confined to the cylinder's opening. If ϕ varies linearly (adiabatically, for small enough V): $\phi = -cVt + \text{const}$, an azimuthal EMF, V is induced. We also consider the system to behave as a perfect insulator with $G_{xx} = 0$, so it is in equilibrium at zero temperature. By very general arguments [8]), the states of the system are invariant to changing ϕ by a flux quantum ϕ_0 (which is equivalent to changing the phase of the ground state wave function around the cylinder by 2π). Thus each time ϕ changes by ϕ_0 the only consequence is that an integral number of electrons, j, is transferred from the lower to the upper contact of the cylinder. This yields a current $I = j\,e^2V/h$, consistent with Eq. 1! While not being able to calculate j (except for free electrons) this argument establishes the generality and exactness of Eq. 1 within non-relativistic quantum mechanics. The current I is a sort of supercurrent (since it flows perpendicular to V, there is no dissipation). The QHE is a macroscopic quantum phenomenon related to the fundamental role of the phase in quantum mechanics and its sensitivity to the vector potential (the Aharonov-Bohm effect). In fact, the QHE has stimulated a recent revival of the interest in such effects in small normal conductor rings, where impressive results have recenty been reported.

A new surprise was in store for the theoreticians when experiments reported [5]) in 1982 in high quality quantum well samples first revealed a new Fractional Quantized Hall Effect (FQHE) in which the integer in Eq. 1 is replaced by a simple rational fraction such as $1/m$, m being an odd integer, as well as e.g. 2/3, 2/5, 2/7, 3/7, 4/5, with more to come. This requires extra stabilization of the 2D electron gas at those fractional fillings of a Landau level, with gaps in the excitation spectrum. The relevant quasiparticles have fractional charges (a subject of current excitement in both solid state physics and quantum field theory) to agree with the above general argument. In fact, in a seminal theoretical paper, Laughlin [10]) showed how electron-electron Coulomb interactions can lead to such effects. The study of the 2D quantum plasma, has since become an important field of many body theory.

The universal significance of the QHE is further demonstrated by the usefulness of the concepts originating in it in high-energy physics. This is yet another demonstration (following the renormalization group method — 1982 Nobel Prize to K. Wilson) of how concepts developed in condensed matter contexts can become relevant, and even crucial, in other branches of physics. It is safe to predict that we shall be hearing even more on 2D electron systems and the QHE and related phenomena in the years to come.

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CMD Applauds

It is with great joy that the members of the EPS Condensed Matter Division learned the news that the 1985 Nobel Prize for Physics had been awarded to Dr. Klaus von Klitzing.

Von Klitzing is well known to EPS as he was awarded the EPS Hewlett-Packard Europhysics Prize* for 1981 and was presented with this award at the 2nd General Conference of the CMD held in Manchester in March 1982. His research and subsequent work have been regularly followed up at the CMD General Conferences and he was a plenary speaker at the 6th General Conference held in Prague in August 1984 (when the above photo was taken).

The QHE (von Klitzing's and the fractional), despite much progress over the past few years presents a major challenge to theoretical physics.

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