Stuart J. Freedman: The Shocking Truth:

On the Occasion of His 60th Birthday

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It is a great honor to speak at this occasion. As Stuart's friend for more than half of his sixty years, I looked forward to the opportunity to examine his distinguished career in fundamental physics. Since much of Stuart's work has been in nuclear and even atomic physics, somewhat removed from my own endeavors, I was anxious for the impetus to survey his many accomplishments with which my familiarity was less than it ought to have been.

What I found was not what I had expected. However, since Stuart is unwavering in his insistence on facing data honestly I feel compelled to tell you what my researches revealed. It is not a pretty picture.

In retrospect much of his later career might have been anticipated from a frank appraisal of his thesis work, though I will offer some mitigating factors. In his thesis, Stuart failed to find the hidden variables in an experiment that used a beam of calcium atoms. Hidden variables are what is needed to make quantum mechanics behave in an everyday way. So we know they are there. Nonetheless, Stuart baldly stated [1] that his data favored the bizarre predictions of quantum mechanics over the expectations of common sense.

This ignominious beginning to Stuart's career must be forgiven, at least in part. First of all, he was only a grad student. More significant, these variables he was looking for were *hidden*. Naturally, they were somewhat difficult to find.

By 1982 we find Stuart looking for fractionally charged particles among the cosmic rays at large zenith angle. Once again, failure [2]. Here we have an early sign of a truly extensive failure, for it wasn't just one time that Stuart looked to see if a cosmic ray particle was fractionally charged, but more than three million times. Still, not a single success.

Stuart was able to extend this failure to one that encompassed tachyons, that is, particles that travel faster than the speed of light. The technique here was to use a detector originally designed for an electron-positron experiment to observe cosmic rays. This bit of deception in no way confused Nature, who steadfastly refused to divulge anything whatsoever to Stuart [3]. Even when he used apparatus the way it was intended to be used, the results were no different. In e^+e^- collisions at a center-of-mass energy of 29 GeV, not a single quark was observed, even though we know thousands were produced [4]. A more stunning lapse is hard to imagine.

If Stuart is known for anything, it is versatility. Cosmic rays, beta decay, electron-positron colliders: Stuart did it all. Now he turned to the decay of an excited state of helium-4. In this way he failed to find evidence for a Higgs boson with a mass between 3 and 14 MeV [5].

In 1986, the nuclear physics community was rocked by the news that in heavy ion collisions, electron-positron pairs were created with discrete masses. Where others could find 500 events or so, Stuart found effectively none [6].

It was in 1988 that Stuart turned his talent for not finding things to the field of neutrino physics. Here he began with muon-neutrinos and asked whether they transformed themselves into electron-neutrinos. Naturally, the answer was no [7].

Returning to nuclear physics, Stuart examined the decay of the barely unbound state of the deuteron to look for evidence of the “axion,” a particle that might constitute a large fraction of the mass of the universe. Here was a target too big to miss. But Stuart did not find it [8].

In 1991 the neutrino was much more massive than it is today. To be specific, its mass was 17 keV, while today it is but a fraction of an eV. You’d think that with it being 100,000 times heavier than it is currently, it would have been easy to find. And it was. Several researchers were able to show evidence for it. In an ingenious experiment Stuart demonstrated that his apparatus should be able to see the 17 keV neutrino. Nonetheless, he could not find it [9].

All these failures did not discourage Stuart. He persevered, and more. He learned. And what he learned served him well. In the KamLAND experiment he looked at anti-neutrinos produced in nuclear power reactors in Japan. It was possible to know how many anti-neutrinos were produced from the power generated by the reactor. This enabled Stuart to predict how many neutrino interactions should be seen in his detector, a large vat, filled with mineral oil and scintillator. Each neutrino reaction gave off flashes of light, which were recorded and the events counted. You won’t be surprised to learn that Stuart failed to find all the neutrino reactions that had been expected.

But now it was time for Stuart to display his real virtuosity. Having failed to find hidden variables, fractional charges in cosmic rays and in electron-positron collisions, tachyons, the Higgs boson, discrete electron-positron lines, axions, and the 17-keV neutrino, he wasn’t about to accept blame for another failure. He declared it wasn't his fault but the fault of the neutrinos! What chutzpah!

This is a man to celebrate! To Stuart!

References:

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