

**Proposal Form**

# **1. Title and author information**

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| **Draft book title** | Quantum Metrology with Photoelectrons Vol. 3: *Analysis methodologies*   * Further developments & techniques * Numerical methodologies * Numerical methods * Numerical techniques and methodologies * Further developments and numerical methods * Analysis techniques |
| **Will your book be authored or edited?**  An authored book is written entirely by you, perhaps in collaboration with co-authors.  In the case of an edited book, each chapter is written by different contributors who are selected and overseen by you as Volume Editor. | Authored |
| **Author / Volume Editor full name(s), positions and affiliations** | Dr. Paul Hockett  Staff scientist, National Research Council of Canada |
| **Author / Volume Editor full mailing address and contact details** | National Research Council of Canada  100 Sussex Drive  Ottawa, Ontario, K1A OR6  Canada  paul@femtolab.ca  Web: [www.femtolab.ca](http://www.femtolab.ca)  arXiv: <http://arxiv.org/a/hockett_p_1.html>  orcid: <http://orcid.org/0000-0001-9561-8433>  Scholar: <https://scholar.google.ca/citations?user=e4FgTYMAAAAJ&hl=en>  Figshare: <http://figshare.com/authors/Paul_Hockett/100955>  OSF: <https://osf.io/ry49v/>  Github: <https://github.com/phockett> |
| **Author / Volume Editor short biographical statement.**  Please also send us a full CV. |  |

# **2. Subject and level of the book**

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| --- | --- |
| **About the topic**  Some background information about the book’s subject, explained in terms that can be understood by non-specialists. | (From Vol. 1):  “The over-arching theme of this work is, as the title suggests, the development of quantum metrology with photoelectrons (chapter 1). This general concept can be viewed as a developing branch of photoelectron spectroscopy, in which the phase-  sensitivity of the photoionization interferometer is utilised via experiments with a high information content.“  Vol. 3 in the series will continue this exploration, with a focus on numerical analysis techniques, forging a closer link between experimental and theoretical results, and making the methodologies discussed directly accessible via new software. |
| **About the book**  A detailed description of the book, including the topics it will cover. Please define any acronyms and advanced terms, avoiding jargon. | Vol. 3. will focus on analysis techniques for quantum metrology with photoelectrons, including:   * Interpreting experimental data. * Extraction/reconstruction/determination of quantum mechanical properties (matrix elements, wavefunctions, density matrices) from experimental data. * Comparison of experimental and theoretical data. * New analysis methodologies & techniques. * Introduction to newly-developed software platform (see below). |
| **Need for the book**  Why do you feel this book should be published? How will it benefit the reader? What will the knowledge shared in the book enable them to do? | Vol. 1 & 2 laid the foundations, but mainly summarised existing work and techniques, with some open-source numerical examples for interested readers. In the next volume, the focus will be on analysis techniques and numerical methods, with a fully “open-science” philosophy, based on newly-developed analysis techniques (continuing the developments at the end of Vol. 2) and open-source software platform. This will allow the reader to make use of the methodologies discussed with the minimum of effort. New python software packages (including *ePSproc*, *ePSdata* and *PEMtk*) will be a key component of this approach, providing the reader with a solid foundation to work from.  For more information, see the *ePSdata* motivations page, <https://phockett.github.io/ePSdata/about.html#Motivation>.  Additionally, if possible, the book itself will be open source, and will be formed from a set of computational notebook (Jupyter notebooks, mainly in Python), with numerical examples in the text immediately accessible to interested readers. (In the previous volumes some computational notebooks were developed, but didn’t form the main part of the work.)  Details to be discussed & confirmed, but the Jupyter Book and Executable Book project may be a good platforms for this, <https://jupyterbook.org/intro.html> and <https://executablebooks.org/en/latest/index.html>. |
| **Table of contents**  A full list of chapters with some description of each. If your book is an edited collection, please include a proposed contributor (including their affiliation) against each chapter title. We understand that the chapter titles and contributor list may change over time. | TBD |
| **Level of the book**  We have three categories of books in our programme. Please check the box against the option you feel is most appropriate:  **☑️ Research & Reference text:** A detailed scholarly overview of a specific topic overview and a way into the primary literature (includes monographs and edited collections)  **☐ Course text:** Aimed at helping the reader (typically at advanced student level) to attain a specific learning outcome and therefore designed to reflect a taught course in universities  **☐ Broad interest:** A widely accessible (usually shorter in length) text introducing a topic for scientists who are not necessarily experts in the book’s topic | |
| **Pedagogical features**  If you are proposing a course-text or reference-text, please list any features that will aid learning, such as worked examples, case studies, end-of-chapter summaries, or chapter problems. | Computational notebooks & software - see notes above. |
| **Key features**  At least four bullet points summarising the main selling points of the book | * New developments in quantum metrology with photoelectrons. * Development of analysis methods from vols 1 & 2, with a focus on direct application by experimentalists. * New applications & examples. * New method development. * Software platform introduction. * Open source. |
| **Key words** | AMO physics, photoelectron spectroscopy, photoelectron imaging, photoionization, ultrafast physics, interferometry, metrology. |

# **3. Market for the book**

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| **Primary market for the book** | Research scientists & students in AMO physics. |
| **Secondary market** | Many aspects of the work also cross-over into related areas, e.g. quantum information sciences, computational physics, scientific software and development. |
| **If your book is a course-text, which courses will it be designed for?**  **If your book is a reference-text, for which courses would it serve as valuable supplementary reading?** |  |
| **Key marketing opportunities**  For example any relevant conferences, professional organisations, journals, societies or companies that would have an interest in this book. | Any conferences with a heavy AMO physics aspect - e.g. DAMOP, CLEO etc. (A previous DAMOP talk on the topic can be found at <https://vimeo.com/223603377>.) |

# **4. Manuscript information**

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| **Approximate length**  Estimated number of pages for the book, based on 450 words per page and half a page per illustration | Similar to previous volumes, ~150 pages. |
| **Approximate number of figures** |  |
| **Supplementary and multimedia materials**  As a digital-first book programme we are interested in including multimedia content where it supports the book. Please supply details and rationale for any multimedia that you intent to submit.  For example: video, animations, interactive equations, interactive figures, software. | Jupyter notebooks + related software platform (see above) |
| **Estimated manuscript delivery date**  Our authors typically spend 12-18 months developing their manuscripts | 12 - 14 months: this work is still in the development phase. |

# **5. Related books**

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| **Which books relate to the book you propose? What are their weaknesses and strengths? In what ways will your book be different to each of them? Please comment.** |  |
| Title |  |
| Author(s)/Editor(s) |  |
| ISBN |  |
| Publisher |  |
| Publication Date |  |
| Page Count |  |
| List Price |  |
| Comments |  |
| Title |  |
| Author(s)/Editor(s) |  |
| ISBN |  |
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| Author(s)/Editor(s) |  |
| ISBN |  |
| Publisher |  |
| Publication Date |  |
| Page Count |  |
| List Price |  |
| Comments |  |

# **6. Reviewers**

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| **Suggested reviewers**  To facilitate the review process, please provide contact details for at least six individuals qualified to give an opinion on the proposal, and include an international mix of reviewers. |  |
| Reviewer 1 |  |
| Reviewer 2 |  |
| Reviewer 3 |  |
| Reviewer 4 |  |
| Reviewer 5 |  |
| Reviewer 6 |  |