**Research Experience Placement (REP) Scheme 2023**

**Supervisor Project Proforma**

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| Project title: | A laboratory study of nitrous oxide |
| Host Institution: | National Centre for Earth Observation, University of Leicester |
| Project supervisor (name, department): | Dr Jeremy Harrison, National Centre for Earth Observation |
| Project enquiries (supervisor email): | Jh592@leicester.ac.uk |
| Co-Supervisor, if any (name, department): |  |
| Proposed start date: | Any time from July 2023 |
| Project description: |
| Like carbon dioxide, nitrous oxide (N2O) is a long-lived greenhouse gas that accumulates in the Earth's atmosphere. Its emissions are intrinsically linked to agriculture, particularly fertilised soil and animal waste. With the atmospheric concentration reaching 336 ppb earlier this year and currently increasing at around 1 ppb per year, N2O not only contributes to climate change but also to stratospheric ozone depletion. N2O is also used for pain relief in dentistry, and is sometimes known as "laughing gas" due to the euphoric effects upon inhaling it, a property that has led to its use as a recreational drug.A number of remote-sensing instruments on satellite platforms measure infrared radiation that has passed through the Earth’s atmosphere. Using these satellite measurements, it is possible to extract the abundances of atmospheric trace gases such as N2O (a “retrieval”) via their unique absorption patterns in the infrared. However, this requires the availability of accurate quantitative spectroscopic data, normally derived from laboratory measurements and contained in databases such as HITRAN. The HITRAN database represents our best knowledge for calculating atmospheric molecular transmission, and we are continually striving to make these measurements more accurate.This project will involve measuring infrared spectra of N2O at the Spectroscopy for Environmental Sensing Research (SPENSER) facility at Space Park Leicester. This facility, co-funded by NERC and the University of Leicester, will provide accurate, SI-traceable quantitative spectroscopic data for satellite remote sensing. The primary instrument is a Bruker IFS 125HR Fourier transform spectrometer. You will be one of the first users of this recently acquired piece of kit. You will then analyse some of the N2O spectra and generate spectroscopic line parameters that can be used in the atmospheric remote sensing of this gas. |
| Project timeline: |
| The project duration is flexible, but is expected to be a minimum of 6 weeks. A possible timeline could be:1. Learn how to use the spectrometer and take measurements (under supervision)2. Format the spectroscopic measurements for input into Labfit3. Calibrate the wavenumber scale of the spectra, and temperature and pressure of the sample parameters4. Learn how to use the Labfit code and extract parameters from N2O spectra5. Generate new spectroscopic linelists and compare with existing HITRAN linelists. |
| Candidate requirements: |
| This project is a mix of lab-based and computer-based work, and would suit a candidate with an interest in laboratory work and data analysis, and who is keen to learn new things.The candidate is expected to work at Space Park Leicester for the duration of the project. |
| Background reading and references: |
| The HITRAN2020 molecular spectroscopic database: <https://hitran.org/media/refs/HITRAN-2020.pdf> |

**To be completed by institutional CENTA PoC**

I confirm that:

* Appropriate supervisory arrangements are in place
* Any necessary ethical committee approvals, animals licences & requirements of regulatory authorities will be in place before the work begins and will be maintained for the duration of the project
* We will take responsibility for identification, protection & exploitation of any intellectual property rights arising from the project
* All facilities, agreements regarding access and collaborations necessary for the work will be obtained before the work commences and can be ensured for the duration of the project
* All costs awarded by NERC for the REP will be used and accounted for appropriately
* A report of the project by the student will be submitted no later than one week after the end date of the placement or 15th September 2023, whichever falls first.

Signed: 

Date: 5 May 2023

Position: CENTA PoC for NCEO