

GSI Helmholtzzentrum für Schwerionenforschung

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Physics and Biophysics with Heavy Ions from Anti-Protons to Uranium

Mission:

- Accelerator Facility Operation
- Fundamental Research with Heavy Ions
- Technological Developments
- Education
- Staff: ~ 1000, + ~200 PhD Students
- Annual Funding: ~ 115 Mio Euro

 **HELMHOLTZ**
| GEMEINSCHAFT

 **FAIR**

 **GSI**

Helmholtz Detectors and Systems Platform, Kick-Off Meeting, Karlsruhe 20 – 21 Feb. 2012

Research at GSI until Today

Production and investigation of short-lived radioactive nuclei:

Astrophysics and nucleosynthesis, nuclear structure far off stability

Production of new elements:

Superheavy elements created by gentle fusion of heavy ions ($Z=106 - 112$)

Relativistic heavy-ion collisions:

Dense nuclear matter (neutron stars), nuclear equation-of-state
in-medium properties of hadrons

Intense heavy-ion pulses:

Generation and investigation of high-density (atomic) plasmas
Inertial confinement fusion

Atomic physics and material science:

QED studies, extremely strong electromagnetic fields,
Ion-matter interactions

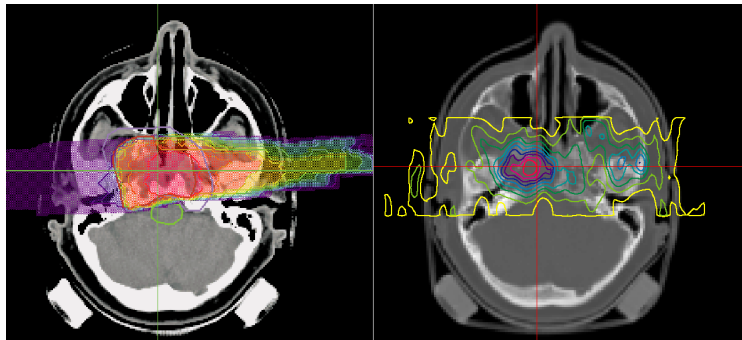
Biophysics and tumor therapy:

Cancer treatment with carbon beams

GSI tumor therapy matured to a dedicated facility

Heidelberg Heavy-Ion Therapy Center (HIT)

Inauguration Nov. 2, 2009
1000 patients per year,
GSI-technology transferred to
medical application



Facility for Antiproton and Ion Research

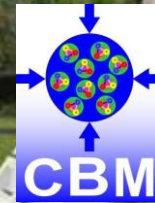
GSI's future project



Facility for Antiproton and Ion Research

@ GSI Darmstadt
Accelerator for
everything from
antiprotons to uranium

FAIR
2018



GSI today



**SFRS,
Atomic-
and
Plasma-
Physics**

Start of construction: 2012
First experiments: 2018
Scientific users: 2500 - 3000 per year

International project:



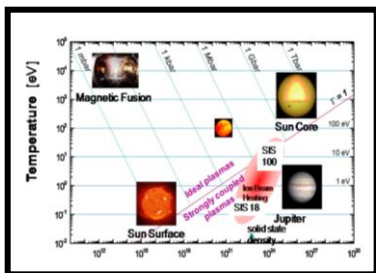
Observers:



Costs & Funding:

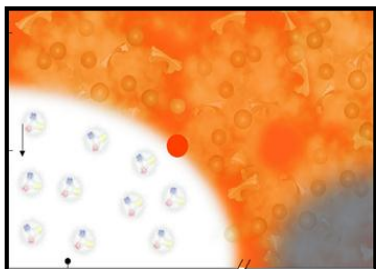
~1.2 billion € – 65% Germany,
10% State of Hesse, 25% Int. Partners
FAIR GmbH founded Oct. 4th, 2010

SCIENCE at FAIR



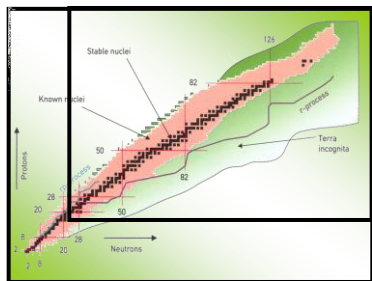
Atomic Physics, Plasma- & Applied physics:

APPA



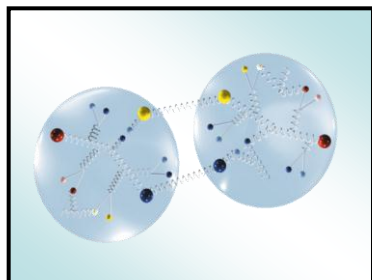
Nuclear and Quark Matter:

CBM



Exotic Nuclei and
Nuclear Astrophysics:

NuSTAR



Hadron Structure and Dynamics:

PANDA



GSI is well embedded

- Daughter Institutions Helmholtz Institute Mainz HIM, Helmholtz Institute Jena HIJ
- Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe
- Intricate cooperation with German universities
 - Frankfurt, Mainz, Giessen, Darmstadt, Heidelberg, München, Siegen, Augsburg
 - Bochum, Köln, Tübingen, Freiburg, Jena, Bonn, Marburg, Wuppertal...
- ... and Helmholtz Centers HZDR, FZJ, DESY ... (KIT ?!)
- Helmholtz International Center for FAIR (HIC-for-FAIR):
Joint Think-Tank of Hessian Universities, FIAS, and GSI
- Extreme Matter Institute EMMI
- International collaborators on current experiments and future FAIR experiments

Technological Research and Infrastructure:

- Department on Experiment Electronics
- ASIC laboratory
- Target Laboratory, isotope-target preparation, PVD coating technologies
- Detector laboratory (gas detectors, diamond- and silicon detectors)
- APD-Test facility under construction



The new GSI Detector Laboratory 2011

600 m² clean room facilities for solid state and gaseous detectors

Infrastructure for high-tech work towards FAIR experiments

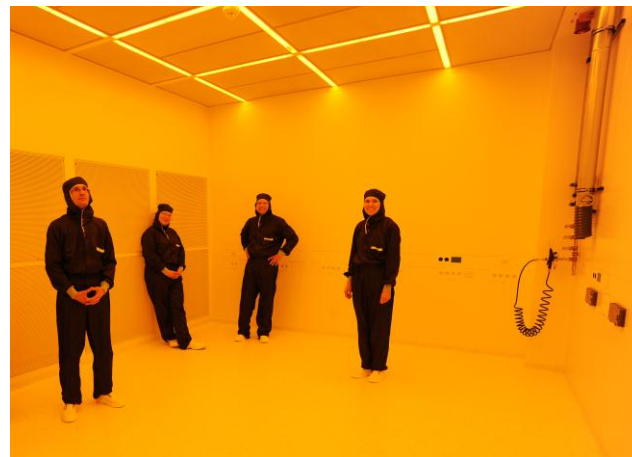
Gaseous-
detectors



First new building towards FAIR




Silicon/Diamond detectors and
bonding laboratory



Laser Lithography prior to Installation



Construction of FAIR has started ...,
enormous technological challenges up ahead towards
FAIR-accelerator- and detector-systems



For the coming years:
Big fun diving into high-tech
and pushing beyond the limits...