

**Summary of the Scientific Evaluation
and
Outlook on the Strategic Evaluation**

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Helmholtz Headquarters

6th December 2018

The Program-oriented Funding (PoF) of the Helmholtz Association

Idea & Process

- The Helmholtz Association consists of eighteen major German Research Centers, which are legally independent bodies.
- The mission of the Helmholtz Association is to contribute to solving grand challenges which face society, science and industry by performing cutting-edge research in Strategic Programs in different Research Fields, one of them is Matter.
- The distribution of the Base Budget to the Research Centers is based on the evaluation of effectiveness and competitiveness of the R&D activities at highest international standards within certain programs.
- An in-depth evaluation of the scientific quality of R&D activities of the running program period within each research field delivers the basis for a strategic evaluation on a higher level two years later with regard to next program period.

Research Centers & Program Structure of **Research Field Matter**

Matter Centers

Deutsches Elektronen-Synchrotron DESY
Hamburg and Zeuthen

Forschungszentrum Jülich (FZ Jülich)
Jülich

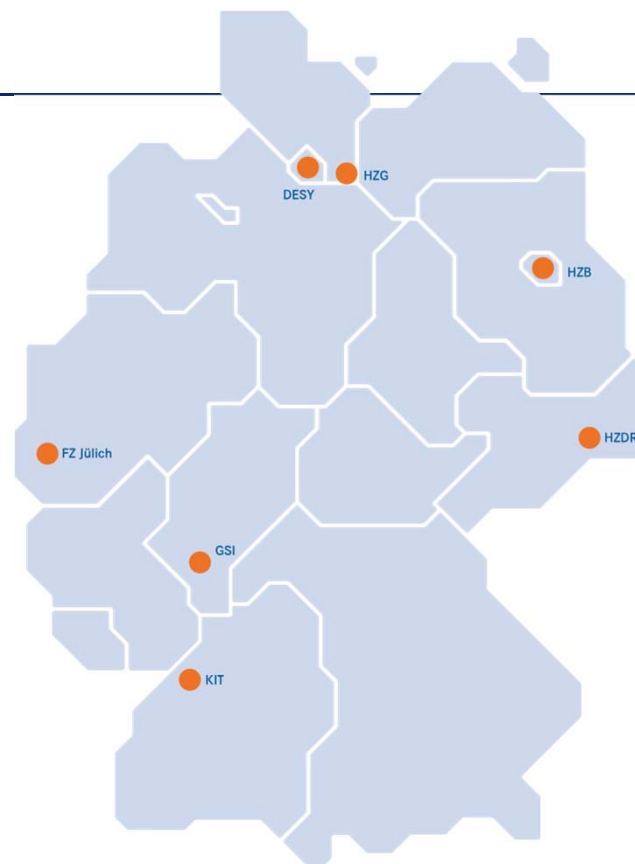
GSI Helmholtzzentrum für Schwerionenforschung
Darmstadt

Helmholtz-Zentrum Berlin für Materialien und Energie
(HZB)
Berlin

Helmholtz-Zentrum Dresden-Rossendorf (HZDR)
Dresden

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research (HZG)
Geesthacht

Karlsruhe Institute for Technology (KIT)
Karlsruhe



Research Centers & Program Structure of **Research Field Matter**

Program Structure of the current Program Period III

Matter and the Universe (MU)

Fundamental Particles and Forces

Cosmic Matter in the Laboratory

Matter and Radiation from the Universe

Facility Topic:
Data Centers

DESY, FZJ, GSI, KIT
(300 FTEs plus 99 FTEs associated)

From Matter to Materials and Life (MML)

Research on the Structure, Dynamics and Function of Matter at Large Scale Facilities

Facility Topic:
Research on Matter with Brilliant Light Sources

Facility Topic:
Research on Matter with Neutrons

Facility Topic:
Physics and Materials Science with Ion Beams

Facility Topic:
Research at Highest Electromagnetic Fields

DESY, FZJ, GSI, HZB, HZDR, HZG, KIT (723 FTEs plus 33 FTEs associated)

Matter and Technologies (MT)

Accelerator Research and Development

Detector Technologies and Systems

Matter in 2016:
1302 FTEs core funded scientists, thereof 158 FTEs associated

DESY, FZJ, GSI, HZB, HZDR, KIT
(134 FTEs plus 12 FTEs associated)

Facts with regard to the Scientific Evaluations

Matter

Overview of the Matter Reviews

- 98 reviewers
- 17 program reviewers
- 8 cross-reviewers
- 1/5 female reviewers

Date	Research Center	Chair of the review panel
– 06. 11. 2017	HZG	George Pharr, A&M Univ, Texas, USA
– 21. 11. 2017	GSI	Enyo Hideto, RIKEN, Japan
– 13. 12. 2017	FZJ	Meigan Aronson, A&M Univ, Texas, USA
– 09. 01. 2018	HZB	Andrew Harrison, Diamond LS, UK
– 16. 01. 2018	HZDR	Manfred Fiebig, ETH, Schweiz
– 05. 02. 2018	DESY	Hugh Montgomery, Jlab, USA
– 13. 02. 2018	KIT	Andrew Taylor, STFC, UK

Results for the Program *Matter and the Universe*

Center
Level
(MU)

FZJ within MU – Observations

FZJ is involved in the program topic “Cosmic Matter in the Laboratory” (13 FTEs). Presently, resources for FZJ’s in-kind contribution for FAIR (25 FTEs) are associated but not directly related to the program.

HaN: “Contributions to the program are performed by the “Institut für Kernphysik” (IKP) and its sub-institutes.

- FZJ’s IKP-1 has a cohesive and excellent science program and an exciting trajectory for the future having leadership in the international collaboration PANDA at FAIR.
- IKP-2 is doing outstanding work as the international leaders in the quest to measure the electric dipole moment of the proton or deuteron in a storage ring. The work on neutrino physics has a high impact and is internationally competitive.
- IKP-4 is making outstanding science contributions through operating and improving the worldwide-unique polarized-proton synchrotron COSY, through designing and constructing – on schedule – the antiproton (and heavy ion) storage ring HESR for FAIR.

Results for the Program *Matter and the Universe*

Center
Level
(MU)

FZJ within MU – Performance and Recommendations

In each of the IKP institutes, there are activities that are forefront, crucial and excellent. They all strongly depend on the critical mass of people with great expertise in accelerator science and technology as well as in fundamental nuclear and particle physics.

Specific recommendations are:

- Preserve IKPs expertise on accelerator science and technology which belongs to the key competencies of FZJ and which should not be lost, at least not for the Helmholtz Association.
- The re-affiliation of FZJ's IKP activities to GSI (TransFAIR) under GSI roof could be a potential host for the existing activities, but make sure that expertise of IKP and the central technical support group (ZEA) at the FZJ main campus is used in the best possible way.
- Investigate and eventually demonstrate the feasibility of the storage ring EDM method (srEDM) at COSY which is the only existing facility where these studies can be performed, and keep the relevant competencies together in order not to lose them in ongoing sub-programs.

Results for the Program *Matter and the Universe*

Center
Level
(MU)

GSI within MU – Observations

GSI = Darmstadt + HI Mainz

GSI is involved in the program topic “Cosmic Matter in the Laboratory” (28 FTEs). Presently, resources for GSI’s in-kind contribution for FAIR (74 FTEs) are associated but not directly related to the program.

HaN: The [Helmholtz Institute Mainz](#) carries out a broad and exceptionally effective sub-program in this program topic ranging from investigating the properties of quark-gluon plasma, the physics of hadrons, nuclear matter at high densities, nuclear structure near and far from stability, nuclear astrophysics, atomic physics, and precision tests of QED in strong fields.

[GSI at Darmstadt](#) is focusing on the preparation and construction of FAIR, however, there are exciting opportunities in the ongoing physics program that directly lead to science at FAIR (SIS-18 and HADES), although they are primarily limited by the availability of beam time. Their leadership in science and hardware contributions in the ALICE experiment at CERN, and its upgrade, are outstanding. This work encompasses much of the technical development that will enable the FAIR CBM experiment. GSI’s capability to produce GeV/nucleon heavy ion beams of atomic number greater than 60 is unrivalled.



Results for the Program *Matter and the Universe*

GSI within MU – Performance and Recommendations

At present, GSI is one of the top three laboratories in the world in super-heavy element production (i. e. *confirmation* of the elements 113-117 at GSI and the single-atom spectroscopy and chemistry of super-heavy elements).

Specific recommendations are:

- Execute the experimental FAIR Phase 0 program efficiently to provide on-going world class science demonstrating the importance of the future FAIR program, while cultivating the user community that is essential for FAIR using the existing accelerators at GSI and synergistic facilities elsewhere.
- Strengthen the in-house theoretical and experimental efforts in the program topic while emphasizing career development for early stage scientists.
- Develop strategies to encourage on-site presence of faculty staff from nearby universities spending significant and meaningful research time at the laboratory on the Darmstadt campus.

Results for the Program *Matter and the Universe*

Program
Level
(MU)

Observations on the entire Program

- The research within program MU and its three topics (HEP, HaN, AP) is carried out using complex and technologically very challenging experiments at particle accelerators and other large-scale facilities, and with **synergies** in various detector technologies, electronics and computing.
- All review panels endorsed the new program structure of the research field Matter offering the opportunity that researchers in the program topics of elementary particle physics, hadron and nuclear physics, and astroparticle physics work strongly together within a common structure, which assures the overall competitiveness of the program topics.
- The program in general is well synchronized with international roadmaps and corresponding science driven discussions, and current achievements are in general aligned with the relevant milestones and plans.

Results for the Program *Matter and the Universe*

Program
Level
(MU)

Recommendations for the entire Program

- Strengthen the interplay between theory groups and experimentalists in all program areas.
 - Take a leading role in scientific computing in the research field. Make investments in line with center's scientific programs and continue playing a key role in the international computing projects. Encourage the Tier centers to continue their work on big data federation, and increase exposure of this work by more engagement with the broader international community dealing with increasing demands from all the scientific activities in the research field in order to cope with a very large amount of data.
 - Use the most important and common strength of the program, namely the contribution of talented people, who, in turn, attract more good people to join.
- ⇒ Overall the program MU with its topics and associated user-facilities was rated as excellent providing excellent and outstanding results.

Emphasized repeatedly in reviews

Results for the Research Field

Matter

Observations and Recommendations

- Outstanding systemic competence, strong complementarity and critical mass in many different areas to explore the structure of matter, and fully compliant with the mission of the Helmholtz Association to “develop and operate large-scale facilities for national and international scientific community”.
- Inventive program structure, allowing to act on recent/new developments enabling outstanding results
- Excellent Research Infrastructures and User Facilities => Prime example for the division of tasks within the German research system and for the cooperation between German and foreign universities

Recommendations

- Play a leading role in the development of roadmaps for User facilities and pursue the upgrade options
- Strengthen the interaction between theory and experimental groups in all three programs
- Make best use of the high attraction of the research field on young talents when recruiting

Remarks

- Very different number of FTEs performing in-house research in the research centers (from 10 to 99)
- FAIR was NOT part of this evaluation, but general remark made: FAIR is now back on track!

... Now Facing the Strategic Evaluation ...

...which will take place in January 2020

Matter

Hugh E.	Montgomery	Jefferson Lab, USA	DESY
Meigan C.	Aronson	Texas A&M University, USA	FZJ
Hideto	Enyo	RIKEN, Japan	GSI
Andrew	Harrison	Diamond Light Source, UK	HZB
Manfred	Fiebig	ETH Zürich, Switzerland	HZDR
Christina	Scheu*	MPG, Germany	HZG
Andrew	Taylor	STFC, UK	KIT
Ursula	Bassler	IN2P3 (Ex CEA), France	additional member
Sine	Larsen	U Copenhagen, Denmark	additional member
Michael	Peininger	RI Research Instruments GmbH	additional member
Freddy	Bordry	CERN, Switzerland	additional member

Research Centers & Program Structure of the Research Field

Program Structure of the Program Period IV

Matter and the Universe (MU)

Fundamental Particles and Forces

Cosmic Matter in the Laboratory

Matter and Radiation from the Universe

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Ion Beams

DESY, FZJ, GSI, KIT, IPP

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Matter and Technologies (MT)

Accelerator Research and Development

Detector Technologies and Systems

Data Management & Analysis

Facility Topic:
Data Centers

DESY, FZJ, GSI, HZB, HZDR, KIT