The Whole of Physics Written on a Postage Stamp.

In the mid 1980s I was a Research Fellow at Glasgow University in the Physics department. In those days the department was called Natural Philosophy. Since most people thought that anything with Philosophy in the title had something to do with the Arts, it seemed a good idea to change the name. That was probably for the best since some of the physics I read nowadays seems to be the result of the most unnatural philosophy conceivable.

Back then, there was a Museum on the top floor of the "*New*" building as it was generally known. The building was already a bit long in the tooth, but was arguably new compared to the "*Old*" building which housed the "*Kelvin lecture theatre*", so named after Lord Kelvin. The New building had been constructed to house a synchrotron. At the time of its construction Glasgow University was something of a world leader in that field. In the event, it seems the machine was superseded by others before it was completed. It apparently worked well enough though once it was commissioned. Then the synchrotron was scrapped a couple of years before somebody realised that radiation from synchrotrons could be used for purposes other than those for which the machines were originally built. Oh Dear.

The museum was a lovely bright airy place with a floor to ceiling window all down one side. On the opposite side were glass fronted cabinets housing ancient apparatus to which few people paid any attention. I was one of those who paid no attention. Had I done so, I might have noticed the Stirling Engine which Robert Stirling had presented to Glasgow University and which Lord Kelvin had later modified. However, I didn't notice it, and sat a few feet away from that valuable piece of history on a daily basis at break time drinking my tea and eating biscuits. You see, at that time, it may even be true today, the museum served as a gathering place for the academic staff and research students.

It was at one such tea break that I overheard a story which Professor Jack Reid was narrating. Professor Reid was in charge of the Kelvin Laboratory at the National Engineering Lab in East Kilbride. The Kelvin Lab had a linear accelerator which was nearing the end of its service life and was being used for development of a Free Electron Laser. Professor Reid's tale referred to an earlier head of department, Professor Dee. Professor Dee had apparently asserted to Professor Reid that "*The whole of Physics could be written on a postage stamp.*" Professor Reid then chuckled "*I never asked him to do it for me*" .

It was an amusing little tale which I really ought to have forgotten long ago. I don't know why it stuck in my mind. Perhaps it was because of the respect I had for Professor Reid. In my mind's eye I can still see him sitting at the table telling the story. Perhaps there was another reason.

I never knew Professor Dee, but I understood him to have been a renowned physicist. In those days, when a renowned physicist made a seemingly absurd comment one would be well advised to pay close attention because it might just be an incredibly subtle and important point. Nowadays things are more straightforward. If a professor makes a seemingly absurd comment, it quite probably is absurd.

For one reason or another I couldn't forget Professor Reid's little anecdote. It probably wasn't the words that made me remember, but rather the origin of the words. I discounted the obvious banality of actually writing the word "*Physics*" across a stamp. However, being able to write the whole of Physics on a postage stamp may have meant that the subject was devoid of meaningful content. There certainly seem to be areas of Physics for which such an assertion might be true, but I felt it would be a bit harsh to apply that interpretation to the subject as a whole. Professor Dee might have believed there were one or two equations which encapsulated the essential matter of the subject. On the other hand he might simply have had very small handwriting or a rather large stamp.

I could readily imagine a few candidate equations with which to start defining the subject. However it soon became clear that if the whole of physics could be reduced to a few equations, it wasn't going to be an easy task deciding which ones they would be.

Directing my idle thoughts on another route, I settled on an average sized postage stamp as the target. I began to contemplate the dual issues of rationalising the subject matter and condensing the print size. To be meaningful, the finished postage stamp would have to be possible in the context of the technology available to Professor Dee at the time he made the assertion.

I realised that there are many concise handbooks which tabulate equations and physical data in compact ways. Electron microscopes had been highly developed in Professor Dee's era and perhaps he foresaw advancements in microlithography which are nowadays taken for granted. That foresight would have been sufficient for his comment to have been worthy of note. However such vision may not have been necessary.

During the second world war, spies were communicating by means of microdot messages. A postage stamp, covered in microdots might be able to store one or more of the concise handbooks mentioned above. While this approach appeared to offer some prospect of achieving the objective, it was clearly a mundane way to go about things. Surely Professor Dee hadn't been thinking in such terms.

So it was that intermittently, over the next 25 years, the puzzle would come to mind. I couldn't help feeling somewhat annoyed at Professor Reid for his failure to obtain a fuller explanation from Professor Dee at the time the assertion was made. Had he done so, there would have been no need for Professor Reid's anecdote. I in turn would not have found myself saddled with a conundrum. In truth, the fault was really my own. Had my thirst for knowledge been greater than my hunger for biscuits, I might not have been aware of Professor Reid's presence, instead devoting my complete attention to examination of Stirling's engine.

That was not to be, and my fascination by heat engines had to wait another 15 years before progressing from open cycle constructions to the altogether more subtle and demanding closed cycle configurations.

I sometimes think that life really quite enjoys taking us on circular tours. As one definition has it: "*A circle is the longest distance between any one point.*" I suspect it was my conjectures on the subtleties of Stirling engines which triggered my best explanation of the postage stamp conundrum. One day it dawned on me that Professor Dee had been correct. "*The whole of physics could be written on a postage stamp*" However, there was no need to do so. The whole of physics was already written on a postage stamp. It had always been there, in the structure of the atoms and molecules constituting the material of the stamps. The entire understanding of the subject of physics had been efficiently and perfectly written by Nature from the outset in her own language.

The role the Physicist is really just the simple one of translating Nature's perfect narrative into a form that is within the compass of the limited comprehension of mere mortals.

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