Alice Eleanor Matthews

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EDUCATION

- **The University of Manchester**   Manchester, UK
  Master of Physics (MPhys); Overall 2:1, MPhys Project 81%   *Sep. 2015 - Jul. 2019*

- **Saint Bedes Sixth Form**   Redhill, UK
  A-Levels: Geography, Physics, Maths; A,B,B   *Sep. 2007 - Sep. 2014*

PUBLICATIONS

- A Faure, P Hily-Blant, C Rist, G Pineau des Forêts, A Matthews, D R Flower, 'The ortho-to-para ratio of water in interstellar clouds', Monthly Notices of the Royal Astronomical Society, Volume 487, Issue 3, August 2019, Pages 3392–3403. https://doi.org/10.1093/mnras/stz1531.

RESEARCH EXPERIENCE

- **Research Masters Project (81%)**   The University of Manchester
  Attempting a first observation of tau pairs produced via vector boson fusion.   *Sep. 2018 - Jun. 2019*

  - A 6 month collaborative research project with Professor Terence Wyatt and laboratory partner.
  - Analysed big data ($> 3 \times 10^9$ events) obtained from the ATLAS detector at CERN.
  - Daily development of object-oriented C++ and Python programs using ROOT and Linux shell scripts to perform analysis in removing large quantities of data and to constrain processes of interest as well as control background.
  - I developed a clear understanding of high energy particle physics concepts and processes and implemented them into the project methodology and data selection and treatment algorithms.
  - I have gained confidence in approaching challenging concepts and problems both collaboratively and as an individual, using both logic and initiative. I have learned discipline in handling uncomfortable situations through determination, patience and consistency.
  - I am confident in presenting results in both written and oral presentations, which has been reflected by my rewarded grades (oral: 90%, written: 80%).
  - As a collaborative effort, my skills in team working, project management and punctuation were enhanced. This was achieved by active communication between both my lab partner and supervisor in organising meetings and presenting weekly reports. This ensured a successful and clear progression and understanding of all aspects of the project.

- **Summer research student**   Grenoble, France
  Institut de Planétologie et d'Astrophysique de Grenoble, Interstellar Department   *Jun. 2018 - Sep. 2019*

  - Conducted a three month research project working collaboratively with Professor Pierre Hily Blant and Professor Alexandre Faure, investigating the ortho-to-para ratio of water in interstellar clouds.
  - Produced derivations of the direct cosmic ray ionisation rate and desorption of water on ice/gas-grains from first principles. This proof was included in the publication for this project. This experience taught me to be vigilant and thorough in my theoretical and mathematical analyses.
  - Wrote scripts in Python and FORTRAN to calculate the cosmic ray ionisation rate, desorption rate and cosmic ray flux.
  - Investigated the evolution of molecular chemistry within the pre-stellar region, throughout the Steady-State and Larson-Penston stages of core collapse and the effects of cosmic ray ionisation on ice- and gas-grain chemistry, using Matplotlib to visualise the results. Developed numerical methods to study various physical phenomena and implemented into programs in FORTRAN and Python:
    - The cosmic ray flux in dense and diffuse clouds, as a function of depth.
    - The Leaky box model and Plateau models were investigated to study the effects of galactic cosmic ray flux on abundances and water chemistry in the gas phase.
    - The ionisation of H molecules by secondary electrons, impacts from electron capture, ionisation processes and cross-sections on molecules by proton impact as well as correcting for heavier nuclei.
    - Simulated the pre-stellar core collapse using the University of Grenoble aples Astrochemical Network (UGAN), studying the evolution of the ortho-para ratio of water (HHO-$H2O$).
  - My personal and professional confidence vastly improved working abroad in both a new country and new area of physics, as well as with an international team.

- **Researcher and Observer** Veleta, Province of Granada, Spain
  IRAM 30m radio telescope *27/Aug. - 05/Sep. 2019*
    - Visited the 30m IRAM telescope in the Sierra Nevada as part of a side project during my time at IPAG. The visit was for a duration of 10 days to perform a survey of Nitrogen bearing species and their isotopic ratios in nearby star formation regions.
    - Performed a total of 36 solo observing hours on the IRAM 30 m telescope collecting spectra. I learned how to calibrate, point, focus, perform on the fly observations and mappings of the sky, using GILDAS and Xephem software.
    - These methods were used to measure the quantum transitions of HCN and HNC and their isotopologues, in the L1512, L1512E and L183 dense cores, within the Taurus environment (L1498) using spectroscopy techniques.
    - I was introduced to the main principles used in radio-astronomy and spectroscopy.
    - Implemented methods such as background subtraction to avoid sky emission and receiver gain fluctuations. These included frequency switching as well pointing and re-focusing the beam using a secondary bright source along the line of sight of observing object in order to reduce noise.
    - Further developed my communication in an international team as well as learning a little Spanish.
- **Weapons Systems Simulation and Experimentation (WSSE) Intern** Bristol, UK
  MBDA *Jun. 2017 - Sep. 2017*
    - Participated in a 3 month internship at MBDA in Bristol, working alongside Helen Vincent, director of the WSSE department.
    - Developed a simulation testbed 'Enforcer', which I tested and developed code in C++, making the hardware elements compatible with the Virtual Battlefield Simulated (VBS) environment and graphical user interface. In addition to this, I developed technical documentation, including fail-safe procedures.
    - The project was under strict time constraints and to be produced to exceptionally high standards, in preparation for its handover to an external organisation. The final simulator was presented at the Defence and Security Equipment International (DSEI) 2017 in London.
    - Worked for 10 days at DSEI as an exhibitor and technical support. I was responsible for giving simulation demonstrations to guests and other organisations, including governmental and military bodies, improving my communication and confidence immensely.
    - Throughout my time at MBDA, I expressed high enthusiasm, worked on multiple projects, and tested my project management and organisation skills. I was invited back for a further placement in 2018.

Additional Experience

- **Product Associate** London, UK
  Fire Tech Camp *Oct. 2019 - Present*
    - Managing the back and front-end of the website, producing products and optimising user-experience.
    - Project leader for the masthead and homepage redesign on the main website, including researching current trends and UX on the website, optimising it for users and developers.
    - Created a marketing dashboard using Google Data Studio and Supermetrics to drive conversions.
    - I played a large role in transforming the company from event based learning to online learning amid the COVID-19 crisis. This experience meant I took on a multitude of additional responsibilities from handling technical enquiries to interacting with students and participating in teaching.
- **Active Science Communicator**
  Blogger, Public Speaking, Outreach Events, Radio Host *Sep. 2016 - Current*
    - **Blogger:** I host my own blog and social media accounts, offering advice to current undergraduates.
    - **University of Manchester Physics Outreach (UMPO):** Collaborated in public speaking events with schools and organisations such as CERN, ScienceX, The Manchester Museum of Science and Industry and Bluedot festival outreach events.
    - **Radio show host, Fuse FM:** Broadcasting the latest science news and recorded interviews with Professor Brian Cox, Tim O'Brien and others.

Interests, skills and other

- **Interests**: Climate and environmental science, engineering, renewable energy, the physical universe, astronomy and space science, programming, culture, travel.
- **Programming:**: Proficient in C++, Python, ROOT, Scientific Linux 6, GitHub, Microsoft Office, LaTeX. Intermediate in html, css, Xephem, GILDAS, MATLAB, Filmora, Adobe Photoshop Pro.
- **Activities**: Blogger, active surfer, played ice hockey for the Manchester Metros team (2018) and a skiing, biking, hiking and climbing enthusiast.