RAS Techniques and Instruments

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Jonathan Tennyson [1]★† and Anna M. M. Scaife [2]‡

[1]*Department of Physics and Astronomy, University College London, London, WC1E 6BT, UK*
[2]*Department of Physics and Astronomy, University of Manchester, Manchester, M13 9PL, UK*

Welcome to the first issue of the new journal of the Royal Astronomical Society (RAS), entitled *RAS Techniques and Instruments* or RASTI for short. The RAS has not been quick to launch new academic journals: its current journals, *Monthly Notices of the Royal Astronomical Society* (MNRAS) and *Geophysical Journal International* (GJI), started publishing in 1827 and 1922, respectively. So the launch of RASTI is the first for a century. Like MNRAS and GJI, RASTI will be published by Oxford University Press (OUP).

The scope of RASTI is broad as it aims to encompass all scientific areas currently covered by MNRAS and GJI, i.e. to stretch across all of astronomy, astrophysics, and geophysics. The journal does not aim to compete with these two existing publications but to provide an alternative platform for publishing papers on techniques and methodologies that are not the normal focus of the result-driven publications currently forming the bulk of those papers published by MNRAS and GJI. In particular, RASTI will focus on advances in methods for collecting, evaluating, and exploring data. These methods will range from new instrumentation to innovative data processing and analysis procedures, along with new theoretical and modelling developments. Topics that have been identified as key to modern scientific research in general and to current astronomy and geophysics research in particular, include artificial intelligence (AI) and machine-learning (ML) methods for obtaining insights from (large) data sets; advances in statistical methods; software for processing and generating data (including pipelines); data analysis and modelling, including the co-design and effective use of high-performance computing; innovations in instrumentation, including such things as detectors, sensors, and sensor systems (including novel missions); and other aspects of instrumentation, including associated developments in software and data processing.

The world of science is changing in many ways, but perhaps the most unifying scheme is the explosion of data, which is being accompanied by the development of novel techniques in AI/ML to exploit these data. To take some astrophysics examples: the internationally run Atacama Large Millimeter/submillimeter Array (ALMA) Observatory in Chile produces up to 5 TB of scientific data every day, which is said to be enough to generate a new PhD thesis in under an hour of observing time. These data volumes will be dwarfed by the upcoming Square Kilometre Array (SKA) telescopes located in Australia and South Africa. The SKA-Low array will generate a raw data volume of 5 ZB per year: global Internet traffic only passed 1 ZB for the first time in 2016. There are of course many other examples of huge volumes of data being generated in the areas of astronomy and geophysics. For example, distributed acoustic sensing (DAS) provides thousands of sensors probing seismic activity with sensor spacing at metre scale: a typical DAS experiment produces 1 TB or more data per day. These various data sets not only provide great opportunities for new scientific discoveries, but also create challenges not only in how the data are interrogated and used, but also in how results are presented and whether they can be reproduced by other scientists. RASTI will provide a vehicle for the discussion of all these issues.

As a response to this rapid increase in data-driven science, scientists are increasingly subscribing to the principles that data in particular and scientific research in general should meet principles of findability, accessibility, interoperability, and reusability (FAIR). For RASTI, FAIR is not just an aspiration it is a major reason for the journal's existence. RASTI will provide a means for authors to provide complete data specification, alongside discussion of the tools used to gather these data whether they be new instruments, novel algorithms, or software. At the same time, RASTI will allow for the full specification of scientific methods, making results fully reproducible, an essential for scientific progress.

In line with the accessibility agenda, RASTI is an open access journal meaning that papers we publish will be available to all. Of course, publication of a high-quality journal is not free, so to compensate for the lack of subscriptions RASTI levies a charge for papers it accepts. We realize that payment for publishing in an RAS journal is a new development, which may not be universally welcomed, and is accompanied by its own challenges. However, we also recognize that the open access model gives huge advantages in terms of impact for papers published under it. We emphasize that if payment for publishing in RASTI represents a serious barrier to publishing with us please contact the journal and we will see what we can do to help.

RASTI is now accepting submissions in all areas of interest. The aim is that most papers should be unsolicited, original research articles submitted by authors to the journal through our submission system (https://mc.manuscriptcentral.com/rasti). However, the journal will also publish review articles covering topics in the general area of techniques and instrumentation in astronomy and geophysics. We plan to invite leading scientists to write such papers, indeed there are already a couple of such articles in the pipeline, but we are also happy to consider proposals for review articles from prospective authors. If you are interested in writing a topical review for possible publication in RASTI, we recommend you contact the editors to discuss the idea at an early stage in the process. All submissions, including both invited and unsolicited review articles, will go through our standard review process.

RASTI also plans to carry special issues and again there are a couple of these already in the pipeline. Special issues will focus on a particular mission or experiment, either space borne or ground based, or technique. Occasionally, they may be based around a conference

★ E-mail: j.tennyson@ucl.ac.uk
† Editor-in-Chief.
‡ Deputy Editor-in-Chief.

or workshop on a particular key topic. We do not plan to carry conference reports as such and, again, all special issue papers will be refereed in the same manner as standard submissions. The advantage of being an entirely electronic journal is that special issue papers can and will be published as soon as they are accepted, and simply linked on the journal web pages to give the special issue as a grouping of papers on the given topic. Special issues will be looked after by one or more nominated editors. At least one of these editors will be on the RASTI board but further special issue editors may be appointed. If you are interested in running a special issue in RASTI, or indeed have an idea for such an issue, please contact us.

RASTI has appointed an international Editorial Board. The Board aims to cover all aspects of the rather diverse scope of the journal. Besides working on developing the journal, Board members will be responsible for overviewing the review process for submissions. At present, we are not asking authors to nominate a Board member to be responsible for their paper but instead will select one as appropriate according to their expertise within the constraints of conflicts of interest and workload. We aim to gradually expand the Board as the journal grows.

RAS Techniques and Instruments is an exciting new venture for the RAS, their first new journal for a century, their first open access journal, and the first journal to take research papers across the entire remit of astronomy and geophysics. We aim to make RASTI an exciting and informative venture in its own right and invite the community to participate in this process with us.

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