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Paul McMillan (1956–2022)

Pioneer of polyamorphism and enthusiast for the solid state.

Paul McMillan was one of the big players in solid-state science, geochemistry and high-pressure science for four decades, making major contributions to the chemistry of solid and glassy silicates, mantle mineralogy, ceramics and superhard materials, and biological materials. To this wide range of phenomena he brought a deep understanding of vibrational spectroscopy, an intuitive grasp of the structure and thermodynamics of both crystalline and amorphous phases, and an encyclopaedic knowledge of the scientific literature. His knowledge was backed up by shelf upon shelf of carefully sorted reprints and photocopies that he was happy to share with colleagues. There was nothing he loved more than to start a scientific argument, preferably in a pub rather than at a formal meeting, to bring into focus an interesting problem with colleagues. He could immediately grasp the importance of the problem from a fundamental perspective and then rapidly suggest experiments and creatively imagine an angle that might be used to raise funding to explore the topic.

Paul grew up in the mining village of Loanhead, just south of Edinburgh into a family of modest means. The breakup of his parents' marriage meant that his grandmother was a major formative influence while he was growing up. In his telling she was a fairly stern woman who ensured that he stuck to the straight and narrow while encouraging his obvious intellectual talents. He spent his secondary school years at Lasswade High School in nearby Bonnyrigg. There was not only science but also a few terms of ancient Greek. He also played the cello, developing a love of music that never left him. He suffered bullying from some of his less studious but aggressive schoolmates who probably resented his high marks. His family's tight finances meant that he needed to earn money working variously as a milkman, butcher's boy and, later, on a mink farm. These jobs taught him the mechanical skills he later applied both as a scientist and as a home owner.

The University of Edinburgh widened his horizons. He studied earth science and chemistry, and played in a band. He would reminisce fondly about his early lessons in spectroscopy that would serve him in good stead for the rest of his career. In his final year, he met a visiting French student a few years his senior, Mary Claude. Their friendship grew and when he accepted a PhD place at Arizona State University, where the chemistry department offered him a full scholarship, she accompanied him for what would become a trip of a lifetime.

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His PhD at Arizona State University, guided by John Holloway and Alexandra Navrotsky, centred on vibrational spectroscopy of silicate glasses, which led to the discovery of five-coordinate silicates that play a key role in thermal and mechanical relaxation of glasses. He progressed to a postdoctoral and then a faculty position in Arizona, uncovering liquid–liquid transitions between high- and low-density supercooled liquids. He would also uncover polyamorphic forms of the tetrels and the transitions between them. He led the effort to obtain a research centre in high-pressure research at Arizona State University and used both multi-anvil apparatus and diamond anvil cells to study many different materials under high pressure. He was a major contributor to the reputation of the growing university.

In 2000, Paul was lured back to the United Kingdom to take up the Professorship of Solid State Science at the Royal Institution, a position that was split with the Chemistry Department at University College London. With a small group of students he set himself up in both places, splitting his time between his main research base in Faraday's old labs, and his teaching at University College London. If he missed the space, the pool and the blue sky of Arizona, he relished the intellectual life in London, and its proximity to the food of France and the mountains of Switzerland, favourite haunts for rest and relaxation. At the Royal Institution his interests widened. He demonstrated the survival of bacteria up to 10,000 atm. He brought Raman spectroscopy to the study of amyloid fibre formation and as a diagnostic tool for cartilage damage and arthritis. There were also studies of layered carbonitrides, including intercalation and exfoliation, accompanied by quasi-elastic neutron scattering studies of choreographed dynamics of water moving through the pores in the sheets.

Paul had an extraordinary ability to focus and think analytically about almost any problem set before him. His insights always lightened up an otherwise dull meeting. A manuscript sent on Friday evening would be returned covered in comments by Saturday morning. For students, a discussion with Paul could be very daunting (however much he managed his diabetes, there were still mood swings), jokes about meeting 'good Paul' or 'bad Paul' were not wholly light-hearted. He pushed students hard but could always be relied upon to suggest new experiments and interpretations; for those he truly rated there was generous support and mentoring as they started out on an academic career. He had a select circle of close colleagues and friends, with some of whom he played football with joy and abandon; this continued well after his cancer diagnosis. Paul never felt sorry for himself, and even during his final illness he was upbeat, contributing to teaching, meetings and manuscripts right up to a few days short of his untimely death. He spent his life 'minding the gap' in science, bridging and narrowing it. He will be missed, but his legacy of science, learning, teaching and friendship lives on. ❐

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