to some particularly unusual effects (such as, for instance, counter-propagating spin-polarized edge states in monolayer graphene[5]). Splitting enhanced by many-body effects has previously been observed in monolayer graphene[5–7] (also at filling factor zero) but we are still in the dark about the exact mechanism and the nature of the resulting electronic states.

Eight-fold degeneracy of the lowest Landau level provides us with an exciting puzzle: which one of those degeneracies will be lifted first, or can we actually even change an order of it by altering some external parameters (such as in-plane magnetic field, for instance). Depending on the circumstances, it might repeat the situation that is most probably realized in monolayer graphene (most probably it is the spin-splitting that is the dominant effect there) or, it might be something much more exotic. The authors claim that the insulating state at the compensation point behaves differently when compared with the similar state in monolayer graphene. In addition, it has some peculiar dependence on in-plane magnetic field, which is generally not expected at all. One is thing obvious: we can expect very exciting new physics to occur in this regime. ❐

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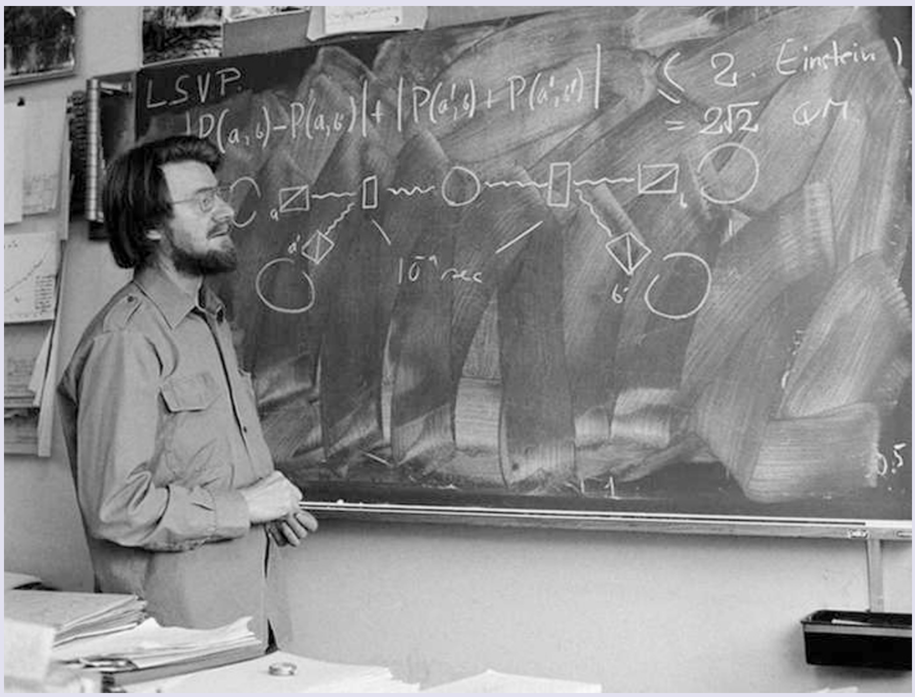
References

1. Novoselov, K. S. *et al. Science* **306,** 666–669 (2004).
2. Geim, A. K. & Novoselov, K. S. *Nature Mater.* **6,** 183–191 (2007).
3. Novoselov, K. S. *et al. Nature Phys.* **2,** 177–180 (2006).
4. Feldman, B. E., Martin, J. & Yacoby, A. *Nature Phys.* **5,** 889–893 (2009).
5. Abanin, D. A. *et al. Phys. Rev. Lett.* **98,** 196806 (2007).
6. Zhang, Y. *et al. Phys. Rev. Lett.* **96,** 136806 (2006).
7. Checkelsky, J. G., Li, L. & Ong, N. P. *Phys. Rev. Lett.* **100,** 206801 (2008).

QUANTUM MECHANICS

Shaken foundations



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In 1975, Alain Aspect presented John Bell (pictured) with a proposal: he would perform a set of new experiments to check whether or not the inequalities that Bell had derived a decade earlier were violated. Legend has it that Bell first asked the young Frenchman if he had a permanent job; only when Aspect answered in the affirmative did Bell encourage him to publish his ideas.

By 1982, Aspect and his co-workers had produced experimental data that showed clear violation of Bell's inequalities. The data could therefore be explained within the framework of quantum mechanics, but not so within so-called realistic local theories. Aspect's work now stands as a cornerstone of our understanding of the foundations of quantum theory, and proved to be a seminal contribution to quantum information science. Moreover, it is only as a consequence of his experiments that the now-famous Einstein–Podolsky–Rosen paper of 1935 was noticed, and cited, by a wider audience. Nevertheless, in 1975 Bell was worried that Aspect's career might be compromised by engaging in research considered to be, at best, on the margins of physics.

This episode is just one example given by Olival Freire in his "collective biographical profile" of nine physicists, including Bell, who around 1970 were researching the foundations of quantum theory (*Studies in History and Philosophy of Modern Physics* doi:10.1016/j.shpsb.2009.09.002; 2009). Freire calls them "quantum dissidents" (with the exception of one — Léon Rosenfeld). These dissidents were fighting the prevailing attitude of the time that all of quantum physics' foundational issues had essentially been put to rest by its founding fathers, and proved that there were important unsolved questions, not only with regard to quantum non-locality, but also concerning decoherence, the quantum measurement problem and the quantization of gravitation.

United as the dissidents were in agreeing that much remained to be done, the scope of their work and the approaches they took were distinctly different. The protagonists of Freire's study were critical of each other's contribution, but the goal wasn't to develop one particular alternative interpretation. Many avenues were explored, and not without sacrifice: certainly the professional careers of H. Dieter Zeh and John Clauser were severely hampered. But the efforts of these nine helped to establish the foundations of modern physics as a 'proper' and important field of research. Quantum theory has grown stronger through their successes — even if it was at the risk of being toppled from its very foundations.

ANDREAS TRABESINGER