

Application for an RAS Grant

An application should consist of:

- This application form completed
- A case for support, not to exceed two A4 sides in a font not smaller than 10pt
- A simple budgetary breakdown, on a fourth sheet.

Mandatory Sections

Applicants name and title: Mr James Matthews

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Title of application: Travel Support to attend 'The Physics of Cataclysmic Variables and Compact Binaries' and Additional Support for a Short Academic Stay at Colombia University.

Amount requested from the RAS: £990.75

Where relevant, indicate if there is a deadline by when you need to have a decision.

Deadline Date: 01/10/14 – although flexible

Other funding sought or obtained in connection with this application: I will be able to use some of the Research Training Support Grant available with my STFC studentship (see budget breakdown).

This application is on behalf of: Myself

Status of proposed grant recipient (please circle the closest matching of the following phrases) student (up to BSc level), **post graduate student**, postdoctoral researcher, amateur scientist, other (please specify)

Category of grant (see website): Conference Travel

If a grant is awarded by the RAS, I will ensure that:

- Appropriate acknowledgement will be made of the support received from the RAS Research and Grants Fund in reports of work benefiting from the grant;
- Where appropriate, published accounts of the work will first be submitted to the Society's journals; and
- If requested, I will account for the use of the grant to the Council of the RAS within two years of the award.

I certify that I am a Fellow of the RAS and I believe that this application is worthy of an award.

Signed..... J.H. Matthews Date..... 14/08/2014 Printed

Print Name..... JAMES MATTHEWS

Case for Support:

I am a postgraduate student at the University of Southampton supervised by Professor Christian Knigge. I will shortly be entering my third year of a project investigating the impact of accretion disk winds across the mass range. This is primarily a computational project, involving modelling of systems such as cataclysmic variables (CVs) and active galactic nuclei (AGN), and is summarised later in the document.

A Month-Long Visit to Columbia University, NY

Prof. Knigge is due to start a sabbatical year, and part of this involves a 4-month stay in Columbia University, New York. During this visit Prof. Joe Patterson is hosting a conference at Columbia entitled ‘The Physics of Cataclysmic Variables and Compact Binaries’. The conference will run from 30th October to 2nd November and will provide the perfect opportunity for me to present my new and exciting results to the CV community (see ‘My research’).

My supervisor’s extended presence in New York and an extremely relevant and useful conference would already suggest that a stay of approximately one month would be beneficial, but there are additional reasons why such a trip is of great scientific merit. Three of my principal collaborators reside in the US; Daniel Proga and Nick Higginbottom are working together at the University of Las Vegas, and Knox Long, of STScI, currently resides in Chicago. We have already worked together on a number of papers (Higginbottom et al. 2013, 2014), and the possibility of a meeting in New York would bring together a number of the leading contributors to state-of-the-art disk wind modelling.

In order to maximise the scientific output from this visit, I hope to stay in New York from approximately 28th October for approximately one month. This will allow for active collaboration with leading figures in both theoretical and observational studies of CVs and AGN – bridging a gap all too often present in astrophysics research. In summary, I hope that this month long stay will yield the following *key outcomes*:

- Presentation of my recent work involving accretion disk winds in cataclysmic variables at the meeting in Columbia. This will involve active discussion with some of the most prominent and respected members of the CV community, a useful exercise both scientifically and for future employment prospects.
- Extended collaboration with a number of high-profile US-based experts on accretion disk wind observations and theory (named above).
- The opportunity to continue to work closely with my supervisor. A 4 month absence could prove detrimental to the progress of the PhD, but a month working together along with other collaborators would be highly beneficial.

Why is funding required?

I am in possession of an STFC-funded studentship, so some money is available from the Research Training Support Grant (RTSG). However, the cost of trip exceeds a whole year’s RTSG funding, especially as I must continue to pay my contracted rent here in the UK. In addition, it is vital to be able to use a relatively large portion of the RTSG as it is intended, namely to attend a number of different conferences throughout my third year in order to aid scientific development and seek opportunities for employment in postdoctoral research. An RAS grant can be used in conjunction with the RTSG, but *without the RAS grant it will not be financially viable to make the trip.*

My Research

Accretion is a universal process in astrophysics, and affects systems across the mass range, from protoplanets right up to supermassive black holes. Outflows are ubiquitous in accreting systems. They can take the form of highly collimated relativistic jets, but can also manifest as mass-loaded winds rising from the accretion disk. These accretion disk winds can affect, and even dominate, the spectral features of accreting objects, and evidence for their existence has been seen in both ultraviolet and optical spectra of CVs, X-ray binaries and AGN. My work involves an attempt to understand the true effect of disk winds on the observational appearance of such systems and the deep connection with accretion implied by their ever-present nature.

In particular, I use a state-of-the-art radiative transfer code⁴ to model accreting systems. Our team aims to investigate how much of the unified AGN and CV pictures can be explained by a simple biconical disk wind model by applying the latest Monte Carlo techniques to the problem. This has so far yielded impressive results with both AGN and CV models.

We have recently conducted simulations⁵ that expand on our team's past efforts by incorporating improved line transfer techniques. Excitingly, these improvements have enabled us to show that the same outflow models used to explain the ultraviolet features seen in CVs also have a significant impact on optical features. In particular, we find that recombination lines in Hydrogen and Helium can be produced by a disk wind, and the same wind geometry can 'fill in' the Balmer absorption edge that has thus far been present in CV models, but not observations. This is the main result that I would present at the conference in Columbia, which would be supported by making the soon to be submitted paper public on the arXiv.

References & Links

¹ <http://cbastro.org/workshop/>

² Higginbottom, N., Knigge, C., Long, K., Matthews, J., and Sim, S. 2013, MNRAS, 436, 1390, <http://adsabs.harvard.edu/abs/2013MNRAS.436.1390H>

³ Higginbottom, N., Proga, D., Knigge, C., Long, K., Matthews, J., and Sim, S. 2014, ApJ, 789, 19, <http://adsabs.harvard.edu/abs/2014ApJ...789...19H>

⁴ Long, K. and Knigge, C., 2002, ApJ, 579, 725, <http://adsabs.harvard.edu/abs/2002ApJ...579..725L>

⁵ Matthews, J. et al., in preparation

Budget Breakdown

The estimated budget for my one month stay at New York is presented in table below. I seek 75% of the cost (£990.75) through this application while the remaining 25% will be taken from my RTSG.

The following table summarises the expected costs of the trip

Cost	Cost, GB £
Airfare London - New York ⁶	415.00
Accommodation and Bills ⁷	806.00
Expenses	100.00
Total	1321.00
Total requested (75%)	990.75

⁶ Fare estimated for direct flight through www.kayak.co.uk August 14, 2014.

⁷ Rent of single room in walking distance to Columbia University through www.airbnb.co.uk, August 14, 2014.