Candidate Information

Position: Research Fellow
School/Department: School of Mathematics and Physics
Reference: 25/112586
Closing Date: Monday 16 June 2025
Salary: £39,922 - £47,631 per annum
Anticipated Interview Date: Tuesday 1 or Wednesday 2 July 2025
Duration: 2 years

JOB PURPOSE:

To work on the development and application of numerical radiative transfer simulations for the study of kilonovae. This will involve incorporating state-of-the-art atomic data into our modelling database, development work on our Monte Carlo radiative transfer code, carrying out full simulations at supercomputer facilities, and collaborating on the use of these results for the interpretation of astrophysical observations. The successful candidate will work within the Astrophysics Research Centre in the School of Mathematics and Physics as part of our ERC-funded HEAVYMETAL project. This will involve active collaboration with our partner nodes in Dublin, Copenhagen and Darmstadt. Successful applicants will have responsibilities in independent research, collaboration, supervision, project planning and managing supercomputer resources.

MAJOR DUTIES:

1. Carrying out numerical radiative transfer simulations with the ARTIS Monte Carlo simulation tool for kilonova models.
2. Development work on the code, as motivated by the scientific aims of the project.
3. Incorporation and utilisation of new atomic data (produced at QUB, and elsewhere) including complex atomic structure and data for radiative/collisional processes, for ARTIS simulations.
4. Analysis and interpretation of simulation results. This to include extraction of synthetic spectra and light curves and analysis of internal thermodynamic / plasma state variables.
5. Managing simulations – including archiving and maintaining records of simulations and their outputs.
6. Contribute to the preparation of proposals for access to high-performance computing systems at national and international level and managing / monitoring the project's use of such resources.
7. Write peer-reviewed publications and present findings at conferences/workshops.
8. Effective collaboration and sharing of results with all nodes in the HEAVYMETAL project.
9. Helping to supervise and mentor postgraduate and undergraduate students within the post holder's area of expertise and under the guidance of a member of academic staff.
10. Ensure up-to-date knowledge of the state-of-the-art within the research field through scholarly activities.
11. Assist in the preparation of funding proposals where relevant.
12. Undertake supplementary duties relevant to the success of the project including administrative duties and additional training and development activities as required.

ESSENTIAL CRITERIA:

1. Normally have or be about to obtain a PhD in astronomy or astrophysics.
   (NB 'About to obtain' is normally defined as within 3 months of application date).
2. Several years relevant research experience in the following areas:
   - Radiative transfer simulations, including Monte Carlo methods.
   - Numerical simulation for astrophysics.
   - Use of atomic databases (energy levels, radiative and collisional transitions).
   - Spectral/light curve modelling, and interpretation of observational data.
3. Strong publication record commensurate with stage of career.

4. Ability to contribute to broader management and administrative processes. Willingness to help with administration and preparation of computer time proposals.
5. Willingness to contribute to the HEAVYMETAL collaboration, including helping to organise meetings between nodes and sharing of expertise and results.
6. Ability to program in C / C++ and python (or related languages).
7. Ability to assess and organise resources.
8. Ability to communicate complex information in English effectively in oral and written format.
9. Ability to build relationships to develop internal and external networks.
10. Commitment to continuous professional development.
11. Practical problem-solving skills, independence of thought and initiative.
12. Demonstrable ability to positively interact with research colleagues and other staff.
13. Willingness to travel for periods of time for the purposes of attending conferences or collaborative visits, including to HEAVYMETAL partner institutes.

DESIRABLE CRITERIA:
1. Experience of using high-performance computing facilities in research, including resource management.
2. Experience of code development in C++ or similar.
3. Experience of parallel computing, such as use of MPI and/or OpenMP in large-scale simulations.
4. Experience of working with atomic structure and associated radiative and collisional data for heavy elements.
5. Experience of multi-dimensional Monte Carlo transport simulations, such as with the ARTIS code.
6. Experience of writing proposals for high-performance computing facilities.
7. Experience of working in multi-institute collaborations.
8. Experience of managing high-performance computer resources.

ADDITIONAL INFORMATION:
Informal Enquiries to Professor Stuart Sim: s.sim@qub.ac.uk