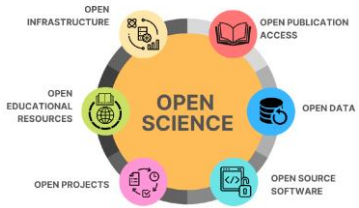
# Open Science at GSI/FAIR: Introduction

Andrew Mistry




GSI/FAIR Open Science Workshop 2023

19.10.23

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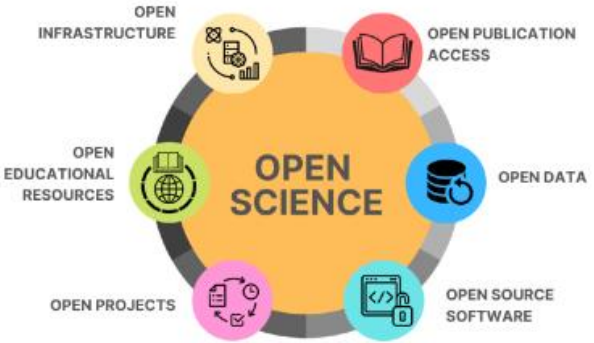
# What is Open Science?

- Science lives on the **open** exchange of knowledge
- ***Openness*** -> offers new prospects in the entire scientific research cycle and ***enables research outputs to be made openly accessible and broadly reusable*** (in sustainable infrastructures).
- This ***open culture*** of scientific endeavor is captured by the term "***Open Science***," Defined by the concepts of: ***transparency, sustainability, transfer, collaboration and sharing***
- *In essence:* Make **research outputs** (+ infrastructure) **publicly** available to science, industry, and society for reuse with ***as few barriers as possible***
- How to define and shape Open Science practices, tools and dissemination in a way that maximises the rewards and benefits? Important to consider what is ***useful for researchers!***
- **Open Science requires a shift in research culture**: it takes additional work and resources to practice open science: **Support needed from leadership**



# Why is Open Science important?

Accelerates **knowledge transfer** by breaking down access barriers to research outputs.

Fosters **collaboration** within and across disciplines, leading to quality improvements and new solutions.

Open Science promotes **transparency**, building **trust** among researchers and the public.

Attracting **future researchers**: Open Science signals inclusivity and appeals to diverse talent.

**Sustainability** improves as resource sharing reduces repetitiveness

Offers a **new metric** for research assessment to remove the outdated dependence on e.g. h-index

Strengthens **technology transfer** with industry partners

On the agenda of many **governments and funding bodies**

***Ultimately, the researcher should benefit from making research outputs open***

# Who are we? Open Science working group @GSI/FAIR

*Monthly meetings, started in April 2022*

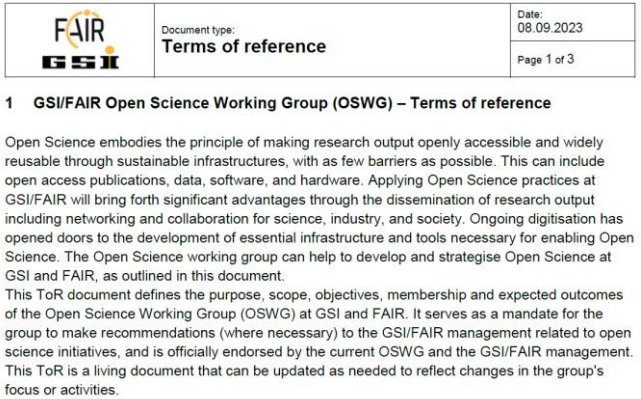
***40 Members:*** Researchers, IT department, library and documentation, accelerator division, scientific council representation, legal department, technology transfer department

***Plan and discuss*** open science national/international initiatives, OS progress at GSI(FAIR), sharing of ideas, new tools. Provides the link through the hierarchy

***Expected Outcomes*** Implement OS policies and guidelines, best practices, test new tools and promotion/communication facility-wide

***Email address(A.Mistry, Y. Leifels):*** open-science@gsi.de

*Endorsed by the GSI/FAIR management:Sept 2023*



| | Document type: Terms of reference | Date: 08.09.2023 |
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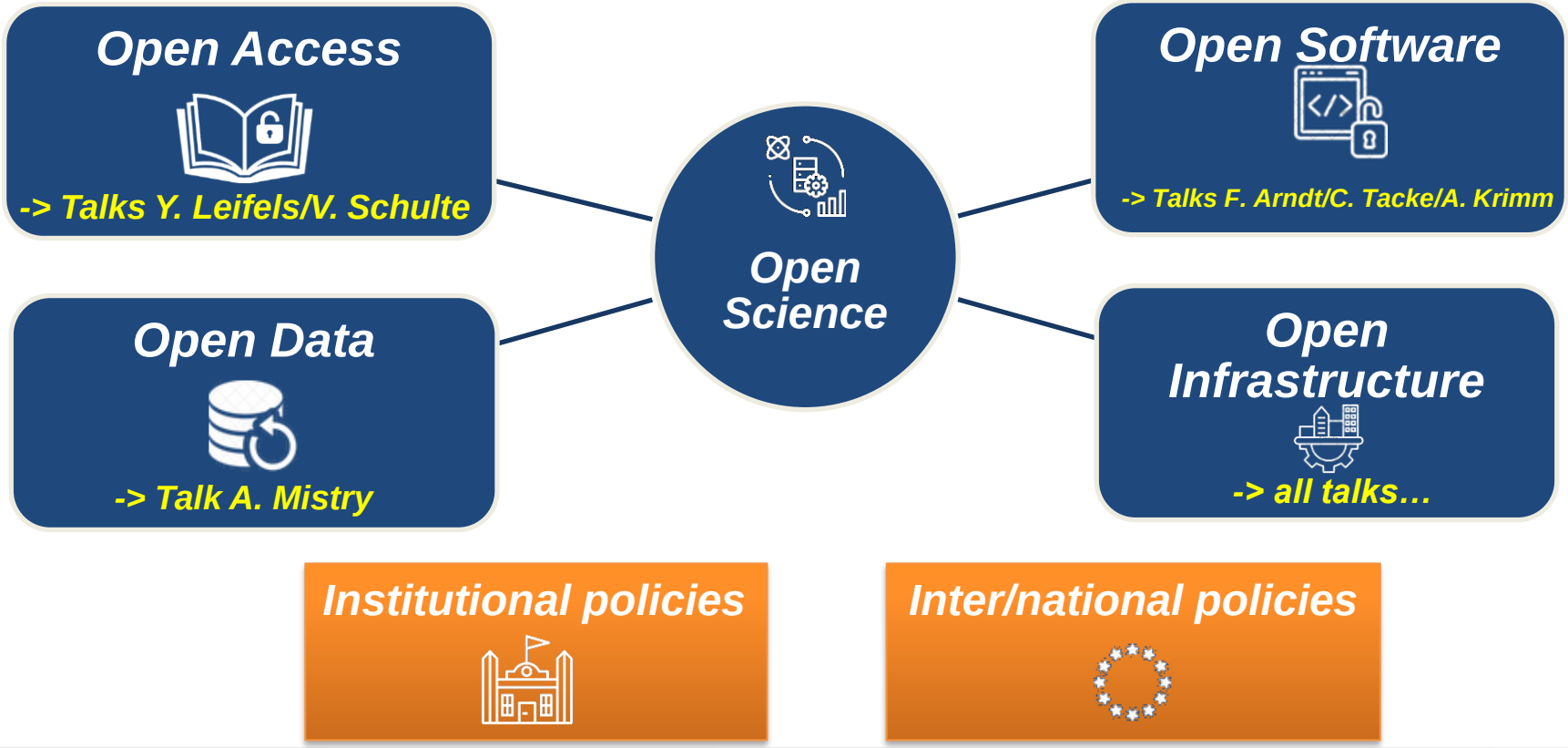
| FAIR GSI | | Page 1 of 3 |

**1 GSI/FAIR Open Science Working Group (OSWG) – Terms of reference**

Open Science embodies the principle of making research output openly accessible and widely reusable through sustainable infrastructures, with as few barriers as possible. This can include open access publications, data, software, and hardware. Applying Open Science practices at GSI/FAIR will bring forth significant advantages through the dissemination of research output including networking and collaboration for science, industry, and society. Ongoing digitisation has opened doors to the development of essential infrastructure and tools necessary for enabling Open Science. The Open Science working group can help to develop and strategise Open Science at GSI and FAIR, as outlined in this document.
This ToR document defines the purpose, scope, objectives, membership and expected outcomes of the Open Science Working Group (OSWG) at GSI and FAIR. It serves as a mandate for the group to make recommendations (where necessary) to the GSI/FAIR management related to open science initiatives, and is officially endorsed by the current OSWG and the GSI/FAIR management. This ToR is a living document that can be updated as needed to reflect changes in the group's focus or activities.

# The Pillars of Open Science



# Open Science Policies/Statements

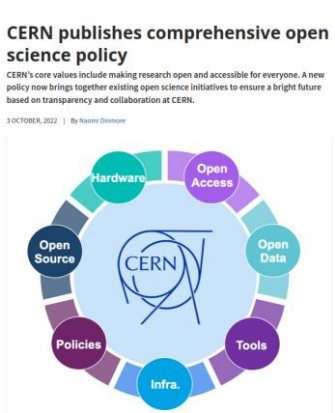
Number of Open Science polices as

**broader statements**

**- Can be broad OS policy or separate Policy for each pillar**

**Institutional**

**Inter/national**



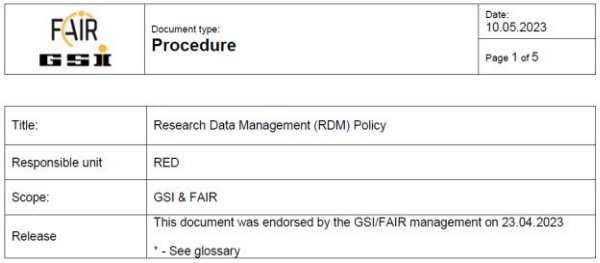
*Literature: Moradi & Abdi.*, **Open Science-related policies in Europe**, *Science and Public Policy,* (2023) https://doi.org/10.1093/scipol/scac082

# GSI/FAIR Open Science related Policies/Guidelines

**GSI/FAIR**

Research Data Management Policy

(2023)



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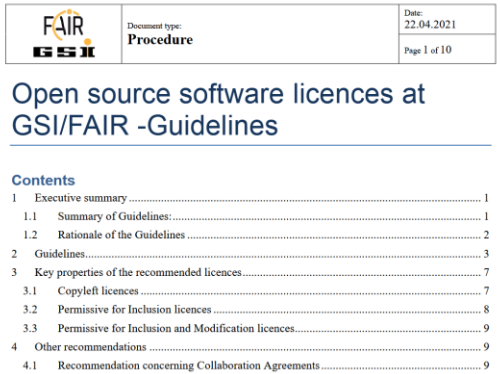
| | |
|---|---|
| Title: | Research Data Management (RDM) Policy |
| Responsible unit | RED |
| Scope: | GSI & FAIR |
| Release | This document was endorsed by the GSI/FAIR management on 23.04.2023<br>* - See glossary |

Software licensing guidelines(2021)



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Open source software licences at GSI/FAIR -Guidelines

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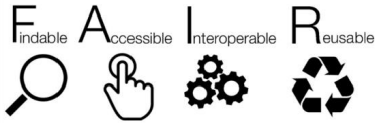
***Coming soon:***

*RDM Guidelines*

*Publication Guidelines*

*Research Software Guidelines*

# F.A.I.R Principles outlines (briefly for info)



**Findable**

**F1** (Meta)data are assigned a globally unique and eternally **persistent identifier**.

**F2** Data are described with **rich metadata**.

**F3** Metadata clearly and explicitly include the **identifier of the data it describes**

**F4** (Meta)data are **registered or indexed** in a searchable resource.

**Accessible**

**A1** (Meta)data are **retrievable** by their identifier using a standardized communications protocol.

**A2** Metadata are **accessible**, even when the data are no longer available

**Interoperable**

**I1** (Meta)data use a formal, accessible, shared and broadly applicable **language** for knowledge representation.

**I2** (Meta)data use **vocabularies** that follow FAIR principles

**I3** (Meta)data include **qualified references** to other metadata

**Reusable**

**R1** (Meta)data are **richly described** with a plurality of accurate and relevant attributes.

**R2** (Meta)data are released with a clear and accessible data usage **license**.

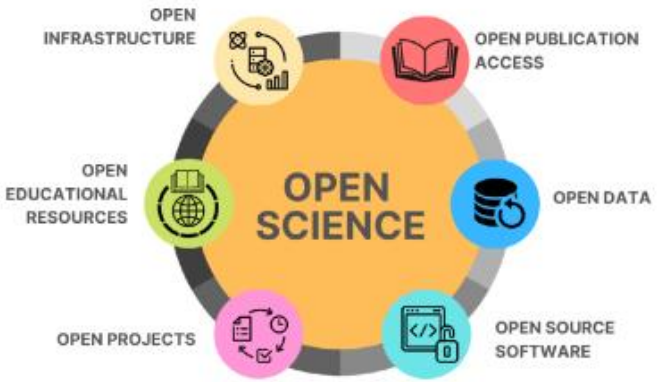
**R3** (Meta)data are associated with **detailed provenance**

**R4** (Meta)data meet domain-relevant **community standards**.

Wilkinson *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016). https://doi.org/10.1038/sdata.2016.18

# Open Science @ GSI/FAIR: What we want to achieve

- **Open Access Publications** –> Mandatory publication of Open Access articles
- **Research Data** –> Publish research data in suitable repositories (F.A.I.R. Data)
- **Open Software** –> Make open source whenever possible (F.A.I.R. Software)
- **Open Projects** –> Open Projects in research and industry
- **Open Educational resources** -> Teaching and training
- **Open Infrastructure** -> Enable the tools to practice Open Science
- Develop an **Open Science Ecosystem** to combine everything

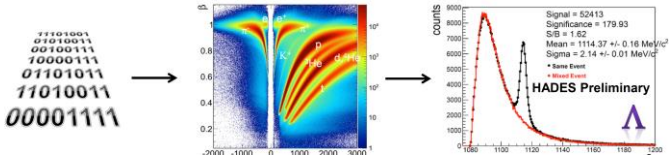



***Considerations:***

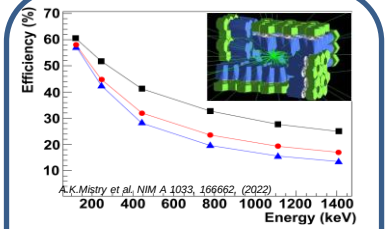
- The steps and processes to achieve this are complex… **Start easier and iterate**
- Work with and develop **internally and with external partners** for common goal ***-> All Talks***
- Needs finer granularity, case-by-case basis and **use-cases** ***-> Talks E. Clerkin, S. Sanjari, A. Marin Garcia***
- Aim to address **all researchers who use GSI/FAIR**: Students, Postdocs, PI's, Group leaders…
- **Teaching and communication** important!

# Research Data and Software at GSI: Rich and varied

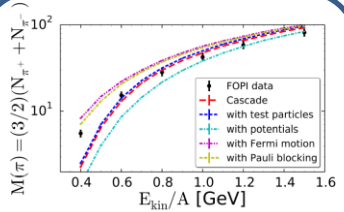
***Experimental Data:***



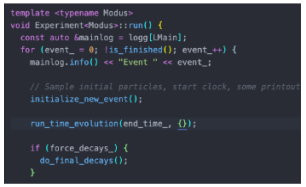

*Raw* *Pre-processed* *Result*



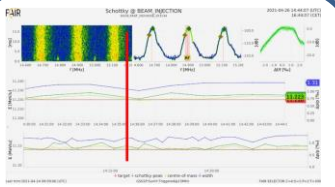

*Simulation*




*Theory*



*Software*

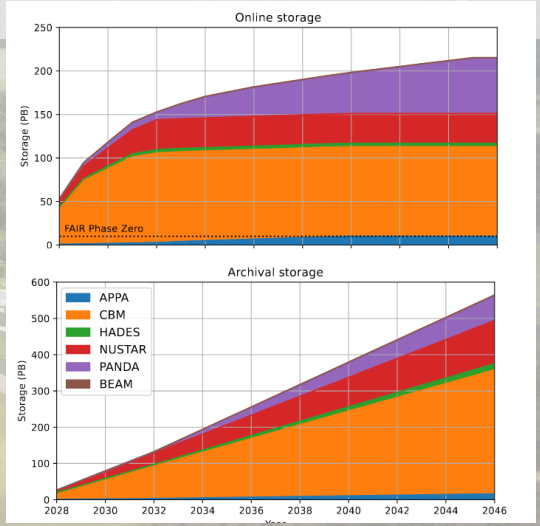


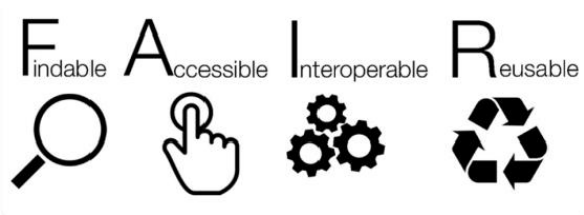
*Machine Parameters*

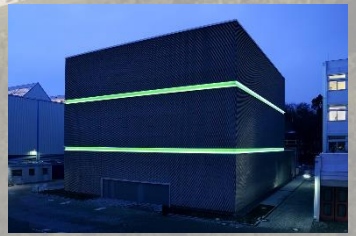
| Research Area | Exp. Run Time | Raw Data | Calibrated Data | Simulations | Final Datasize |
|---|---|---|---|---|---|
| Heavy-ion reactions | 3 weeks | 130TB | 300TB | 150TB | <1TB |
| Materials Science | ~Minutes | ~MB - GB | - | - | 10MB |

# FAIR Goes F.A.I.R *-> Talk J. Messchendorp*

- **'FAIR goes F.A.I.R**': commitment to open science
- Towards the next generation "**data challenge**"
- **~TB/s data rates**, online processing, 105 -106 cores
- **Distributed computing** with a large user community
- **Data preservation** and **accessibility** key to success
- **HPC** Green cube expansion



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# GSI/FAIR Involvement in External OS projects

ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructures

NuPECC

eosc

EURO-LABS
EUROPEAN LABORATORIES FOR ACCELERATOR BASED SCIENCES



PUNCH 4NFDI

HELMHOLTZ Open Science

HMC HELMHOLTZ Metadata Collaboration

***OpenTransfer Project***

ELEMENTS

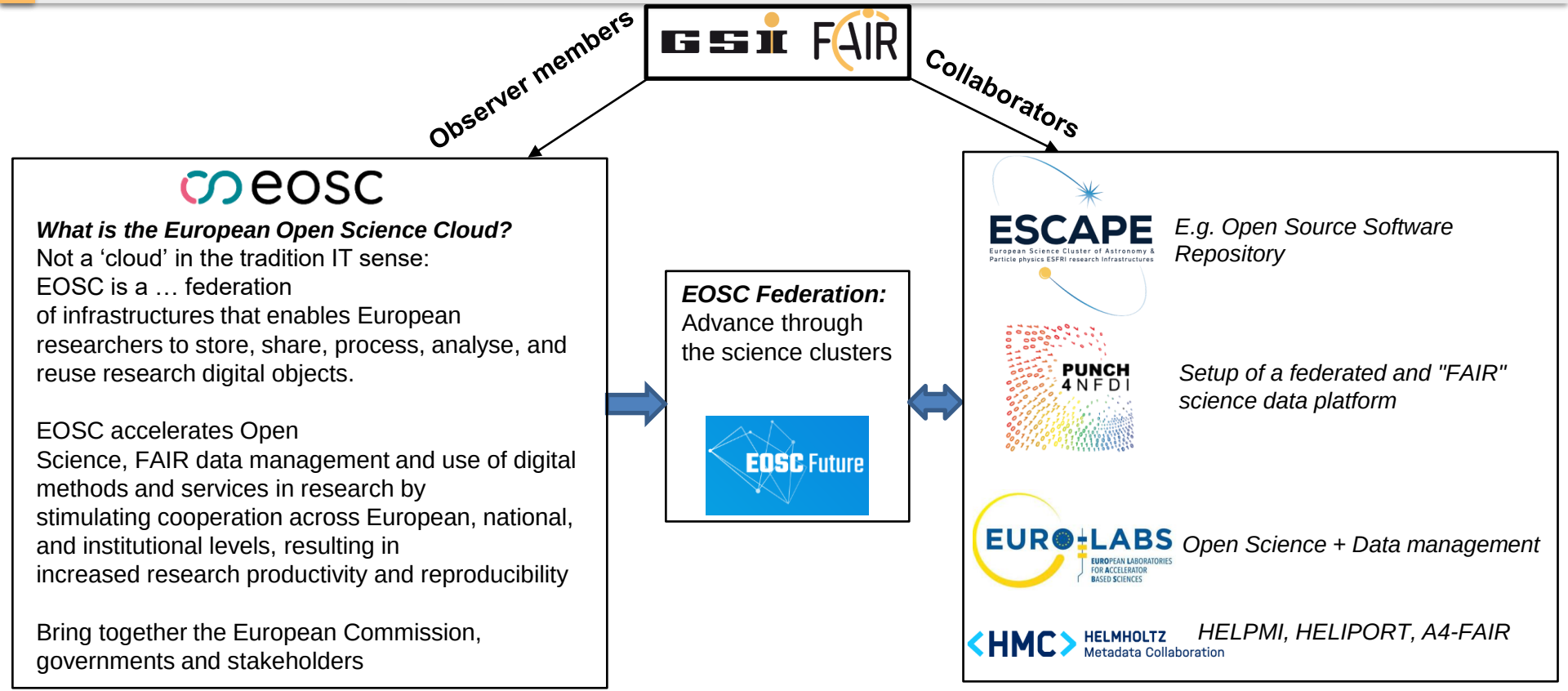
MTDMA

# GSI/FAIR Involvement in External OS projects

| | |
|---|---|
| ESCAPE | ***E**uropean **S**cience **C**luster of **A**stronomy & **P**article Physics **E**SFRI Research Infrastructures:* Open Source Software Repository (OSSR) developer and maintainer ***-> Talk C. Tacke*** |
| NuPECC | ***Nu**clear **P**hysics **E**uropean **C**ollaboration **C**ommittee:* Participation Open Science section of the LRP 2024 |
| eosc | ***E**uropean **O**pen **S**cience **C**loud:* GSI/FAIR both observer members, contribution and suggestions for EOSC Future |
| EURO-LABS | ***Euro**pean **Lab**oratorie**s** for Accelerator based Science* Work Package on Open, diverse and inclusive Science ***-> Talk C. Hornung*** |
| PUNCH4NFDI | ***P**articles, **U**niverse, **NuC**lei and **H**adrons **for** the **NFDI**:* Two Task areas; Developments on data portal, AAI, data lake and other infrastructure from GSI IT department and Research division ***-> Talk I.Knezevic*** |
| MT DMA | ***M**atter and **T**echnology, **D**ata **M**anagement and **A**nalysis:* IT contributions |
| HELMHOLTZ Open Science | ***Helmholtz Open Science Office**:* Members of the OS, software and POF IV indicators working groups ***-> Talk C. Bruch*** |
| HMC HELMHOLTZ Metadata Collaboration | ***H**elmholtz **M**etadata **C**ollaboration:* Participation in HMC funded projects; HELIPORT, HELPMI ***-> Talks O. Knodel + U.Eisenbarth*** |
| **OpenTransfer Project** | *Technology Transfer:* new methods for the improved transfer of knowledge and technologies in the context of Open Science ***-> Talk K. Göbel/V.Voroshnin*** |

# EOSC + PUNCH + ESCAPE + …

*->Will appear in multiple talks*



# Developments: GSI/FAIR Open Science Website

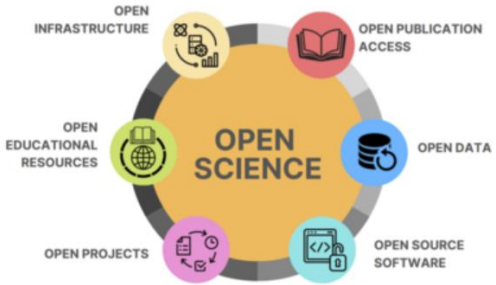
***Email address:*** open-science@gsi.de

***GSI/FAIR Open Science Webpage:*** https://www.gsi.de/open-science

- **Forschung**
  - Publikationen
  - Ethik & Regeln
  - **Open Science**
  - APPA/MML
  - Biophysik
  - CBM/NQM
  - NUSTAR/ENNA
  - PANDA/Hadronen
  - Theorie
  - FAIR Forschung NRW
  - Detector Laboratory
  - Experimentelektronik
  - Targetlabor
  - Bibliothek und Dokumentation

GSI > @Work > Forschung > Open Science

## Open Science GSI/FAIR




For questions, comments, and support please contact ✉ open-science(at)gsi.de

### What is Open Science?

Open Science is the practice of making scientific research output openly available in the form of data, software, publications, hardware and infrastructure. This promotes transparency, collaboration, and reproducibility in research, as well as wider access to knowledge for the public and to researchers.

GSI and FAIR are committed to Open Science practices and provide tools, support, and information to internal and external researchers involved in GSI/FAIR projects. Organisations such as UNESCO, the DFG, the BMBF and Helmholtz among many others have recognized the benefits of Open Science, and have issued recommendations to support the movement.

The GSI/FAIR Open Science Working Group hosts monthly meetings to promote and advance Open Science at within the facilities. Membership of this group comprises researchers from a variety of disciplines, as well as members from the accelerator division, Grant Office, Technology Transfer, IT, and Library and Documentation.

Adopting Open Science principles aligns with good scientific practice, and more information on this can be found on the GSI/FAIR Ethics and Rules webpage

The GSI policy on Research Data Management can be found here.

The GSI guidelines on Software licences can be found here (Internal only).

- **Open Access of publications**
- **Open Data**
- **Data Management Planning**
- **Data Publication**
- **Open Software**
- **Experiment logging and Notebooks**
- **Links to Open Science Projects GSI/FAIR Involvement**
- **Additional Material and Training**

## Summary

- **Open Science as a practice of making research outputs openly available is under development at GSI/FAIR and beyond**
- **The Open Science working group is founded to investigate and implement OS practices**
- **We are working with external projects and collaborations develop the infrastructure and measures needed**
- **We want to work closely with researchers on all aspects and support them in their efforts, iterative process needed**
- **Support from top (management level) essential, as well as engagement from all levels**

**This workshop will include some Open Science aspects (not exhaustive!)**

**Goal: Use case from each group at GSI! -> Develop from there**

**Open Science related questions or Comments: open-science@gsi.de**
**Website Open Science @ GSI/FAIR: https://www.gsi.de/open-science**

***Thanks for your attention!***