rzero

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Dedicated to Katherine

Contents

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Preface

"I am a Quantum Engineer, but on Sundays I Have Principles."
– J.S. Bell, March 1983, as quoted by Nicolas Gisin, *[1]*

About Tom

I didn't have a choice. I think that's the case for many people in science.

Education

I attended high school in the small lakeside community on the Great Lakes, Canada. I attended University of Toronto for my undergraduate studies, starting with a cohort of over 100 students in the Physics Specialist program, which the University of Toronto Physics Department had just finished remodelling after other top departments around the world. It was a disaster - there were maybe 10 people left by the time third year started - and I wasn't one of them. Thinking that maybe I had made a mistake, I tried a half a year of other topics, before deciding that physics could not be removed from me. So I switched to a double major in math and physics. And by fourth year (ok sixth depending on how you count), I was doing well in any course I cared about, which turned out to be some more abstract math courses, my undergrad thesis course (on Bell's Theorem), and General Relativity. Our fourth year courses were mixed with graduate students entering U of T's physics department.

Trying to attend graduate school was, I was informed, impossible, as my marks were too low. So I again tried to convince myself that physics wasn't for me, and I painted houses for a year and used the savings to travel around the world. I then met the love of my life, Katherine.

I applied at a few schools for a masters program in physics, and got in at Laurentian University of Sudbury, Ontario. I lucked out on my choice of advisor, Prof Doug Hallman, as he was collaborator in the then proposed

Sudbury Neutrino Observatory. At a Sudbury collaboration meeting in 1992, my future PhD supervisor John Simpson stood up and said "We have an emergency - we've been funded!". After my masters, I went on to John's low level lab at the University of Guelph, where I did my PhD on a few things, mainly the water team, where we built a novel Radon detector and the software side, where I poked around in the 'SNOMAN' software, writing some muon tracking software. John was an amazingly smart, generous and kind advisor. When we went to off site meetings he would always buy wine way above my palette, I think trying, and succeeding at, educating us on the finer points of living. He was an honest gentleman.

Aside

The Sudbury Neutrino Observatory was a great success, we built a remarkable ten story high detector 2km under ground at the Sudbury nickel mine. The project leader, Art McDonald won the Nobel prize, and the entire collaboration won the Breakthrough Prize in Physics. I even got a nice certificate and a small cheque.

Career

After my PhD, we were starting to have children, and a post doc just didn't seem the way to go. For me this was the right decision. I instead started a software company with a dear friend, Ted. We built the world's biggest (so like 8 person) astronomy software package, called Starry Night, which made it easy for everyone from ordinary people to scientists to see where everything was in the night sky, to visit planets, etc. I can't resist blowing my own horn at this point:

> "In the first five years or so of both the Spirit and Opportunity Mars rover missions, Dr. Jim Bell (lead scientist in charge of the on-board Panoramic camera, Pancam) and colleagues on the rover science team occasionally used Starry Night Pro to verify the positions of the moons Phobos and Deimos in the Martian sky, given the positions of the rovers on the surface and the dates and times of the intended observations. These predictions allowed both rovers to acquire time-lapse images of these moons, including daytime "solar eclipse" transits of both Phobos and Deimos across the Sun as well as nighttime "lunar eclipse" passes of Phobos entering and emerging from the shadow of Mars."
>
> It really was cool that Starry Night was right on! It was like having a planetarium program made for Martians! (and you can quote me on that!)
>
> Thanks again, Jim[1].

[1] Private communication, 2019

For a reason having everything to do with the tech stock market bubble of 2000, we ended up selling the entire operation to Space.com. I was not rich, but hey it helped.

Why this book

While working on several software projects, over years I have kept up with the fields of quantum foundations, general relativity, and experimental quantum gravity (which is now a thing!)[5]. I was originally hopeful that physics would soon jump ahead, but it just hasn't happened. Physics isn't dead, it's a big field. But the supposed cutting edge is, as Sabine Hossenfelder points out, Lost in Math[3].

I have always had a different vision on the foundations of quantum mechanics than the mainstream physics community, a vision that is frankly easier to keep by being somewhat on the outside of academia.

Throughout my software career, I published several papers and attended conferences on quantum foundations and General Relativity. It's hard to publish papers, and often even to attend conferences with a busy job (and three wonderful sons). What I learned from my software career is that marvelously complex things can be built with simple underpinnings. My favourite example of that in software is that the 'c' programming language - a human creation just decades old - runs the entire world. And it's a short book[4].

Physics is in crisis [3]. I'm not the only one, of course that thinks this, but it is by no means an accepted fact in the academic world. To continue my software analogy, physics has gone the way of C++ - an extremely useful convoluted mess (only worse). My hope of standing back and watching the community leaders guide physics into the next revolution has more than faded over the past 20 years. I have about zero hope.

So I have decided to put my ideas - such as they are - into a book form, as I feel books can teach much better than papers. Papers are too short and formal. Books by such greats in Physics as Lee Smolin, Carlo Rovelli, etc (to me anyways) give a much clearer idea of where these people think physics is or should be going. Journal papers feel like straightjackets on free expression.

So the purpose of the book is simply to reveal another viewpoint on where physics should go, and it's a very different direction than where it's headed today. The first chapter runs over the plan and outline of the book, but I will tell you right now that this new viewpoint I have runs on one theory - Einstein's General Relativity. The thesis is that the other fields and phenomena of the world we live in can be built with this 'one simple trick'.

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TL;DR

"You guys need more money. You struck the worlds worst licening deal."

– Eric Weinstein talking to Brian Keating, *Youtube[2]*

2.1 Everything all at once

It seems obvious that I should start the book with a chapter on the present state, and what's wrong, etc. But I don't. Instead I'll outline the entire program, like an executive summary. That way, if you're bored you can cut out early and use the saved time to work on a few more eigenvalues or that pickle ball swing.

2.2 General Relativity

If the other fields of physics were this smooth, I wouldn't have to write this book. General Relativity describes how space and time, known as spacetime, for some reason, behaves. Newton figured out how the planets orbit, but perhaps his biggest message - one that still runs almost all of physics - is that spacetime is a perfect, god - given grid, and on that grid, we have forces. That is the major concept of physics even today.

> "What Descartes did was a good step. You have added much several ways, and especially in taking the colours of thin plates into philosophical consideration. If I have seen a little further it is by standing on the shoulders of Giants.

Theoretical physics went well until about 1980. Theoretical physics then got worse over time. The culprits were the astronomers, who found that 95% of the world wasn't in the Standard Model, the experimental physicists, who showed that the world really has faster than light effects, high

temperature superconductivity. But perhaps the biggest enemy of all was the top end schools of thought themselves. Only a few lines of thought have been permitted at all, and if 10,000 person years of effort are any indication, these directions are not useful.

Science is supposed to proceed by opening

What has worked, as

After that, two things happened. Firstly, the model of nature that was settled on around that time, the Standard Model, has gone from explaining virtually everything in the world to about 3-5% of it. Extensions to that theory, primarily, Super Symmetry, String Theory, and Loop Quantum Gravity have proved unfruitful to say the least. [**woit**][**SmolinTrouble**][**SabineLost**].

Explain the layout:

1. Generally Covariant[1].
2. Has the .

- What's right wrong in present day physics.
- General Relativity
- Quantum Mechanics
- Energy in General Relativity (foundational field)
- Emergent Quantum Mechanics
- Quantum Gravity
- Electromagnetism
- Goopy thoughts
- Goodbye for now

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[1] Chapter xxx will try to argue not only that Einsteins ether exists, but is at rest in our universe.

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[2] `www.example.com`

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Table 2.1: Sample table

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Structure of book

Each unit will focus on <SOMETHING>.

About the companion website

The website[4] for this file contains:

- A link to (freely downlodable) latest version of this document.
- Link to download LaTeX source for this document.
- Miscellaneous material (e.g. suggested readings etc).

[3] Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis risus ante, auctor et pulvinar non, posuere ac lacus.

[4] `https://github.com/amberj/latex-book-template`

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- A special word of thanks goes to Professor Don Knuth[5] (for TEX) and Leslie Lamport[6] (for LATEX).
- I'll also like to thank Gummi[7] developers and LaTeXila[8] development team for their awesome LATEX editors.
- I'm deeply indebted my parents, colleagues and friends for their support and encouragement.

Amber Jain
http://amberj.devio.us/

[5] http://www-cs-faculty.stanford.edu/~uno/
[6] http://www.lamport.org/
[7] http://gummi.midnightcoding.org/
[8] http://projects.gnome.org/latexila/

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[3] Sabine Hossenfelder. *Lost in Math: How Beauty Leads Physics Astray*. Hachette UK, 2018.

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