# James F. Scott (1942–2020)

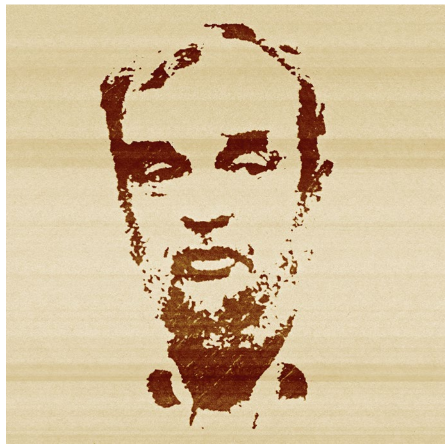
Father of modern ferroelectrics.

Professor James Floyd Scott was such a character that, despite his common first name, there was never any doubt to whom you were referring when you talked about 'Jim'. It is customary to highlight scientific contributions to a field, but, in Jim's case, it is easier to just name the entire field: his Fellow of the Royal Society citation refers to him as the 'father of integrated ferroelectrics'.

Most of us came into contact with Jim's oeuvre in his ferroelectrics period, but that was actually his second career. His first, for which his scientific contribution was arguably as important, was solid state spectroscopy. Having completed his degree at Harvard and his PhD thesis at Ohio State at 23, he was recruited by Bell Labs to do solid state Raman spectroscopy. There, he produced a series of remarkable studies of phase transitions. One of these works was on the soft mode of $SrTiO_3$, a model system for perovskites — the materials family to which many ferroelectrics belong — that would continue to fascinate Jim, and about which he continued to publish to within weeks of his death.

At 29, Jim became a professor at the University of Colorado, Boulder, where he developed his research on thin films, co-founded Symetrix, and forever tied his name to ferroelectric memories. Over the next 20 years, he would lead the transformation of ferroelectrics, from a bulk ceramic technology to an integrated thin film technology apt for microelectronic devices ranging from ferroelectric memories (about which he wrote the book) to microwave antennae. Jim and co-workers discovered that the Aurivillius class of ferroelectrics, such as $SrBi_2Ta_2O_9$ (SBT), showed no polarization fatigue, a radically different behaviour from that of classic perovskite ferroelectrics. The discovery led to a revolution in ferroelectric memory technology, since polarization fatigue was a barrier to commercialization; Jim was so convinced of the importance of SBT that he even invested in a South American bismuth mine, which he later joked about.

Jim's career has been so long and prolific it is difficult to do anything in our field without treading on an old gem of his. When magnetic multiferroics became all the rage at the turn of the century, he could pull out old articles on multiferroic fluorides, written in the 1970s. Ferroelectric skyrmions are now 'hot', but dig into the literature and the first article you'll find on them is from Jim and co-workers in 2006. And he did not rest on his laurels. In the multiferroics renaissance, he played pivotal roles in resolving the complex phase diagram of arguably the most important one, $BiFeO_3$ (a room-temperature multiferroic), or showing that existing multilayer capacitors could be repurposed as magnetoelectric sensors. Even after his retirement from Cambridge, he found a new academic home in St Andrews, where he continued to produce exceptional work, including the discovery (and explanation) of a giant negative electrocaloric effect in antiferroelectrics.



A ferroelectric memorial. Portrait made using piezoresponse force microscopy to write nanoscopic ferroelectric domains on a thin film of ferroelectric bismuth ferrite, 30 μm × 30 μm. Credit: Pavlo Zubko and Benedikt Ziegler

But it would be a disservice to talk only about his research. For Jim, physics was a way of life, and his personal history was interwoven with his science. His work took him around the world, from the United States to Australia (as dean of Royal Melbourne Institute of Technology and the University of New South Wales), and later to the UK (first Cambridge and then St Andrews), with spells elsewhere, everywhere forging life-long collaborations, picking up accolades and getting himself into all sorts of trouble. He had a unique perspective on the Cold War, having spent a lot of time in the Soviet Union in the 1980s, where he met and married the love of his life, Galya. The adventures of an American scientist (with Los Alamos clearance) trying to bring back a Russian wife would be worthy of a separate book. It is a shame that he never got around to writing it, for he was an exceptional raconteur.

Jim was generous with his time and ideas, and his door was never closed. He was gifted with an incredible memory: he rarely made notes and could often not only recall complete citations, but tell you something about the author or history behind the work. He combined his encyclopaedic knowledge with unique insights, often ahead of the curve. If you walked down the Earth Sciences corridor in Cambridge and didn't hear Jim pounding on the keyboard the first (and often final) draft of his next paper, you would often hear his calm voice explaining why bananas are not ferroelectric or sharing his latest thoughts on ferroelectric physics, usually with a detour into the personal lives of other scientific greats or his own adventures on the journey from his working-class roots in small-town New Jersey to the grand halls of Cambridge.

Jim loved an argument and his verbal venom gave him a fiery reputation; his putdowns were legendary, as were some of his catchphrases ('I don't work for you!'). However, he was also a caring colleague and mentor, taking personal satisfaction in the success of his students and postdocs. He had a soft spot for underdogs, which is why many of us love him and will forever feel privileged to have known him. Rest in peace, Jim Scott. ❐

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