Fully funded PhD Studentship

ROYAL HOLLOWAY UNIVERSITY OF LONDON

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

Supervisors: Prof. Martin King (RHUL), Dr Rebecca Welbourn (Rutherford-Appleton Laboratory)

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
Jones, S.H., King, M.D., Ward, A.D., Rennie, A.R., Jones, A., Arnold, T.: "Are organic films from atmospheric aerosol and sea water inert to oxidation by ozone at the air-water interface?" *Atmospheric. Environment,* 161,274-287, 2017, doi: 10.1016/j.atmosenv.2017.04.025
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
M.D. King, A.R. Rennie, K.C. Thompson, F.N. Fisher, C.C. Dong, R.K. Thomas, C.Pfrang and A.V. Hughes "Oxidation of oleic acid at the air–water interface and its potential effects on cloud critical supersaturations" *Physical Chemistry Chemical Physics*, 2009, 11, 7699–7707
M.D. King, A.R. Rennie, C. Pfrang, A.V. Hughes and K.C. Thompson **"**Interaction of nitrogen dioxide (NO_2) with a monolayer of oleic acid at the air–water interface – A simple proxy for atmospheric aerosol", *Atmospheric Environment* 2010, 44(14) 1822-1825. (doi:10.1016/j.atmosenv.2010.01.031)

Application

The position is fully-funded at UKRI rates and for UK students only.

The application **deadline is 16th June 2021**, with remote interviews likely to be a week later.

For further information, please contact m.king@rhul.ac.uk

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