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| Book Name: | [Current Research Progress in Physical Science](https://www.bookpi.org/bookstore/product/current-research-progress-in-physical-science-vol-1/) |
| Manuscript Number: | **Ms\_BPR\_4601** |
| Title of the Manuscript: | **Shot-noise-limited optical polarimetry with spin-alignment and magnetism decoupling** |
| Type of the Article | **BOOK CHAPTER** |

**Special note:**

**A research paper already published in a journal can be published as a Book Chapter in an expanded form with proper copyright approval.**

**Source Article:**

**This chapter is an extended version of the article published by the same author(s) in the following journal.**

**Results in Physics, Volume 65, October 2024, 107960.**

[**https://doi.org/10.1016/j.rinp.2024.107960**](https://doi.org/10.1016/j.rinp.2024.107960)

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| PART 1: Comments | | |
|  | Reviewer’s comment **Artificial Intelligence (AI) generated or assisted review comments are strictly prohibited during peer review.** | Author’s Feedback *(Please correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)* |
| **Please write a few sentences regarding the importance of this manuscript for the scientific community. A minimum of 3-4 sentences may be required for this part.** | The work is of great significance for **quantum sensing** and **precision quantum metrology**, particularly in the field of **atomic magnetometers and comagnetometers**, which are used in **fundamental research** (such as the search for new physics and dark matter) as well as **applied fields** (biomagnetism, navigation systems). The authors propose a **theoretical model** and support it with **experimental data**. |  |
| **Is the title of the article suitable?**  **(If not please suggest an alternative title)** |  |  |
| Is the abstract of the article comprehensive? Do you suggest the addition (or deletion) of some points in this section? Please write your suggestions here. | The introduction contains a large number of references and descriptions of previous studies, and it is well-written. However, it does not sufficiently emphasize the key scientific problems that are currently relevant and the necessity of addressing them.  The last paragraph of the introduction could be shortened by briefly summarizing the main results obtained by the authors. This would improve the focus on the research problem while maintaining clarity and conciseness. |  |
| **Is the manuscript scientifically, correct? Please write here.** | The authors provide a detailed description of the problem of noise arising from the interaction between the optical probe and the atomic medium and propose a new method for noise suppression by manipulating multipole moments in zero magnetic fields. The experimental results demonstrate a noise reduction of 8.2 dB at 1 Hz and 10.4 dB at 10 Hz, achieving the shot-noise limit (SQL). The main findings appear convincing but require further clarification and elaboration.  In Figure 3, the dependencies of responses on magnetic fields are presented, but the axis labels are unclear, making data interpretation difficult. A possible revision could be:  "Experimental results of polarization-rotations obtained by sweeping magnetic fields in different directions: (a) x, (b) y, (c) z."  Alternatively, the description could follow the style of Figure 5, e.g., “… magnetic fields in the x, y, and z directions…”  The sentence:  “As the error φ is gradually null, the response amplitudes of the triaxial sweeping fields decrease. In particular, the response of Bsweep\_x is gradually transformed Lorentz-shaped to dispersion-shaped, which can be applied to determine the threshold where spin-alignment polarization dominates.”  could be moved to the section where the presented graphs are discussed for better coherence.  While the authors demonstrate noise suppression, it remains unclear how applicable the method is at different frequencies or in media with different scattering characteristics.  Additionally, the contribution of the study should be more clearly formulated, possibly with a comparison to alternative noise reduction methods, if feasible. |  |
| **Are the references sufficient and recent? If you have suggestions of additional references, please mention them in the review form.** | The article includes a sufficient number of references, with many of them being recent, primarily from 2023 and 2024. This indicates that the authors have incorporated the latest research developments in the field, ensuring the relevance and up-to-date nature of their study. The references appropriately support the theoretical and experimental foundations of the work. |  |
| Is the language/English quality of the article suitable for scholarly communications? | Overall, the language and quality of English in the article are appropriate for scientific communication. However, some phrases, such as “magnetism remanences”, are incorrect in English. The correct term is “magnetic remanence”.  Similarly, “multipole moments evolution” should be revised to “evolution of multipole moments” for grammatical accuracy.  Additionally, the phrase “The probe noise is suppressed by 8.2 dB@1Hz and 10.4 dB@10Hz, achieving a noise floor at the standard quantum limit.” appears three times in the text. A better formulation would be:  “We achieved a suppression of probe noise by 8.2 dB at 1 Hz and 10.4 dB at 10 Hz, reaching the standard quantum limit.” |  |
| Optional/General comments | Overall, the article represents a significant contribution to the field of optical polarimetry and quantum sensing. The proposed noise suppression method is effective and has the potential for widespread application in precision measurements of magnetic fields and quantum effects. The work deserves publication with revisions, including an expanded analysis of the method's applicability limits and, if possible, a comparison with alternative approaches. |  |

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| **PART 2:** | | |
|  | Reviewer’s comment | Author’s comment *(if agreed with the reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)* |
| **Are there ethical issues in this manuscript?** |  |  |

**Reviewer details:**

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