
Einstein Once Removed

It was late fall when my colleague Subramanyan Chandrasekhar — Chandra as we all called him — usually the epitome of aristocratic demeanor, appeared in my office, visibly shaken up, indeed outraged.

“Have you seen the new Schrödinger biography?” He was referring to Walter Moore’s delightful book about the great Austrian physicist Erwin Schrödinger. “It contains pictures of five of his mistresses and two of his illegitimate daughters.”

“So what? Physicists are not saints, and for that matter, even saints are not always saints. Saint Augustine?”

“Oh, but Peter, when I was a student, the great teacher Sommerfeld came to India to talk about the new quantum mechanics. He impressed upon me the fact that this was the creation of a group of exceptional young men: Heisenberg, Schrödinger, Dirac and Pauli, who had dedicated themselves to science to the exclusion of everything else in life. There and then I vowed to follow their example and I have lived accordingly all my life, and now this....”

I was so intrigued by what Chandra had said that I immediately headed for the bookstore and purchased the book. That Schrödinger had been a ladies' man came as no big surprise to me; stories about his dalliances are legion. What came as a real shock for me was to learn that his wife, Annemarie, had had an affair with Hermann Weyl, one of the twentieth century's greatest mathematicians — Alma Mahler-Gropius-Werfel eat your heart out. I had met Mrs. Schrödinger during my student days in Vienna. On more than one occasion after her illustrious husband's death, I had lunch at her IX-th district apartment. She was a native of Salzburg where she grew up next door to those "insufferable Karajans." Mrs. Schrödinger did not take well to widowhood. She got quite depressed. At the recommendation of friends and of her doctor she frequently invited guests for lunch, in Austria still the main meal of the day. As it happened, she had the services of one of Vienna's finest cooks. In all of Vienna you could not eat better *Beuschel mit Knödel*, that quintessentially Austrian delicacy made of calf's lungs. It is at one of these lunches that I first heard about the Einstein-Schrödinger feud, which grew out of their unified theory.

Unified theories have grown out of the realization that many of the forces and forms of matter that play an important role in our lives (such as friction, pushing, pulling, doors, fire, water, etc.) are but irrelevancies in the grand scheme of things. It all boils down to a very small number of *fundamental* forces and *fundamental* forms of matter. Just as the ancients kept reducing the number of fundamental deities, till in the end they landed at the doorstep of one or of another form of monotheism, so in this striving to understand nature, a reductive struggle also goes on and ultimately brings us to the doorstep of one or of another unified theory.

When introducing words like *unified theory*, I should admit that over the centuries, physicists have been rather profligate in the use of language. Words like *atom* and *proton* have been coined in the excitement of the moment, only to be superseded in the quest for the *truly* fundamental forms of matter. The same with forces, for which unified theories and then even *grand* unified theories have been constructed only to yield later on to the more fundamental as well. But then, all these grandiose words bear witness to the heroism of the quest and the dangers of letting oneself get carried away by what parades before us in the guise of triumph. It is a little like walking around some European capital and suddenly being hit by the realization that many of those generals and marshals for whom the streets are named ultimately lost their wars.

The very first step on the road to unification was taken in the nineteenth century when James Clerk Maxwell unified electricity with magnetism in a beautiful and coherent theory. That Maxwell's example should be heeded and that *all* forces should be unified was first proposed by Gustav Mie early in the twentieth century, though at that time all forces hadn't even been discovered yet. Mie was the Giacomo Meyerbeer of unified theory. Just as that composer's operas are now almost forgotten and were never taken seriously by Verdi and Wagner, the heavyweights of grand opera in Meyerbeer's day, so Mie's work on unification is now essentially forgotten and was never taken seriously by Einstein. Things even went so far that Wagner, motivated in part by his anti-Semitism, openly proclaimed his outright hatred for Meyerbeer, and that Einstein's gut reaction to Mie, though untainted by any bigotry, was also heavily antagonistic. Yet, just as *grand* opera — do I detect verbal profligacy among the musicians as well? — would be inconceivable without Meyerbeer, so

it is doubtful that the urge to unify would have struck as early as it did without Mie.

In the middle of the twentieth century Albert Einstein in Princeton and Erwin Schrödinger in Dublin were independently at work on an early variety of a unified theory, in which only gravity and electromagnetism are considered worth unifying. The two men were utterly unfamiliar with the remaining two fundamental forces — the, at that time very poorly understood, weak and strong forces responsible for beta-radioactivity and nuclear energy. These limitations were further compounded by the fact that the sixtyish Schrödinger and the seventyish Einstein came up with a macroscopic, or “classical” theory, ill-defined at the microscopic level of atoms and of their constituents. At that level energy is emitted in quanta and a new different “quantum theory” applies.

The two physicists constructed this theory in a leisurely fashion and exchanged letters on its details. Then, in 1947 Schrödinger gave a lecture about it, and made some exaggerated claims as to its prospects. These were reported in the press much to Einstein’s dismay. In a *folie à deux* the two old physicists greatly overestimated the value of this incomplete unification. Older wartime issues, over which the two former Berlin colleagues had had an earlier falling out, fanned the flames. This much is well known and excellently told in Moore’s book. But there is more to the story. According to Mrs. Schrödinger, the Einstein–Schrödinger feud escalated to the point where the ugly p-word — plagiarism — was sounded by both parties, and both were considering legal action. It is at this moment that the right mediator, Wolfgang Pauli, stepped in. Pauli was respected by both unifiers as brilliant, critical, thoroughly honest and frank. No matter what great things they had done in the past, he warned them, were they to sue each other, they would become the laughing stock of the

whole world and their reputations would badly suffer. He then added, “Besides, I really don’t see what the whole fuss is about. This theory is ill conceived. If you connected *my* name with it in any fashion then *I* would have a right to sue *you*.” This did the trick.

Old age goes a long way towards explaining this episode; older people tend to be more suspicious and less critical. Add to this that in old age Werner Heisenberg, Einstein’s only true peer at the very pinnacle of twentieth-century physics, also went about finding *his*, you guessed it, unified theory, initially in collaboration with none other than Wolfgang Pauli, who to his credit pulled out before anything got published.

What is it that made all these giants chase after unification in old age? One can answer this question on two levels. On one level it is an act of ultimate grandiosity. All these men were time and again extremely successful in physics. As they see their powers waning, they take one final stab at the biggest problem: finding the ultimate theory, *ending* physics. To do so is somewhat egotistic, for if successful, all that would be left to later generations would be to mop up and move on — to the study of complex systems, of chaos, wherever, but away from the search for beautiful simple laws, as these would all have been found. Maybe aside from their property of being readily mapped onto the human brain, the laws of nature are such that it is impossible to find them all, or at least impossible to know that one has found them all. This way, full employment for future generations of physicists would be guaranteed.

On another level, maybe these men are just driven by the same insatiable curiosity that has stood them in such good stead in their youth. They want to know the solution to the puzzle that has preoccupied them throughout life; they want to have a glimpse of the promised land

in their lifetime. I don't pretend to know their true motives: the fact is, what all these masters (along with Einstein, Schrödinger and Heisenberg, I include Mie, Nordström, Kaluza, Klein and Weyl) have started, has become the main preoccupation of a whole new generation, still hoping for that TOE — that Theory Of Everything. Maybe it is a mirage, but maybe it is truly within our grasp.