

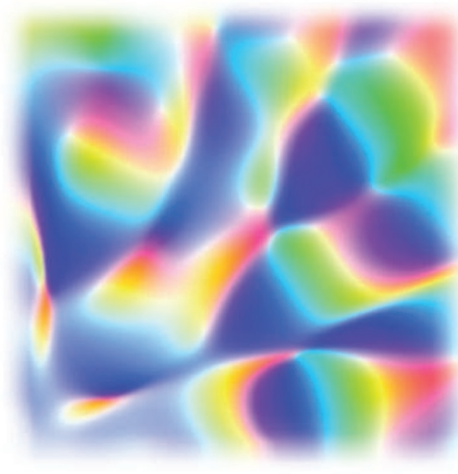
Things of beauty

The celebration of 50 years of the Aharonov–Bohm effect, and 25 years of Berry’s phase, is a celebration of the elegance of physics.

What is the most beautiful concept in physics? Answers to that question will be many and diverse — depending on whom you ask, their background and ‘soft spots’, on their teachers, and on personal ‘light bulb’ moments. There are ideas in physics that strike us as simply beautiful from the first moment we encounter them: their full implications and significance still far from apparent, they seem to have an innate and inevitable elegance.

For many, and certainly for those who have a weakness for quantum mechanics, the Aharonov–Bohm effect is among those ‘beautiful things’. The very idea is intriguing: that a solenoid can have a measurable effect on a charged particle even if the particle never passes through a region where either the solenoid’s electric or magnetic fields are non-zero. But the implications are of course much broader.

Last month marked 50 years since its discovery. Writing on page 160 of this issue, Murray Peshkin and Lev Vaidman survey an “intellectually delicious” meeting



that took place, in December 2009, at the birthplace of the effect, the H. H. Wills Physics Laboratory in Bristol. The event celebrated the fiftieth anniversary of the discovery of the Aharonov–Bohm effect, and also 25 years since the discovery of Berry’s phase, another (and not unrelated)

concept that, for all its many ramifications, also charms physicists with its inherent beauty. On page 148, Sir Michael Berry recollects the events surrounding his famous 1984 paper, discussing both the work that followed shortly after and the anticipations of the geometric phase that preceded his own. “In retrospect what we call ‘discovery’ sometimes looks more like emergence into the air from subterranean intellectual currents”, says Sir Michael.

There is much more still to emerge from the 50-year-old Aharonov–Bohm effect, which may well have impact on the very foundations of quantum physics. Indeed, on page 151 Sandu Popescu argues that the deepest implication of the effect has been widely ignored so far — and that, without it, a real understanding of the nature of quantum mechanics is impossible.

When John Keats wrote his 1818 poem *Endymion* it wasn’t physics he had in mind, but his famous opening line rings true in this case too: “A thing of beauty is a joy for ever”. □

Treasured archive

Funding of the arXiv preprint server must now be shared by more of its users.

The arXiv preprint server has become central to the working lives of most physicists: ‘checking the arXiv’ is the starting point of many a daily routine. Founded by Paul Ginsparg, the arXiv has expanded to include not only physics — astrophysics, condensed matter, and high-energy physics being heavily represented — but also mathematics, computer science, quantitative biology and even quantitative finance. The arXiv now hosts nearly 600,000 preprints from 101,000 registered submitters in 200 countries, and serves more than 2.5 million article downloads every month to 400,000 users.

The statistics are remarkable. And it is also remarkable that, having initially been hosted at the Los Alamos National Laboratory, the server has in recent years been funded and managed by a single institute, Cornell University. Now

the operating costs of the ever-growing arXiv match the entire Cornell library budget for physics and astronomy, and the university has made a plea for help in funding it.

As a short-term solution, Cornell is approaching the top 200 user-institutions of the arXiv — who account for 75% of institutional downloads — for a financial contribution to the maintenance of the arXiv. It is heartening that help has already been promised from several large universities and laboratories, but wider support is still being sought. For the longer term, Cornell will assess, with those who come forward to support the arXiv, what the options are in developing a sustainable model for the future.

Secure, ongoing funding of the preprint server is vital, and surely deserves at least national endorsement from US

funding bodies, if not some international arrangement. The fast communication of results — data or theory — between experts that the arXiv facilitates is a boon to physics, and one well recognized by the Nature Publishing Group: any submission to *Nature Physics* or its sister journals may be posted, in that original submitted form, on the preprint server (although we do ask that the final, revised and accepted version is not posted until six months after publication in the journal; the published version, in the *Nature Physics* layout, may not be posted).

It’s up to physicists now to sustain their arXiv, encouraging their institutions’ libraries in particular to engage in its development. More information is available at <http://arxiv.org/help/support>; and comments and suggestions may be sent to support@arxiv.org. □