**Research Strategy: Isotope Geochemistry and Cosmochemistry, and Planetary Science.**

**Bottom Line:** A lot of the research that we built our reputation on involves state-of-the-art dedicated analytical facilities both within and outside the group – these are the core of our STFC funding, underpin our participation in high profile missions, and enable us to develop wide-ranging collaborations. Some of these within our group were closed for more than two years while we attempted required upgrades to laser safety for which no external support was made available. We understand the need for the upgrades, but decision makers exhibited no interest whatsoever in helping to mitigate the consequences of their decision. **A repeat of this could be calamitous, since access to these facilities is required (1) for our contribution to leading international science collaborations which have narrow time windows (including sample return missions Hayabusa 2, Osiris Rex – Japanese Space Agency and NASA, respectively) and (2) to deliver the science recently funded by STFC whose funding provides a stable base from which other activities grow. Failure to deliver on our commitments could have a decades-long impact on Manchester’s reputation.** Others depend on continued maintenance of facilities (rather than exploitation that can be funded through responsive mode research grants) - issues here have similar implications.

We also need to work closely with our technical support team – there cannot be a hard divide between academic and technical staff in this area. The current review of technical provision is an opportunity to address this, but also presents a risk of making our research impossible.

**What we do:** We seek to understand how the Earth and objects in the wider Solar System formed and evolved. We pioneer and deploy instruments and techniques so we can uniquely contribute to the quantitative understanding of terrestrial and extra-terrestrial systems; these have potential applications in other areas, which we try to exploit.

**Beneficiaries:** Our novel techniques and new insights benefit society culturally and economically. The breadth of our research fosters cross-collaboration between disciplines.

**Strategy**

1. Sustain and grow activity in traditional areas of expertise by excellent delivery of funded projects, development of new areas with existing funding, and increasing and diversifying funding.
2. Build collaborations internally, nationally, and internationally:
   1. With complementary areas of specialisation to advance our scientific goals.
   2. Where we can contribute our specialised skills and understanding to new areas, including identifying and sustainably exploiting resources.
3. Improve engagement with industry and wider society.
4. Attract externally funded fellows and research visitors to grow the academic standing of the group.

**Evidence of success of strategy to date**

* **Funding:** Royal Society, STFC, Leverhulme Trust, UKRI Future Leaders and Marie Curie research fellowships. STFC Consolidated Grant funding increased (now to 2024). ESA project participation funding (Fairspace). Funded collabs w. Chem Eng, Maths, and Medicine (Leverhulme). STFC Capital Equipment funding (LA-ICP-MS), STFC DTP centre and RS-funded studentship, NERC DTP students within the group, joint PhD students with Chinese Universities - GIG-CAS and Beijing Normal University.
* **Publication** **highlights:** Evatt et al. (Nat. Comm. 2016), Clay et al. (Nature 2017), Broadley at al. (Nat. Geosci. 2018), Tartèse et al. (PNAS 2018), Gilmour and Filtness (Nat. Astro. 2019), Robert et al. (Nat. Astron. 2020), White et al. (Nat. Astro. 2020).
* **Research Networks:** Co-led first UK meteorite collection expeditions to Antarctica (2018, 2019). Participated in meteorite recovery missions (Atacama Desert Chile, 2017, 2019). Co-Is of NASA ANGSA programme to analyse newly opened Apollo samples (lead C. Shearer, Univ. New Mexico). Missions: Chandrayaan-2, BepiColumbo, Luna-27 (PROSPECT), Hayabusa-2, ESA collaboration for Chang’e 5 lunar sample return mission, OSIRIS-REX sample analysis WG. ESA Topical Teams (Polar EL3 mission), ESA lunar caves project (working with UoM MACE). EU network associates (CHETEC-ULTRA). Swiss Ambizione fellowship contribution. ICDP Oman Drilling Project. Co-lead Lab Analysis of Returned Samples – LARES (UK community proposal to STFC). Funded visitors from Chinese Academy of Sciences. Involvement in Templeton Foundation-fFAME program “Collaborative Research in Origins” (CRiO), University of Colorado (lead). NERC Volatiles, Geodynamics & Solid Earth Controls on the Habitable Planet programme.
* **Workshop and conference organisation:** Noble Gas Workshop, China University of Geosciences, Wuhan (YEAR); European Lunar Symposium, Manchester (2019); RAS Specialist Discussion day on Science from Apollo (2019) and extraterrestrial sample analysis (2020).
* **Industry links:** Close collaborations with instrumentation sector (Thermo-Scientific, Agilent, Isotopix, Teledyne-CETAC). New collaborations initiated with Chinese companies (Sinopec and Petrochina). Three recent graduated PhD students now working at the European Space Agency, and one at NASA Goddard.
* **Professional Recognition:** Advisory and review panels: NERC, STFC (subpanel chair), UK Space Agency (Aurora Panel Chair), EU, Swiss federal, ESA, NASA, CAPTEM. Roles in professional societies (Meteoritical Society, RAS). [Annie Maunder Medal for Outreach from](https://ras.ac.uk/awards-and-grants/awards/2820-annie-maunder-medal) RAS. Editor in Chief, Earth, Moon & Planets. Associate Editors GCA, MaPS.

**Current (continued) Priorities and Planned Future Developments**

* Sustain and invest in facilities base including unique instrumentation, & planetary sample receipt, characterisation and curation facilities in support of Antarctic meteorite project and participation in future sample return missions. Address “bottom line” issues above. (1, 2.1).
* Diversifying our funding base, reducing exposure to policy shifts by our traditional funders (2.1). Notably the LA-ICP-MS presents an opportunity here.
* Continue and grow extensive involvement in planetary missions including, but not limited to, sample return missions. Deliver on current commitments. (2.1).
* Expanding and building on relations with other research areas (2.2), incl. shared PhD places.
* Maintain and grow engagement with national and international networks – UKCAN, LARES, Europlanet, NASA SSERVI, Space Universities Network, EU incl. Networks (as available) (2.1, 4).
* Building on outreach public engagement activities under the “Earth & Solar System” brand (3), including the Cosmic Cast (Youtube channel).