Jan Post on Topology and the Quantum Hall Effect

Is Public Relation in Physics Prevailing over Academic Evaluation?

Many of those working in physics have had some thoughts about the question posed in the title. Yet it is hard to be specific as to what extent it is true and how much of it is part of a scheme to dominate. Large organizations have an edge in the PR game, yet how often do they use this advantage unfairly?

Most people are inclined to give them the benefit of the doubt, because there always are malcontents claiming, or imagining, they have been wronged by steam roller tactics of the high and mighty. If it is a clear judicial situation, the standard argument is let them bring suit if they are serious about what they say.

So not unless and not until there is striking provable evidence to the contrary does one like to set the wheels of justice in action. After all, legal action is very costly, which is again another reason why the high and mighty prevail. More important is how a bunch of lawyers can be expected to bring good judgment to highly specialized matters pertaining to physical procedure. Rarely, but not impossible, lawyers take a more detached look, where physicists are blinded by their esoterics. Yet, before anything can be set in motion, legal specialists, called upon to adjudicate a matter, need to be instructed.

This discussion attempts to home in on a case pertaining to a striking provable event. It is the 1998 physics Nobel prize awarded for the fractional quantum Hall effect. While the awarding of a Nobel prize remains uncontested, the target of litigation is a preceding process of dissemination of information.

The situation is relatively simple. The so-called integer effect was discovered in 1980. It received a Nobel award in 1985. The fractional effect was discovered in 1982. It received a Nobel award in 1998. The difference of time interval between the dates of discovery and award of 5 and 16 years respectively justifies an ordering in terms of a primary discovery and a secondary discovery contingent on the first.

The question is whether the '98 award grants the secondary discovery a status independent of the primary integer effect or a status subordinate to the primary effect. The dominant theories about the fractional effect have led to associations with fractional charge, yet without a commitment whether it is to be taken per charge carrier or collectively in terms of unexplained open spots in the charge carrying lattice.

The cited two effects have all been assessed in the perspective of approaches, which assume unrestricted validity of Schroedinger's inherently statistical methods to these highly ordered mesoscopic quantum situations. In contrast to Schroedinger's local differential process, an approach lending preeminence to global methods for highly ordered quantum phenomena appeared in 1983. It shows the quantum Hall effect is governed by the ratio of two quantum numbers: the flux state n of the cyclotron states and the (even) number of circulating electrons accumulating in the same cyclotron state. Whether a fractional or integer effect prevails is now contingent on whether the ratio s/n is a true fraction or reduces to an integer. So, the arithmetic condition of the ratio s/n conveys the distinction between the two effects. Note how reduction of s/n for even s favors the observed odd denominator fractions!

Apart from this exception, the entire body of existing quantum Hall literature takes a position that the fractional and integer effects are fundamentally different. This distinction must have emerged as an almost preconceived notion, because not a single reference can be found in this entire body of literature, which even indicates cognizance of the mere possibility of a unified treatment of the two effects.

Whenever people make discoveries, it is understandable and human, that they like to believe, that they are treading new territory. Yet, when closer scrutiny reveals the discovery to be reducible to new manifestation of an earlier discovery, it is still new although a different kind of new. Nineteenth century physics used to take much pride in the strength of such reductionism.

Whatever the truth in the case at hand, the ground rules of proper academic behavior require investigators to take cognizance of possible alternatives so as to relate and compare them to their own case. Yet, an exhaustive perusal of the very extensive body of literature on the quantum Hall effect does not reveal a single reference to an existing unified treatment of integer and fractional Hall effect. This frightening uniformity of opinion to keep this Hall dichotomy alive is unfortunately more indicative of a business objective than a pursuit of truth. There is indeed a good chance that this Hall dichotomy belongs in the same category as the search for magnetic monopoles and the quark's fractional charge.

The apparent reality of everybody following a party line of quantum Hall dichotomy defies common sense and is contrary to independent thought. Can we understand what is going on here?

The possibility of unification escaping attention is very small, because as one of the instigators of a unified approach, I have personally conversed in private and open meeting with quantum Hall protagonists. I can only say there is an unspecific arrogant unwillingness to consider the unification option. The idea of a code of academic ethics imposing, within reason, an obligation of taking cognizance of opposing views is either ignored or dismissed as irrelevant for their situation. In the light of these experiences, I can't give these attitudes much benefit of my doubt about their honorability; perhaps they pass muster within the realm of corporate business, they are on the whole incompatible with academic pursuits. Granted the scientific issue here at stake is not a minor one, because the quantum Hall effect precipitates a crisis for the Copenhagen interpretation. Just let it sink in that a better than 99% majority tries to understand or describe a perfectly nonstatistical quantum Hall effect, with an inherently statistical Schroedinger equation. This is the kind of contradictory procedure that can only be unblushingly accepted under the cover of Copenhagen's nonclassical paradigms. Here is a striking example how, in the course of time, Copenhagen's temporary ontic crutch has now emerged as a near-religious movement with all the familiar pitfalls of excessive orthodoxy.

Envision your chances of bringing about changes in the many nonclassical status quos of contemporary physics, if you are faced with an army of editors and reviewers recruited from that 99% population holding uniform Copenhagen beliefs. Religions function on the basis of articles of faith. Copenhagen's interpretation is to be regarded as a temporary escape into a realm of pure faith. It is an ontic phase in the development of physics. Yet, after three generations of nonclassical paradigms, their content have solidified into articles of faith. The orthodox defenders of those articles frown on any modification of these ontic propositions so as to have them integrated into a wider epistemic realm.

The eight references, listed below, account for a 15 year attempt to bring about needed changes in the Copenhagen interpretation with the purpose of having the quantum Hall effect benefit from those changes. Almost none of this was publishable in the major media of physics who pride themselves of their high standards (in orthodoxy). The doors of the establishment media are closed and remain firmly closed to changes in officially approved articles of faith. Those who want proof of how effective this opinion screening works, just check the quantum Hall literature and you will not find a single reference to any of the eight references here listed on the subjects of period integration, changes in Copenhagen views and their relation to the quantum Hall effect.

This uniformity of behavior is indeed revealing for a corporate business atmosphere rather than academia. In the corporate world everybody tries to stay in tune with what the corporate line of command expects. While this may well be essential for corporate survival, it obviously does not gibe well with the best pursuit of truth. Contemporary physics is overwhelmed by a corporate rationale. Similarly, editors and reviewers of the physics media live in fear of passing anything that might not fit the public relation mold. Even the American Physical Society is now more corporate than academic. So not surprisingly, the 1998 Nobel decision finally reflects a public relations element characteristic more of the corporate than of the academic world! The chances are that the 1998 Nobel decision sanctions an avenue of approach that may well have to be discontinued. While discontinuations of product lines are common place in corporate life, such discontinuations are rare in academia and perhaps academia should try to keep it that way. Think of it, the survival rate of universities is better than that of most corporations.

Literature relevant to global approaches to the quantum Hall effect and alternatives to the Copenhagen interpretation.

1. Post, Physics Letters 94A,343(1983). Suggesting a period integral description of the quantum Hall effect.
2. Post, Physics Today, April 1987, p. 120; a reminder that the fractional quantum Hall effect is covered by the description of ref.1.
3. Kiehn, Physics Today, April 1987, p. 122; a response to inquiries about relations between flux- and Hall impedance quantization. This letter triggered the publication of ref.2.
4. Post, Phys.Lett. A125, 225 (1987); quantum Hall effect as a key to identify inadequacies of the Copenhagen interpretation.
5. Kiehn, J. Math. Phys.18, 614(1977) seminal exploration of period integrals in physics.
6. Post, in Phys. Essays I, 279(1988);Rejects of the Past holding Promise for the Future .

More about period integrals in physics.

7. Post, A Two-Tier Quantum Mechanics; (period integrals for single systems and Schroedinger process for ensembles); p.229 of the Proceedings of a 1992 meeting at Columbia University on the Interpretation of Quantum Theory(Published by the Enciclopedia Italiana, Roma,1994) ed. Luigi Accardi. 8. Post, Quantum Reprogramming (Kluwer, Dordrecht-Boston,1995) A monograph holding out for a Schroedinger process restricted to phase and orientation random ensembles and period integrals as single system tools. E J Post

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