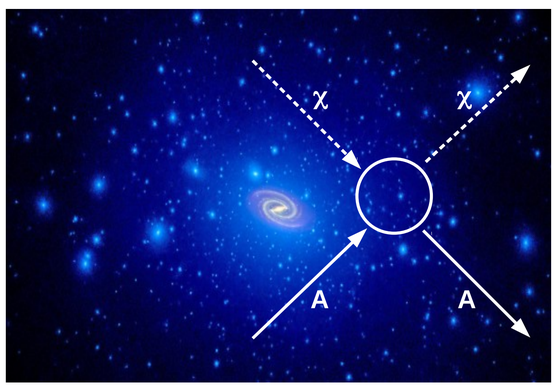

Colliding galaxy clusters (“Bullett Cluster”)

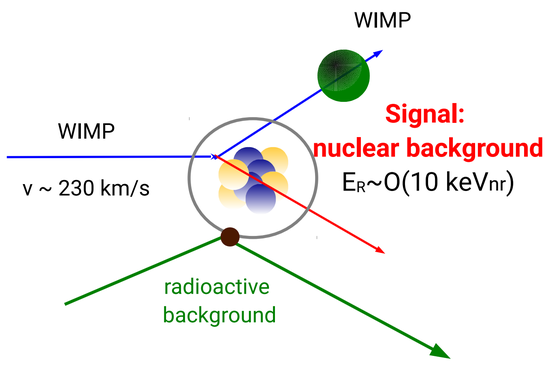
Astroparticle Physics



Search for Dark Matter

- Dark Matter: cold, massive, neutral, stable
- Expectation: new elementary particle
  → Weakly Interacting Massive Particle (WIMP)
- Search for WIMP-induced nuclear recoils





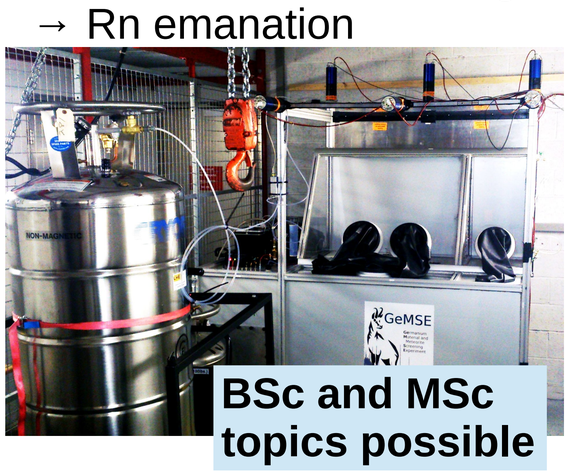
- very low count rate: <1 event per ton and year

Dark Matter: Background Sources

Background everywhere
Our expertise is to reduce it.

Low-background Physics

- Cosmic rays
  → underground lab required
- all detector components need very low intrinsic radioactivity
  → Germanium Screening
  → Rn emanation



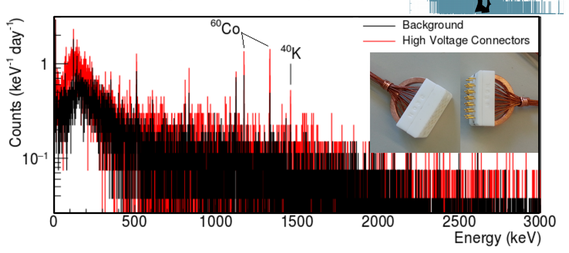
BSc and MSc topics possible

MonXe

MonXe Facility
Freiburg, Rn emanation

GeMSE Facility
Vue des Alpes Lab (CH)

GeMSE
Germanium Material and Meteorite Screening Experiment



Activities in Freiburg

- development of low-background detectors
- ultra-clean materials, detector components, electronics
- new concepts, simulations, sensitivity studies

→ **many projects for BSc and MSc thesis**


DARWIN test platform
in Astroparticle Lab

Contact

Prof. Dr. Marc Schumann
Physics Highrise Room 601, marc.schumann@physik.uni-freiburg.de

apl. Prof. Dr. Horst Fischer
Physics Highrise Room 609, horst.fischer@cern.ch

www.app.uni-freiburg.de