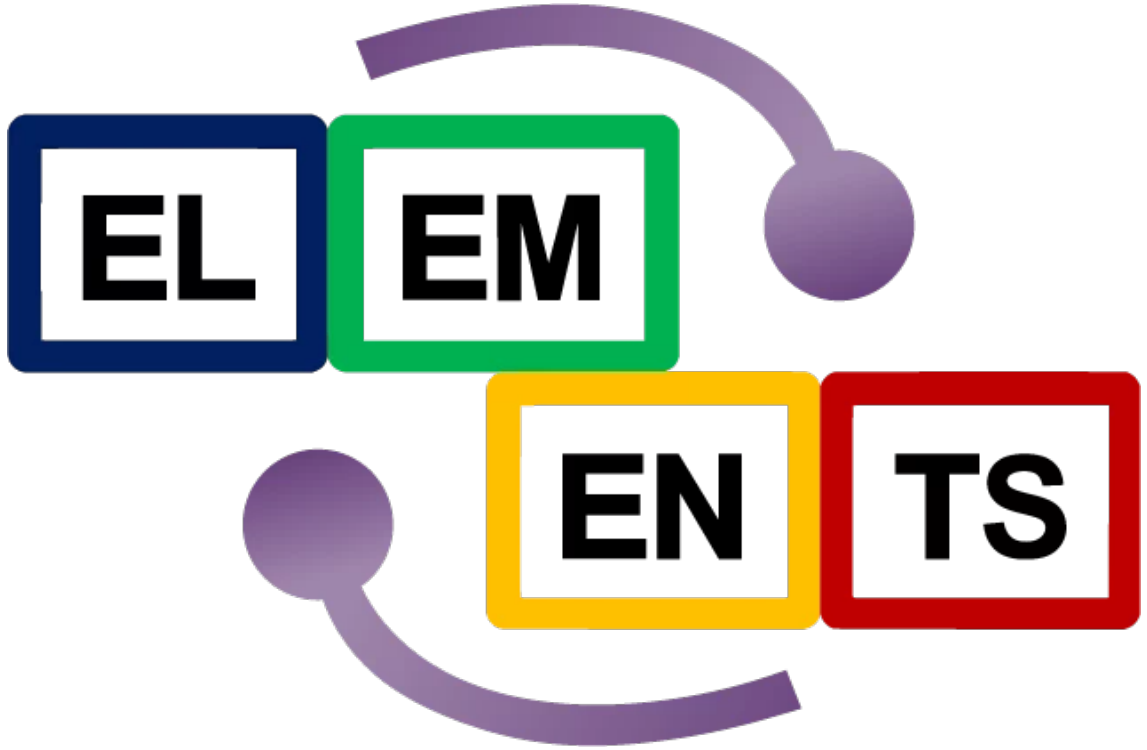

Exploring the Universe from Microscopic to Macroscopic Scales

Dr. Mohab Abou Zeid, ELEMENTS Administrative Director

EXPLORE 2024 Summer School
FIAS, Frankfurt, 21 August 2024

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
TECHNISCHE UNIVERSITÄT DARMSTADT
GOETHE UNIVERSITÄT FRANKFURT AM MAIN
GSI

HESSEN
Hessisches Ministerium für Wissenschaft und Kunst

ELEMENTS is a Research Cluster funded by the HMWK (2021-2025)

ELEMENTS aims at understanding **heavy-elements nucleosynthesis** from **first principles**

There has been a revolution in astrophysics over the past two decades and now is a unique time to address the following question, which is the main one for ELEMENTS:

Where do gold and the other heavy elements come from?

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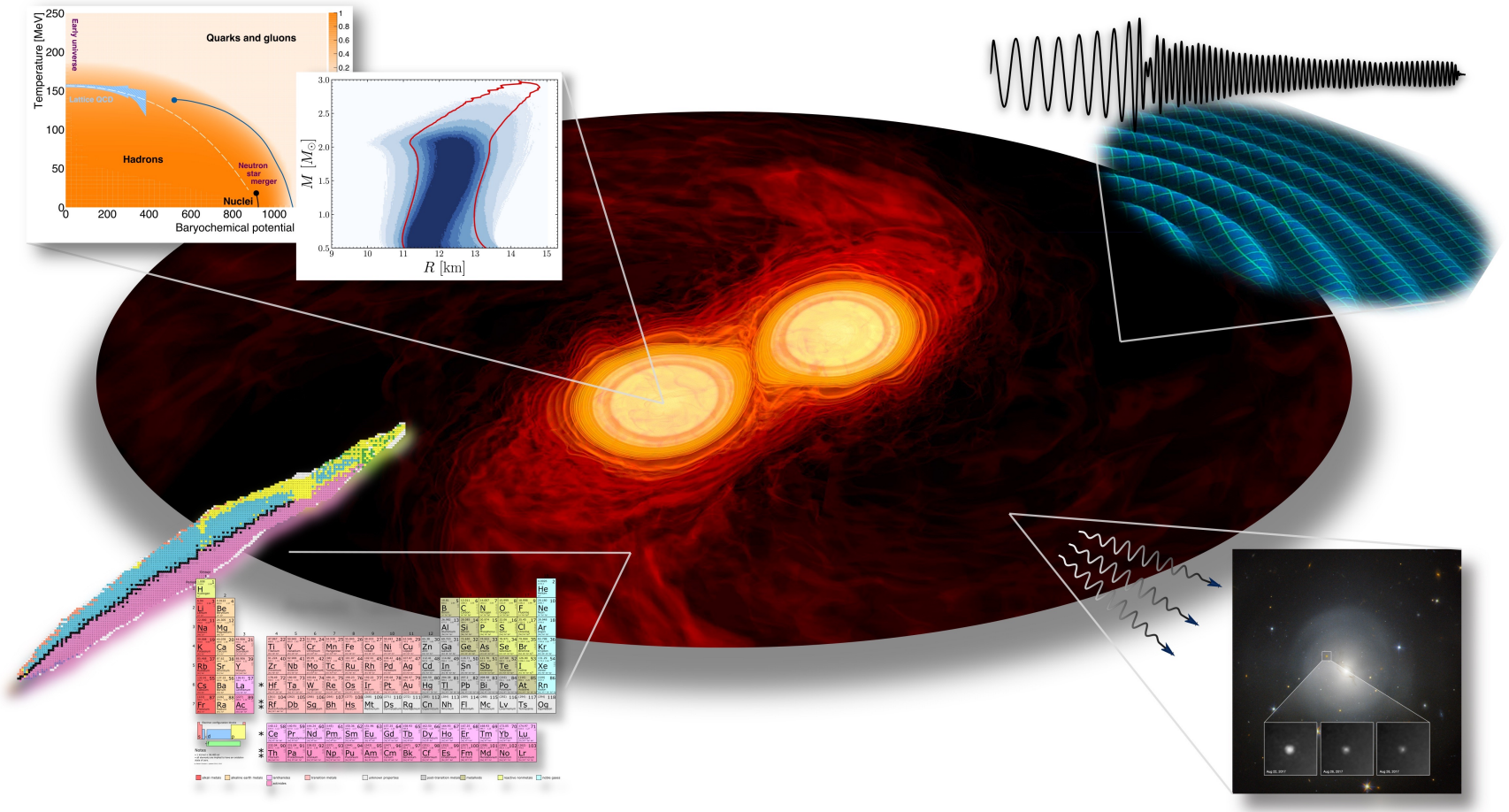
Microphysics of strong interaction

Macrophysics of strong interaction



Microphysics of the r-process

Macrophysics of the r-process

FOUR ELEMENTS INTERRELATED WORK AREAS TO ADDRESS THESE QUESTIONS:

What are the properties of matter under extreme conditions?

What information about merging binary neutron stars is provided by gravitational waves and other ejecta?

What are the microphysical conditions under which r-process nucleosynthesis operates?

What do astronomical observations tell us about the synthesis of heavy elements?

WA1: the **microphysics** of the **strong interaction**

WA2: the **macrophysics** of the **strong interaction**

WA3: the **microphysics** of the **r-process**

WA4: the **macrophysics** of the **r-process**

ELEMENTS aims to provide the ***„complete scientific production chain“*** of heavy elements from fundamental interactions to observations on Earth

Who is in our team (I)?

Principal Investigators

- Good mix of seniority and expertise
  - demonstrated outstanding leadership
  - several prizes and awards
  - highly visible: conferences, journals, panels, etc.
- **9** PIs recognised as in **top 2%** of their fields (Stanford citation analysis)
- **12** (8) **ERC–Grants** (Grantees)
- **1 Leibniz-Prize** (2022)
- **1 (+1) AvH / 1 Heisenberg** – Professorships
- **32%** female (German physics average: 12%)
- **8** PIs with **international** background

  (1 Danish, 1 French, 2 Italian, 1 Russian, 2 Spanish, 1 Ukrainian)
- average age of PIs: **48 yrs**

Who is our team (II)?

Director and Officers

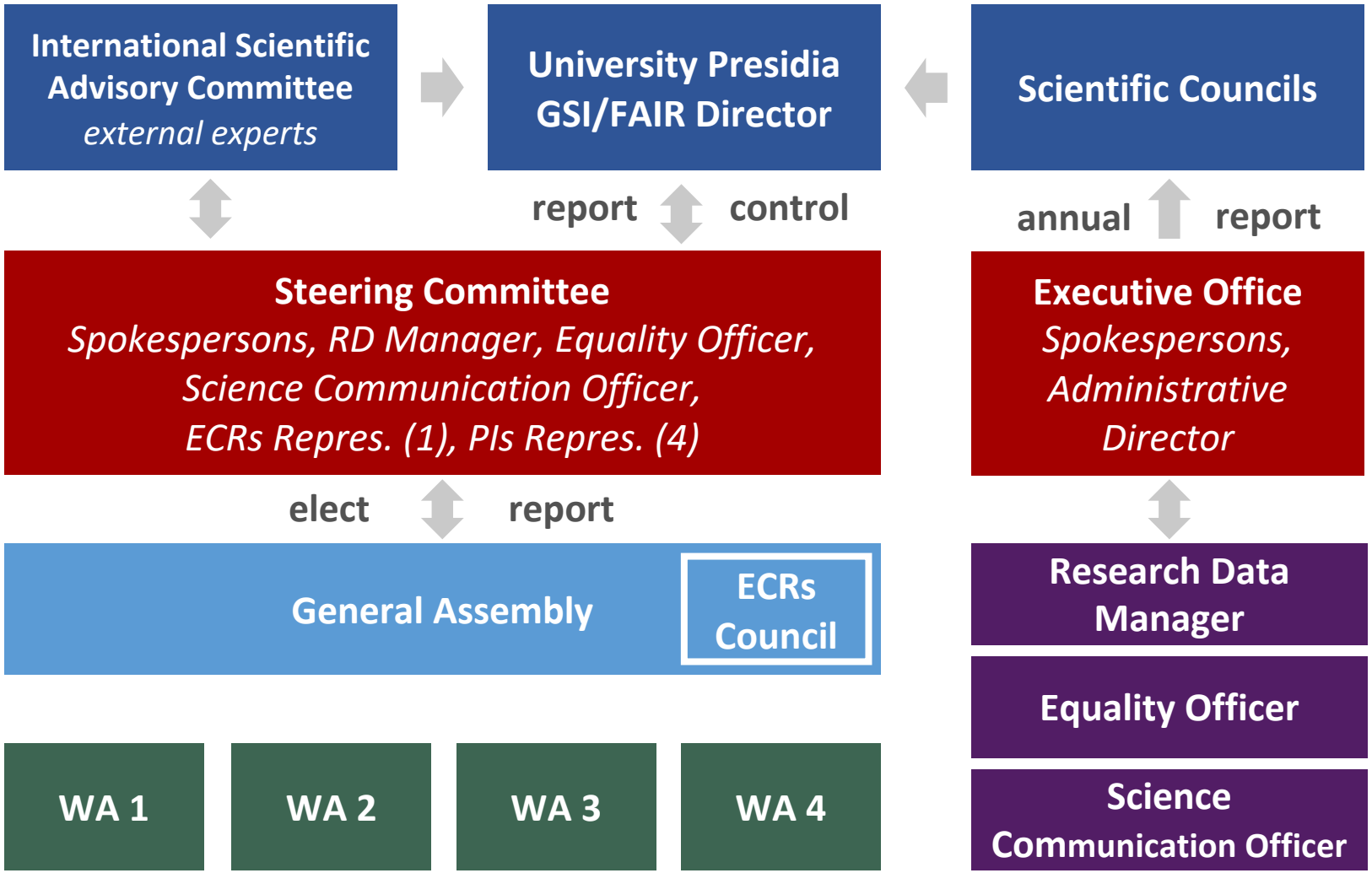
- **Administrative Director**
  Dr. Mohab Abou Zeid
- **Administrative Assistants**
  Ms. Jessica Kramer, Ms. Christin Schlemm
- **Science Communication Officer**
  Dr. Phyllis Mania
- **Equal Opportunities Officer**
  Dr. Enikö Baga
- **Research Data Manager**
  Dr. Johann Isaak

ELEMENTS Support Structures

- ***Research-Oriented Teaching:*** English Master Courses *„Accelerator Science“* and *„Nuclear Astrophysics“*
- ***Early-Career Researchers:*** Ira Rischowski-Program, Young Investigator Groups
- ***Internationalization****:* highly international environment, intense visitors program, guest lecturers, Ira Rischowski-Program,
- ***Governance & Quality Management:*** (**Dr. Abou-Zeid**), INGA, Int'l Advisory Board
- ***Science Communication:*** Science Comm. Officer (**Dr. Mania**), ELEMENTS-Van, TURMsouth, Neutron Star exhibit
- ***Equality and Diversity:*** Equality Officer (**Dr. Baga**), Ira Rischowski-Program, WOW-Physics!
- ***Research Data Management:*** RDM-Officer (**Dr. Isaak**), PUNCH4NFDI
- ***Open Access:*** *„green-OA"* strategy, arXiv, RMU-open access policy
- ***Sustainability:*** reduction of CO_2 footprint; energy-recycling accelerators; Green IT Cube

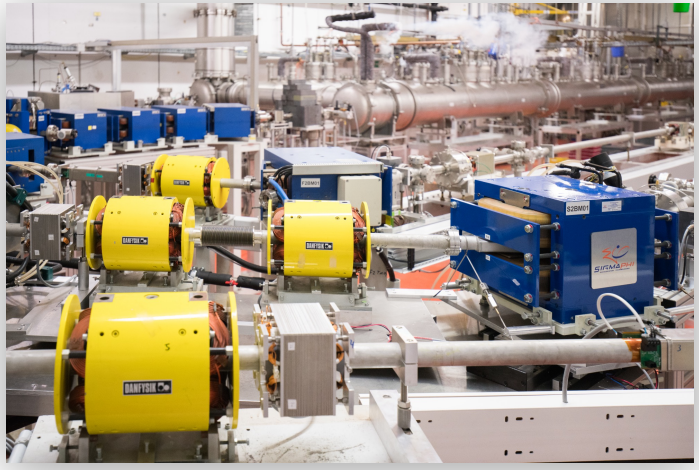



ELEMENTS organisation



World-unique Large-Scale Research Infrastructure

GSI/FAIR (top left) and **S-DALINAC** (bottom) at Darmstadt



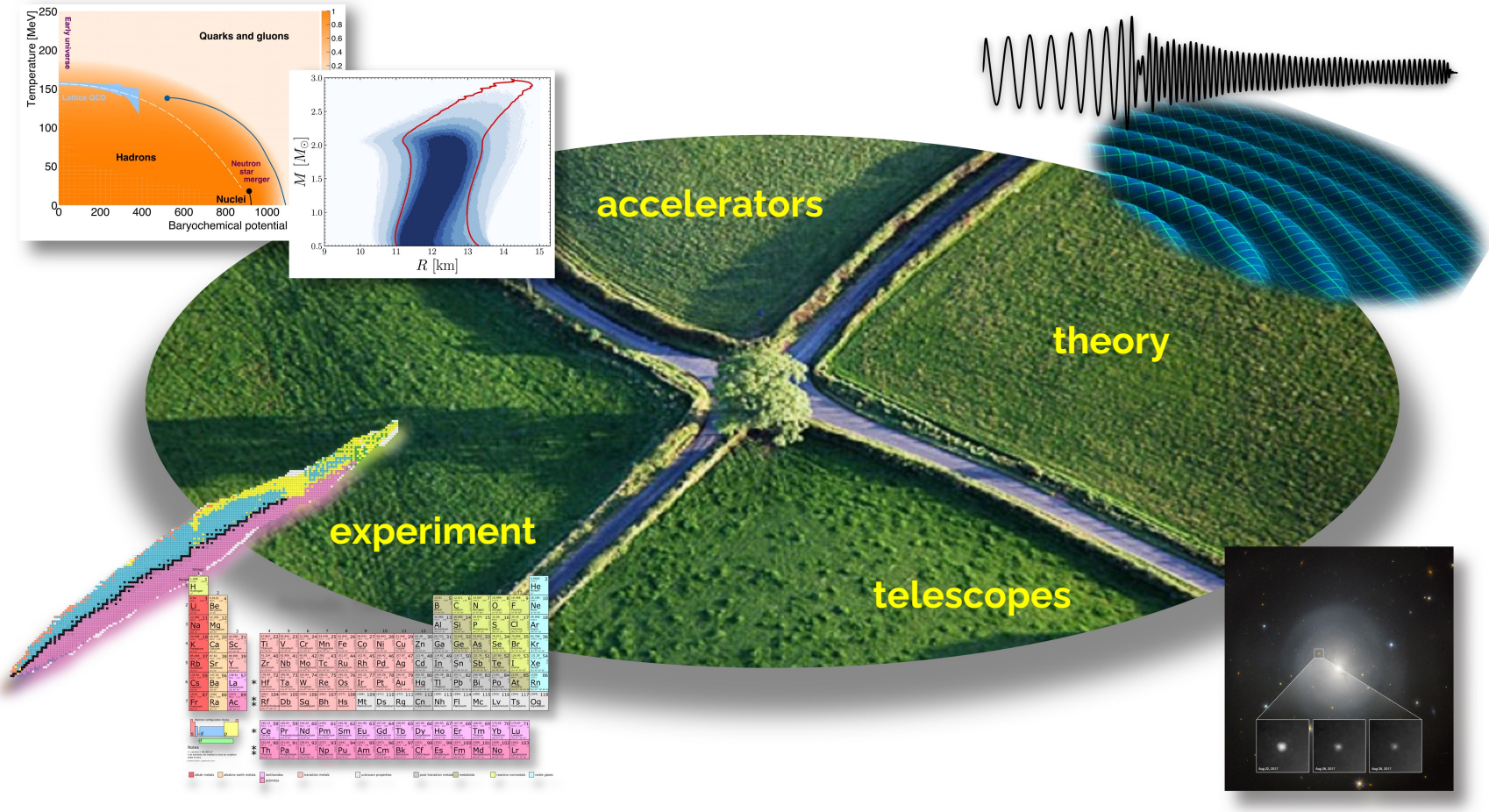
Experimental Infrastructure

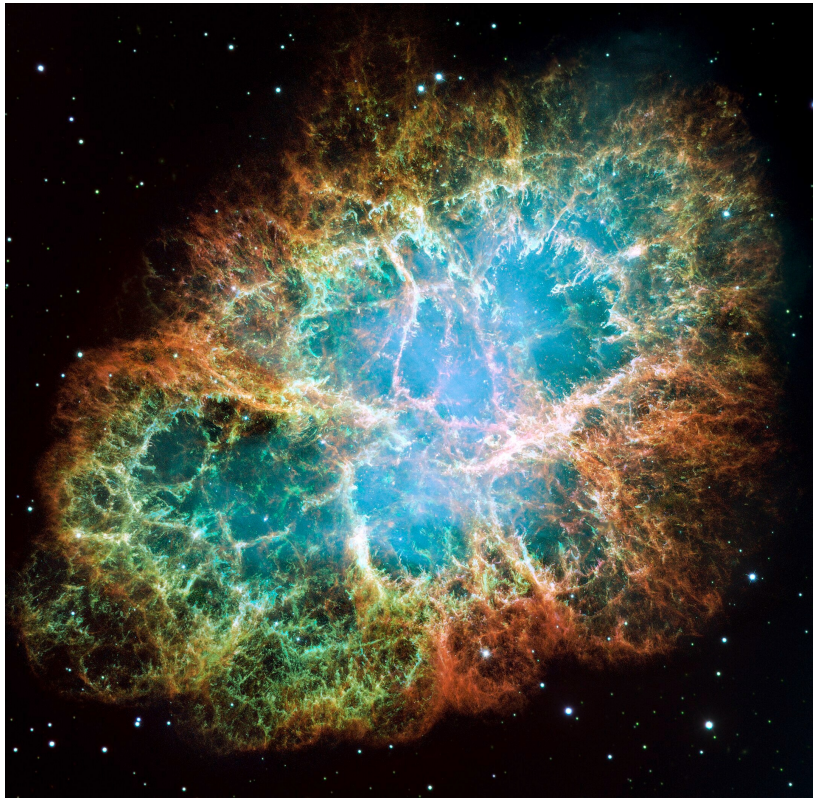
- GSI/FAIR (CRYRING,ESR,HADES,R3B)
- S-DALINAC / DICE@ESR
- PUMA @ CERN
- HEAVENS

Computational Infrastructure:

- Goethe-CSC
- Lichtenberg-II
- Green IT Cube

ELEMENTS is a **crossroad: nuclear/gravitational/astro-physics**





Thank you for your attention!