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e [carolina.antunes@tandf.co.uk](mailto:carolina.antunes@tandf.co.uk)

Title and author(s)

1. Provisional title of your book:

*“Superfluous”: The Stories of Einstein’s Special Relativity*

1. Author(s) contact information:

|  |
| --- |
| Name(s): Raymond Brock |
| Affiliation(s): Michigan State University |
| Email(s): [brockr@msu.edu](mailto:brockr@msu.edu) |

1. Please provide a brief biography. Please list any activities that relate directly to the writing of this book and detail any other books you have written/edited.

Raymond Brock is an experimental elementary particle physicist and University Distinguished Professor at Michigan State University (MSU). He received his B.S. in Electrical Engineering from Iowa State University in 1972. After a year in industry, he returned to the university receiving an M.S. in Physics and the Philosophy of Science from Northern Illinois University and his Ph.D. degree Physics from Carnegie-Mellon University in 1980. After two years as a post-doctoral researcher at the Fermi National Accelerator Laboratory he joined the MSU Department of Physics and Astronomy in 1982. In 2011 he was named MSU University Distinguished Professor.

He was Chair of the Department of Physics and Astronomy (PA) from 1994-2001 during which he was instrumental in the construction of a new PA building, facilitated MSU's participation in the creation of the SOAR 4m telescope in Chile, and integrated the private Abrams Planetarium into the PA Department. He returned to full-time research and teaching in 2001.

In the 1980s he was spokesperson of Fermilab neutrino experiment E733 and has been a member of the Fermilab D-Zero collaboration since its inception playing important leadership roles in significant measurements. He led construction of various pieces of the D-Zero apparatus as well as its data-grid team, chairing the experiment's Computing Policy Board for years.

Brock is a member of the MSU LHC ATLAS group, serving originally as the first convener of the Single Top Group and PI of the MSU ATLAS effort. He led the “Phase 0" electronics upgrade to the L1Calo system. He and a colleague at the University of Michigan created and jointly direct the competitively-awarded ATLAS “Tier 2” data center on the MSU campus.

During 2010, he was the elected Chair of the American Physical Society Division of Particles and Fields. He is a past member of the DOE High Energy Physics Advisory Panel (HEPAP), was the U.S. representative to the International Committee on Future Accelerators, and served two terms on the Fermilab Physics Advisory Committee as well as serving as a member of the Fermilab Research Alliance Board of Directors. He was elected as the US ATLAS Institutional Board Chair which coordinates the research activities of the 400 U.S physicists who are members of the ATLAS collaboration. He was subsequently the co-convener of the DPF Snowmass 2013 Energy Frontier decadal study of all of U.S. particle physics.

Brock has taught across the undergraduate and graduate curriculum and has dedicated himself to teaching general education students with the creation of two unique courses for non-science majors: one combining the history of physics with the history of art and another on elementary particles and cosmology. He especially highlights biography and history for non-science students with the strong belief that stories are a great way to locate scientific breakthroughs in history and to inspire students with the creativity that is discovery science.

Brock is the author or co-author on over 1000 publications in experimental and phenomenological particle physics and has been continuously funded by the National Science Foundation since 1982. He is a Fellow of the American Physical Society and a recipient of the two Michigan State University all-university awards for research and teaching.

He is an avid baseball fan and coached baseball many years at the high school level in Michigan.

Synopsis

1. Please describe in approximately 500 words the subject of your book. Please provide information on, for example, what it will cover, and in what way; what needs it will aim to satisfy and how have they arisen; why these needs are sufficiently important to support a new book.

Einstein’s Special Theory of Relativity is iconic. Everyone has heard the (unfortunate) phrase that “everything is relative” and laughed at the well-worn cartoons that suggest the discovery of the T-shirt equation went like, . Well, it wasn’t like that.

In the second paragraph of his remarkable 1905 paper the less-than-unknown, 26 year old Albert Einstein asserted that, "The introduction of a 'luminiferous ether' will prove to be superfluous..." "Superfluous"? That's a word that carries with it the hint of an attitude (in English and in German) and Einstein was nothing if not full of attitude.

With that label, he accomplished two things. First, he rid science of the substance that for a century was presumed to carry light waves through space – the ether. He didn't disprove its existence directly, or even deductively. No, his second contribution was the invention of a new standard for scientific acceptability: since he found that no measurement could confirm the ether's privileged stationary state, then the ether doesn't deserve to share the table with actual, real stuff. Can't measure it? Can't declare it real.

I can state the entirety of the Special Theory of Relativity in two sentences:

1. All of nature is described by the same rules regardless of how you move.
2. The speed of light is constant regardless of how you move.

Of course the devil is in the details of "how you move" and indeed, our story of Relativity follows three separate threads that Einstein tied into a single bundle:

* What is the nature of motion on the earth,
* what is the nature of motion of the earth, and
* what is the nature of electricity plus magnetism.

Special Theory of Relativity has its origins among the ancients, was given hints of life in Medieval times, found its footing in the Renaissance, came into its own with the Baroque, and was thrown into confusion in the Modern age. So a long, interesting trip to 1905.

I’ve found over 20 years of choosing to teach general education instruction along with the “regular” technical physics curriculum that the people and their stories matter. I’m convinced that students remember concepts and the discoveries better when they associate them with the (often courageous) creative individuals who first thought or did something brand new. So I spotlight biography – the good, bad, and ugly side of my physics-ancestors – as the home-base around which I teach the content.

What I propose here is to flesh out the many biographies that I’ve integrated into two “boutique” general education courses at Michigan State University and turn them into a general audience book that highlights often fascinating individuals, focused exclusively on how they informed Special Relativity.

The bulk of each chapter would be a biography that fits into its historical context, including “what was known then.” Each biographical narrative would be followed by a light-touch presentation of how we now use those ideas. Often they change over time and so modern terminology and symbols would be used in this second part of each chapter. There might be a few equations, but descriptively presented: no problems or derivations in the body, although I envision technical appendices that go further, following on the example of Stephen Weinberg’s historical books. In *The First Three Minutes*, *The* *Discovery of Subatomic Particles*, and *To Explain the World* each narrative in the body was written for a lay audience but followed by college-level mathematical explanations in multiple appendices.

I envision a common template for each chapter. For example, for Chapter 12 on Albert Michelson:

**Chapter 12 The Most Important Zero Ever – Albert Michelson**

12.1 *A Little Bit About Michelson*

the biographical narrative

12.2 *The Modern Bits From Michelson*

a topical set of outcomes from Michelson’s work that are important today

12.2.1 The Speed of Light

12.2.2 Michelson’s Interferometer

12.2.3 The Immediate Consequences of the Michelson-Morley Experiment

**Appendix 12**

*The Technical Bits Of Michelson*

Technical explanations of his experiments, some derivations of relations referred to in 12.1 and 12.2

I have in mind a readable set of stories that follow the three strands above to their unpredictable unification into Special Relativity. My hope is that readers will enjoy a pleasurable acquaintance with some incredible historical figures, learn some physics along the way, and be gently guided into an appreciation of how we do science today.

1. Please list at least five specific marketable features of your proposed book.
2. Amazing individuals can always be inspiring. I envision 15 such stories.
3. Readable science that can serve as a recollection for those who had experience in a high school level physics course, or a readable account of terms and relations that can be gently appreciated for the first time.
4. An appreciation for the foundations and the consequences of an iconic model of the world.
5. A layered presentation that can be enjoyed at the level of just stories, at the level of a recollection of some of the physics, and even a technical layer (in appendices) that can serve as a supplement to a standard physics course.
6. Through the narratives, an appreciation for how science develops will hopefully be apparent. “Science” wasn’t birthed fully-formed. Rather it developed over centuries and many of our folks had either direct or indirect influence on process as well as discovery.

Table of Contents

1. Please create a detailed table of contents, preferably broken down to the level of primary subheadings and, if appropriate, secondary subheadings. If the book is intended to consist of chapters by many contributors please include the names and affiliations of the likely authors of each chapter and indicate if they have already been asked and/or agreed to write their chapter.

*(N.B. The contributors do not need to have confirmed their involvement at the time when a book proposal is submitted)*

OPTIONAL/ALTERNATIVELY: Please provide a detailed outline (or paragraph explanation detailing the aims and scope) of each chapter.

See the attached narrative outline.

Manuscript details

1. Publishing to an agreed deadline is fundamental to good publishing. When will you expect to be able to submit the final manuscript?

January 2023?

1. What program (Word or Latex) will you use to prepare your text? (We encourage LaTeX, if at all possible).

LaTeX

1. What is the estimated word/page count of the final book?

400-500 pages?

1. How many equations will be included (estimate)?

50-100? (not counting the appendices)

1. Do you anticipate including any tables or line figures? Please provide an estimate.

50?

1. Will your book feature any supplementary material, e.g. code, datasets, extra homework problems?

I envision technical appendices to accompany each chapter. These would be at the level of college or AP High School physics and consist of expanded explanation of experiments and derivations of important mathematical relations, perhaps only hinted at or presented without derivation in the narrative.

Market

A clear description of your intended readership is essential. Remember that the core market — those individuals and institutions who will actually buy the book — is a good deal smaller than the total potential readership. The following points provide a guideline for describing this market (this list is not exhaustive):

1. At what level will the book be pitched, or what academic background are you assuming?

My approach would accommodate both interested non-specialist readers as well as students, as I anticipate a general flow that is non-technical, but with appendices that go into more pedagogical detail. I’m inspired by Steve Weinberg’s history books that do this very well.

1. What is its exact niche in terms of course titles, research or professional interests?

Apart from the general public, any high school physics student, general education student satisfying a physical science requirement, or undergraduate non-calculus-based course student would benefit.

1. Please provide names of any societies or organizations that may be interested in the book.

American Association of Physics Teachers

American Physical Society Topical Group on the History of Science

American Physical Society Topical Group on Physics Education Research

American Physical Society Forum on Education

American Physical Society Forum on Outreach and Engaging the Public

AAAS Science in the Classroom

Related and competing books

1. Please list below published books (or online resources) which one might consider as similar to your own: on the same topic, written at the same level, and intended for the same audience

Also, please indicate how your book is better or different compared to the competition or related titles. Please be as specific as possible with the differences, as this helps our sales reps a great deal when trying to sell your book.

If you feel there is no direct competition for your book, please list those titles that are more generally related to your book.

My inspiration is somewhat eclectic as I don’t know of any books which take the biography-specific approach to teaching physics that I do. But I distinctly remember books that I’ve read in which the stories inspired me.

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| Title | Author | ISBN | Pub year | $ | Publisher | Differences |
| Men of Mathematics | E.T. Bell |  | 1935, reissue 1986 | $16 | Touchstone | Every chapter a biography: technical subjects, but essentially no mathematics |
| The First Moderns | William Everdell | ISBN-13: 978-0226224800 | 1997 | $50 | University Of Chicago Press | every chapter a biography (not all scientists): no mathematics |
| To Explain the World: The Discovery of Modern Science | Steven Weinberg | ISBN-13: 978-0062346667 | 2015 | $28 | Harper | Every chapter an historical episode with much biography plus technical appendices |
| The First Three Minutes | Steven Weinberg | ISBN-978-0-465-02435-3 | 1977, 1993 | $12 | Cambridge University Press | Topically arranged with technical appendices |
| The Discovery of Subatomic Particles | Steven Weinberg | ISBN-13: 978-0521823517 | 2003 | $31 | Basic Books | Stories in spirit like the proposal here. Again, with technical appendices |

Additional details

1. Please list five possible reviewers for this proposal who are researching or teaching in this area, including their names and e-mail addresses. Please also let us know of any potential conflicts of interest.

We may or may not use the reviewers you suggest. Reviewers will be anonymized. If there are any materials you would like us not to distribute to potential reviewers, please let us know.

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# Thank you for your time