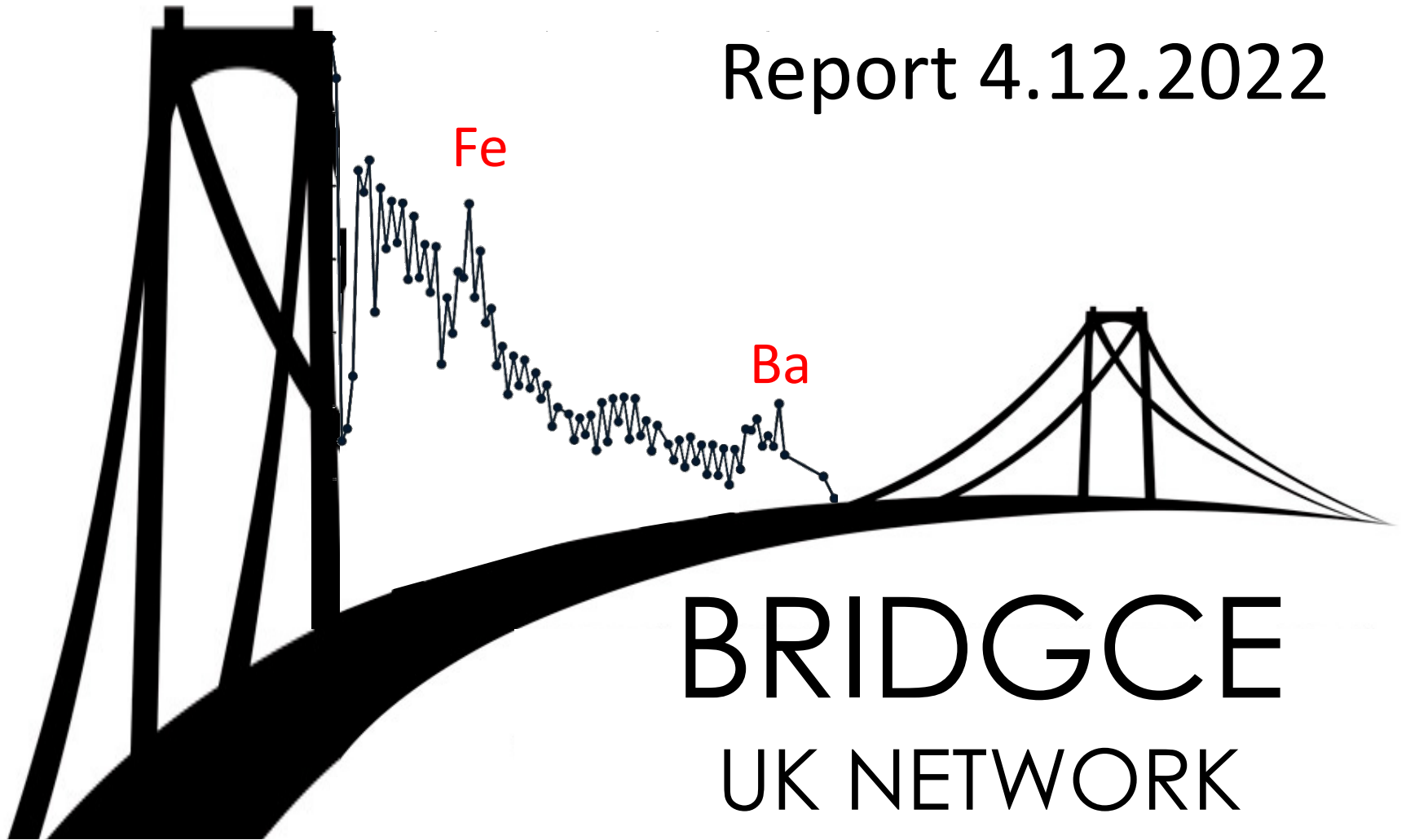


# BRIDGCE: BRIdge the Disciplines related to the Galactic Chemical Evolution

Report 4.12.2022



<http://bridgce.ac.uk>

# BRIDGCE Network

- Started in 2013, led by Raphael Hirschi (Keele)
- **75 researchers** from **19 UK universities**; to join, **just sign up** at <http://bridgce.ac.uk>
- Chair: Chiaki Kobayashi (Hertfordshire), since 2019
- Research network on nuclear astrophysics, similar to EU ChETEC and US JINA
- Aim: knowledge transfer between different disciplines
- All BRIDGCE members are entitled to join IReNA, by agreeing its rule on <http://www.jinaweb.org>

# Multi-discipline

## **Nuclear Astrophysics**

Reaction Rates: GSI-  
FAIR, CERN-nToF, Ganil

## **Stellar Physics**

Stellar Mass Loss  
Stellar Evolution  
Supernovae  
Nucleosynthesis  
Rotation vs Binary

## **The Milky Way**

Galactic  
Archaeology (GA)  
surveys: Gaia,  
APOGEE, HERMES-  
GALAH, 4MOST,  
WEAVE, MSE...

## **External Galaxies**

Integral Field Unit  
(IFU) surveys:  
SAURON, MaNGA,  
CALIFA, SAMI, Hector,  
KMOS, MUSE,  
NIRSpec/JWST!

## Steering committee

- Chiaki Kobayashi (Hertfordshire), chair
- Clare Worley (IoA Cambridge) for observations
- Stuart Sim (Belfast) for supernovae/transients
- Raphael Hirschi (Keele) for stellar evolution
- Alison Laird (York) for nuclear physics

# BRIDGCE Consortium for funding

- Continuously funded by STFC in 2014, 2017, 2020
- In the 2020 round, 2 PDRAs funded, out of 5 projects (40% success rate!)
- But STFC grant scheme is changing...
- Large Grant in ~~2023~~2024?
  - Eligibility: academic members of staff (lecturers or equivalent) or hold a Fellowship, such as an STFC or Royal Society Fellowship, won through open competition.
  - if you are interested in contact the potential PI (Chiaki Kobayashi)

# BRIDGCE activities 2022

- NAM parallel session 2022, Warrick/online, led by **Erin Higgins** (Armagh), “Bridging stellar interactions with galactic chemical evolution, nucleosynthesis and dust”, 1.5 hrs x 2 on 15 July
- NAM parallel session 2023, 3-7 July, Cardiff, **if anyone is interested in leading a proposal (deadline 31 Jan), contact CK asap**
- AM 2022 winter, Keele/online, led by **Federico Rizzuti** (PhD student!)
- Support for **students/ECRs**, e.g., opportunities of oral presentation and organizing meetings
- Monitoring **diversity and inclusion** (more later)
- Website may be updated, volunteer wanted...

# Some selected News

- Please feel free to upload news/events on BRIDGCE web (if you have the access right) or e-mail me (so that I can upload it).
- Surrey→Herts: **Dr. Rob Yates**, CAR fellow
- Cambridge→NZ: **Dr. Clare Worley**, senior lecturer at University of Canterbury, Christchurch
- Belfast→Oxford: **Prof. Stephen Smartt**, Wetton Professor of Astrophysics, Director of the Hintze Centre for Astrophysical Surveys
- EU ChETEC-INFRA, EU Community of Research Infrastructures, led by Hirschi, see 2020 annual report on web.

# BRIDGCE joined IReNA! 20<sup>th</sup> Jan 2022

<https://msutoday.msu.edu/news/2022/irena-welcomes-new-partners>

## MSUTODAY

They join other networks that comprise IReNA: [Joint Institute for Nuclear Astrophysics](#) - Center for the Evolution of the Elements, or [JINA-CEES](#); [Center for the Evolution of the Elements as Tracers of the Evolution of the Cosmos](#), or [ChETEC](#); [ExtreMe Matter Institute](#), or [EMMI](#); [Nucleosynthesis Grid collaboration](#), or [NuGRID](#); [Collaborative Research Center "The Milky Way System"](#), or SFB 881; and [Japan Forum of Nuclear Astrophysics/UKAKUREN](#).



The Michigan State University-led International Research Network for Nuclear Astrophysics has expanded to include three new partners in its global quest to answer science's most important questions. Credit: Facility for Rare Isotope Beams

"We are very excited about the 'bridge over the Atlantic Ocean' joining the UK BRIDGCE research network and U.S.-based IReNA," said Chiaki Kobayashi, chair of BRIDGCE's steering committee and professor of astrophysics at the University of Hertfordshire, UK. "This bridge opens up excellent opportunities to exchange multidisciplinary knowledge and expertise, establish international connections and enhance training of the next generation of researchers. Our goal is to understand the origin of elements such as gold and platinum in the universe."

# ERC Synergy Grant HEAVYMETAL

**Dr Stuart Sim from Queen's University Belfast (QUB), a member of the BRIDGECE steering committee has been awarded funding as part of the 11M Euro European Research Council Synergy Grant "HEAVYMETAL".**

HEAVYMETAL is a multi-institution research project that will bring together experts in astronomical observation, experimental plasma spectroscopy, and numerical simulations to study mergers of neutron stars, with a key aim of understanding how nucleosynthesis of the heaviest chemical elements take place in the immediate aftermath of these events.

Prof Darach Watson (University of Copenhagen, Denmark) has already played a key role in the interpretation of existing kilonova spectra, and will be leading observational work in HEAVYMETAL from Copenhagen. Dr Andreas Bauswein will lead the development of simulations of merger dynamics, and associated nucleosynthesis calculations in HEAVYMETAL at the GSI Helmholtzzentrum für Schwerionenforschung (Germany). Prof Pádraig Dunne at University College Dublin (Ireland) is an expert in plasma spectroscopy who will lead experimental work to study the spectra of heavy ions, providing the atomic physics measurements needed to identify these elements in astrophysical spectra. At Queen's University Belfast, Dr Sim will be performing numerical radiative transfer calculations, working closely with his QUB colleagues, Dr Catherine Ramsbottom and Dr Connor Ballance, who are leaders in the theoretical calculation of the atomic data needed for modelling spectra of heavy elements.



# BRIDGCE poster/brochure is available



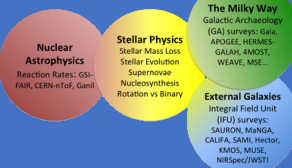
## Overview

BRIDGCE is a UK-wide network, supported by the Science and Technology Facilities Council (STFC), part of UK Research and Innovation.

The goal of this network is to facilitate collaborations across the different disciplines involved in the study of the origin of the elements, as well as the use of chemical elements as tracers of the evolution of the Universe.

Currently 75 members (33% female) from 19 institutes across the UK are involved. We have an open membership policy – any UK-based researchers (students, postdocs, and faculty) who work in the relevant research areas can join by signing up on the website: [www.bridgce.ac.uk](http://www.bridgce.ac.uk)

## Research Areas



## Aims

The main goals of BRIDGCE are the following:

**Facilitate** transfer of knowledge and collaborations related to the origin of the elements across the various disciplines and institutions in the UK.

**Develop** synergy between the various expertise available in the UK. A BRIDGCE consortium grant has been awarded from the STFC since 2015.

**Liaise** with other national and international networks (e.g. JINA and CHETEC) which share the same goals. All BRIDGCE members are eligible for joining IReNA and applying for financial support.

**Enhance** PhD student training in this multi-disciplinary research area and participation in organizing conferences to acquire management and leadership skills.



A UK-wide network established to BRIDGE research in the different Disciplines related to Galactic Chemical Evolution and nuclear astrophysics.

## Steering Committee

- Chiaki Kobayashi (Hertfordshire) for galactic chemical evolution (chair)
- Raphael Hirschi (Keele) for stellar astrophysics
- Alison Laird (York) for nuclear physics
- Stuart Sim (Belfast) for supernovae/transients
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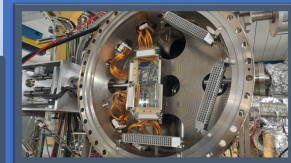
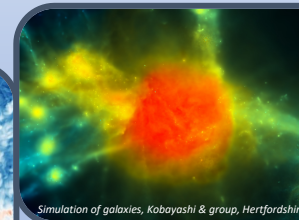
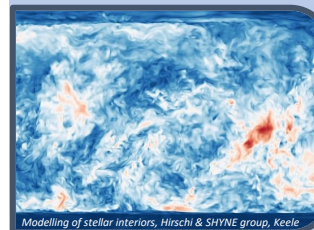
pdf file available at <http://www.bridgce.ac.uk/useful-info-links/bridgce-brochure>

## WHY WAS BRIDGCE SET-UP?

To answer questions like: "Where were the elements we are made of created? How different were the first stars compared to nearby stars? Which nuclear reaction rates affect stellar model predictions? How efficiently are chemical elements mixed in the interstellar medium? What are the building blocks of our galaxy?", knowledge in various disciplines of astrophysics and nuclear physics is necessary. Nuclear data are a key input for stellar evolution models since nuclear reactions provide the energy that powers stars, and thus determine their lifetimes, and the composition of their final ejecta.

Stars, in turn, provide crucial radiative, kinetic, and chemical feedback into the galaxies they belong to through the light they shine, their strong winds and powerful supernova explosions, and the multitudes of chemical elements they produce. Stellar evolution model outputs therefore are key ingredients for galactic chemical models of galaxies. These models follow successive episodes of star formation and trace the history of the enrichment of chemical elements in the Universe.

The model predictions can then be compared to observations of stars that carry the chemical fingerprints of the cumulative chemical enrichment that preceded their birth. Comparison to observations can thus constrain both the galactic and stellar evolution models and tell us what aspects of the models need to be improved. Stellar evolution models can also be used as virtual nuclear physics laboratories in which we can test the impact of uncertainties in certain nuclear reaction rates.

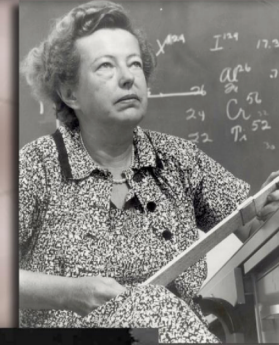
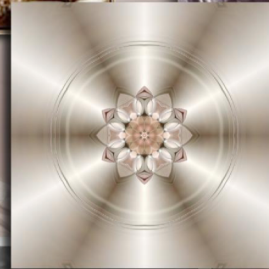
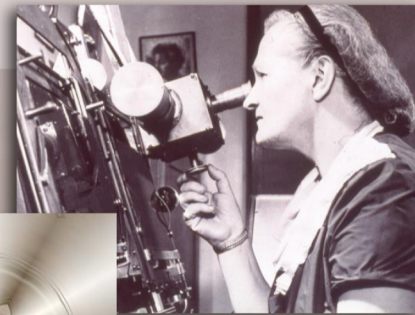
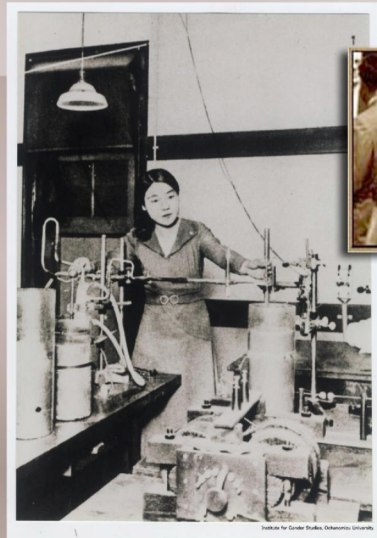


Edinburgh's CARME set up at GSI

Although there are many experts in the UK trying to answer these questions, research and collaboration across different disciplines of physics is difficult due to separate funding agencies and the lack of efficient knowledge transfer mechanisms between disciplines (in particular between nuclear and astrophysics). The BRIDGCE UK network was set-up to remedy this important problem.

**2022 Calendar; printout order** <https://forms.office.com/r/CSVqFs6fDj>  
(to Hirschi); pdf download <http://bridgce.ac.uk/news/2022-calendar-of-women-scientists-who-made-nuclear-astrophysics>

2022 Calendar



presented by COST Action ChETEC

Women Scientists Who Made Nuclear Astrophysics

# Gender Statistics

- $29/75=38.7\%$  in BRIDGCE members
- $8/22=36.3\%$  for speakers at AM2022
- $3/4=75\%$  for invited speakers
- $2/4=50\%$  for session chairs
- $1/5=20\%$  for AM2022 organizers
- $5/8=63\%$  for NAM2022 session organizers
- $3/5=60\%$  in BRIDGCE steering committee

# BRIDGCE annual meeting 2022@Keele

- Organizers:
  - **Federico Rizzuti** (Keele) – chair
  - **James Keegans** (Keele)
  - **Dyna Ibrahim** (Herts)
  - **Alexander Hall-Smith** (York)
  - **Alex Murphy** (Edinburgh)
- Apologies: CK is travelling in Australia now..
- Thanks in advance to all speakers and participants
- Any feedback: e-mail [c.kobayashi@herts.ac.uk](mailto:c.kobayashi@herts.ac.uk)
- This slides will be available at <http://bridgce.ac.uk>