

# Chapter 1

## Prologue

*“The scientific theory I like the best is that the rings of Saturn are composed entirely of lost airline baggage.” Max Born*

Ever since 1958, when I attended a seminar by Arthur Leonard Schawlow (1921 – 1999), I have been on the lookout for humorous and illustrative anecdotes about famous and not-quite-so-famous physicists. At the time I was an undergraduate at the University of Toronto and Schawlow (who shared the 1981 Nobel prize “for his contribution to the development of laser spectroscopy”) had returned to his alma mater to talk about and demonstrate the just invented laser. After a fifteen minute period of “pumping” the laser, our eyes were directed to one of the walls in the big lecture theatre of the McLennan Laboratory where, for a fraction of a second, a very bright spot appeared. I was less impressed by this than the  $12 \times 2$  cm rubies he had grown to make the lasers. I remember very little of Schawlow’s talk, but I did retain that maser was an acronym for microwave amplification by stimulated emission of radiation because Schawlow quipped, it should really stand for “money acquisition scheme for expensive research.” This was my first exposure to physics humour and started me on my quest for physics anecdotes.

At the time I was not aware that Schawlow was as notorious for his humorous activities as he was famous for his excellent teaching and research. As an example, he and Ted Hänsch built the first “edible laser” out of gelatin and food colour. This dessert led to the later development of a laser that is now used in fiber optics for communication. Art Schawlow also entertained

many a class at Stanford with his “Mickey Mouse demonstration”. He would place an inflated blue balloon, shaped like Mickey, inside a clear balloon and shoot a laser beam at Mickey. The beam passed through the clear balloon without damaging it and demolished Mickey. This “childish” demonstration was the stimulus for the development of laser surgery to reattach a detached retina in the human eye.

That Schawlow’s jokes were always understood as such, even by the people who were the butt, is illustrated by the following. At Stanford he began a seminar with the title “Is spectroscopy dead?” by presenting a long and detailed definition of spectroscopy. In the audience was Felix Bloch who shared the 1952 Nobel prize with Edward Mills Purcell “for their development of new methods for nuclear magnetic precision measurements and discoveries in connection therewith.” When Schawlow paused, Felix Bloch challenged him, “Now define dead.” After a pause Schawlow responded, “Dead is when chemists take over the subject.” Rather than be offended, the chemists in the audience laughed.

In 1970, while still a fresh assistant professor in the physics department at the University of Alberta I participated in a symposium for the undergraduates to familiarize them with current research. Each professor talked for roughly fifteen minutes about his specialty. In my case I talked about Axiomatic Quantum Field Theory. My emphasis was on the idea that in this subject we start with what we believe to be hard and fast facts and then proceed by rigorous mathematics so as to make sure that “even if we can not be sure of the physics, we can be sure of the mathematics”. During the question period a student asked, “What if some of your hard and fast facts, your axioms, should turn out to be wrong, what would you do?” I was taken aback. These axioms were something I believed to be beyond doubt. My senior colleague, Professor Werner Israel, came to my rescue with the correct response, “We would be very happy and excited because then we would have some really worthwhile puzzle on which to concentrate.”

This little episode highlights two points. The first is that physicists love to solve puzzles that explain how nature works. The second point is more subtle. Progress is more likely to come from an incorrect theory than from no theory at all. This was stated in his typically unembellished manner by Richard Feynman at the *1973 Hawaii Conference on the Development of QED — Quantum Electrodynamics*. “When everything agrees in experiment and theory you are learning nothing. Only when things are crazy and nothing seems to work, then you are learning something.”

After I started to teach physics, I found that my students also enjoyed hearing some of the anecdotes about the people whose ideas they had to study. As a consequence I livened up my lectures on quantum mechanics with stories about Bohr, Heisenberg, Schrödinger, Dirac, and Born. In a similar manner, Einstein's numerous foibles and memorable utterances helped to make relativity lectures less austere.

I believe that making such personalities less remote, showing their idiosyncrasies, and making them more like the rest of us answers a need that arises not, as in the case of politicians, from the fact that they wield power, but rather from the fact that their abilities are often so much more developed than our own. Consider the effect on us of the story of Sir Isaac Newton (1642 – 1727) and the Brachistochrone problem.

After Jacques Bernoulli (1654 – 1705) had solved the famous Brachistochrone problem he challenged the natural philosophers and mathematicians of Europe to find the solution within a year. This problem required the mathematicians to find a curve that connects two points, separated both horizontally and vertically, such that if a bead slides under the action of gravity and without friction from the higher to the lower point, the time taken is a minimum. It is a problem in what is today known as the calculus of variation. The mathematical machinery to handle this had just been invented by Bernoulli when he solved the problem and he thought that no one else could solve it. Now Newton, because then master of the mint, had not been active in science for some time and did not hear of the problem until the year was almost up. However, upon addressing the problem he solved it in an extremely elegant fashion and in a very short time, using purely geometric means. Today after three-hundred years of mathematical progress no simpler solution exists. The modern solutions, using the calculus of variation, require several pages to write out. Newton's solution required only one page and was purely geometrical. When Bernoulli was presented with the unsigned solution he had no doubt as to who had created that marvellous piece of work. "I recognize the lion by his paw," was his comment. Incidentally, the solution is a portion of a curve called a "cycloid".

In *Quips, Quotes, and Quanta* I dealt with the physics of roughly the first third of the twentieth century. This might have been called the "European period" of physics. In this book I deal with developments from roughly the 1930s until the mid 1980s and the present.

It is often said that physics is a young person's game. Thus, it is somewhat surprising that many of the names that appeared in *Quips, Quotes,*

*and Quanta* again come up in this book. Good advice to a young physicist is that, “If older physicists tell you that something is possible, believe them. They have tried this and succeeded. If they tell you it is impossible, they have tried and failed. In this case you may doubt them.” Although original physics ideas require the properties to be found in the young: stamina, courage, imagination, and lack of knowledge of the impossible, many of the great physicists continued to produce original ideas at the forefront of their discipline even after middle age. Still, young minds seem to have often led the way.

Until about the 1930s European physics dominated. True there were a few Americans such as Michelson, Compton, and Millikan who made seminal and crucial discoveries, but by and large the great theories of the first quarter of the twentieth century were developed by Europeans. Starting in the late 1930s this changed and by the end of the 1940s the USA had emerged as the dominant power in physics. Not only were most of the crucial experiments performed in the USA, but the new crucial theories also were conceived in the USA. True, some of the “American” physicists — having fled from Hitler — were of European extraction, but many of the truly great were born and educated in the USA.

Most of the founders, of what is still called “Modern Physics”, are now dead. My generation was the last to mingle with some of them and to record some of these memories before this generation also dies out is timely. I have not any pretensions to having produced a “scholarly” work. Some of the stories recorded here are Gossip, or physics folklore. I have tried to verify as many of the stories as I could, but I have not hesitated to include all stories that I heard and noted down on scraps of paper. Sometimes I had to rely on memory since it would have been rude to take out a pencil and paper and immediately write down what the speaker said.