Proposed Studentship

COMPETITION FUNDED

Does the oxidation of organic material on atmospheric mineral aerosol change the solar radiative forcing of mineral aerosol?

Supervisors: Prof. Martin King (RHUL), Prof. Dave Waltham (RHUL), Dr Rebecca Welbourn (STFC), Dr Andrew Ward (STFC)

Project background

The atmosphere of the Earth is an oxidizing medium and effectively acts as a low temperature, dilute fuel, combustion system, oxidizing complex compounds and returning them to the surface of the Earth via cloud water and dry deposition. The chemical composition of particulate matter affects climate directly, by scattering and absorbing solar radiation, and indirectly, owing to its ability to act as cloud condensation nuclei, leading to a change in cloud formation rainfall patterns. Cloud processing of atmospheric particulate matter changes the optical properties of clouds. Atmospheric mineral particulate matter contains organic films that effect the reactivity of the particle and its potential to act as cloud condensation nuclei. You will study the optical properties and kinetics of atmospheric oxidants reacting with organic films on mineral aerosol. The kinetics will give an atmospheric lifetime and optical properties will enable calculation of the change in climatic radiative forcing. If the lifetime is less than ten days and more than 1 minute then it is important.

Research methodology

You will be based at the enviable facilities of the Rutherford-Appleton laboratory (Oxfordshire) and undertake experiments at the ISIS neutron source and central laser facility with supervisors currently working with RHUL students. You will extract organic material from atmospheric aerosol, place it on silica, alumina and rutile and subject it to atmospheric oxidation. Neutron reflection studies will determine the morphology and thickness of the organic material kinetically allowing an assessment of atmospheric lifetime. Laser tweezer studies will determine the refractive index of the material during oxidation allowing the estimation of a change in radiative forcing of the oxidation.

Training

You will train in bleeding-edge facility techniques studying a new interface between mineral and water whilst relying on a track record of success on the air-water interface. The Rutherford-Appleton Laboratory will allow you to interact with many world-leading scientists. You will be trained in laser spectroscopy, neutron reflection, chemical extraction, atmospheric sampling and atmospheric modelling achieving a PhD with modelling, field and laboratory components.

Person specification

Candidates with degrees in Chemistry, Physics, Engineering or Earth science are encouraged to apply.

Key references

Shepherd, R., King, M., Ward, A., Marks, A. & Brough, N., "Determination of the refractive index of insoluble organic extracts from atmospheric aerosol over the visible wavelength range using optical tweezers" 2018, *Atmospheric Chemistry and Physics*. 18, 8, p. 5235-5252
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S.H.Jones, M.D.King, and A.D. Ward, "Atmospherically relevant core-shell aerosol studied using optical trapping and Mie scattering", *Chemical Communications,* 51, p. 4914-4917 doi: 10.1039/C4CC09835H
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Application details

This project has been shortlisted for funding by the ARIES NERC DTP and will start on 1st October 2021. The closing date for applications is 23:59 on 12th January 2021.

Successful candidates who meet UKRI's eligibility criteria will be awarded a NERC studentship, which covers fees, stipend (£15,285 p.a. for 2020-21) and research funding. For the first time in 2021/22 international applicants (EU and non-EU) will be eligible for fully-funded UKRI studentships. Please note ARIES funding does not cover visa costs (including immigration health surcharge) or other additional costs associated with relocation to the UK.

ARIES students benefit from bespoke graduate training and ARIES provides £2,500 to every student for access to external training, travel and conferences. Excellent applicants from quantitative disciplines with limited experience in environmental sciences may be considered for an additional 3-month stipend to take advanced-level courses in the subject area.

ARIES is committed to equality, diversity, widening participation and inclusion in all areas of its operation. We encourage enquiries and applications from all sections of the community regardless of gender, ethnicity, disability, age, sexual orientation and transgender status. Academic qualifications are considered alongside significant relevant non-academic experience.

All ARIES studentships may be undertaken on a part-time or full-time basis, visa requirements notwithstanding

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