

# On the microscopic approach to describing spin torques in two-dimensional Rashba ferromagnets

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**Abstract.** This letter is written to draw readers' attention to some aspects of the presentation on the microscopic approach to describing spin moments in two-dimensional Rashba ferromagnets, which was presented in a recent review by A.A. Pervishko and D.I. Yudin [*Phys. Usp.* **65** 215 (2022); *Usp. Fiz. Nauk* **192** 233 (2022)].

**Keywords:** Rashba ferromagnets, spin torques

With this letter, I would like to bring to the attention of readers an inaccuracy in the quoting of the original results in recent review [1]. The review focuses on a microscopic approach to describing spin moments in two-dimensional Rashba anti- and ferromagnets. In the introduction, the authors of Ref. [1] state that they consider “the major theoretical results obtained,” including those from Refs [2, 3], which are cited in the review as [37] and [54], respectively. This indicates that the priority of these original papers is acknowledged in the introduction. However, when reading through the review, readers familiar with Refs [2, 3] may be perplexed.

Without citation, the authors of review [1] provide equations (25)–(28) for the coefficients  $a$ ,  $b$ ,  $c$ , and  $d$  determining spin-orbit torques. These formulas can be obtained by routine algebraic substitutions from equations (11), (12b), and (15a) of Ref. [2]. Although there are no explicit expressions for these coefficients in Ref. [2], it is clear that they were calculated for the first time in that paper for the Rashba ferromagnetic model, albeit in an implicit form. Therefore, a reference to [2] would be appropriate in the context of discussing formulas (25)–(28) in review [1].

In Section 3.2 preceding formula (29) in review [1], it is discussed that, in order to obtain accurate results in the presence of disorder, it is essential to take into account vertex corrections within the ladder approximation. It is these corrections, as first demonstrated in Ref. [2], that result in a simple formula (29) that coincides with equation (16) presented in Ref. [2]. However, neither the paragraph above nor below equation (29) makes reference to [2].

There is a similar situation in review [1] with equations (34)–(36) for spin transfer torques. These formulas, even in

notations, are identical to those presented in equations (78), (79) from study [3], where they were first derived. However, in review [1], no citation of Ref. [3] is made either above or below equations (34)–(36).

In Section 3.3 of review [1], which was based on the study [3], there is only one citation of the original work. This reference is in the following context: “In particular, in Fig. 2, ..., these coefficients are in full agreement with the asymptotic values [54] calculated for weak spin-orbit and weak sd exchange interactions.” Note that Fig. 2 includes 9 panels, which match exactly the panels in Fig. 4 from Ref. [3]. The caption for Fig. 2 says, “Two asymptotic cases [54], ...”. This gives the impression that the dashed lines (asymptotes) in Fig. 2 in review [1] were obtained in Ref. [3], while the solid lines are the results obtained by the authors of the review for the first time. However, [3] has not only dashed lines on all panels but also solid ones.

Thus, it can be stated that a reader unfamiliar with original studies [2, 3], after reading review [1], may get a wrong impression about the priority of some results obtained in [2, 3] in the framework of the microscopic approach to describing spin moments in two-dimensional Rashba ferromagnets. In conclusion, I would like to emphasize again that results (25)–(29) and (34)–(36), as well as Fig. 2, presented in review [1], were first obtained in Refs [2] and [3].

## Addition from the editorial board

The authors of review [1] became informed about the letter to the editor from I.S. Burmistrov and sent the following response:

It was not without surprise that we read the text of I.S. Burmistrov's letter to the editors of the journal *Physics Uspekhi* (*Usp. Fiz. Nauk*) concerning our review “Microscopic approach to the description of spin moments in two-dimensional Rashba anti- and ferromagnets” [1].

The letter begins with a rather subjective judgment: “With this letter, I would like to bring to the attention of readers an inaccuracy in the quoting...” (the author means Refs [37] and [54] from review [1], which are cited in the letter as [2, 3]). It remains unclear what is hidden under the term ‘inaccuracy’; moreover, the author immediately contradicts himself, reasonably stating that “...the priority of these original papers is acknowledged in the introduction...” of review [1].

Further in his letter, Burmistrov writes: “Without citation formulas (25)–(28) are presented in the review....” Turning to the text of the original manuscript, an attentive reader will easily find a reference to paper [37] (Ref. [2] in Burmistrov's letter) in the paragraph immediately preceding Eqns (25)–(28).

He then writes: “There is a similar situation in review [1] with equations (34)–(36)... These formulas, even in nota-

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tions, are identical to those presented in equations (78), (79) from study [3]...”. Indeed, in formulas (34)–(36), the original notations from [54] were retained (the numbering is given as in the review) in order to link the text with the original papers, and the corresponding reference [54] (reference [3] in Burmistrov’s letter) is given in the caption to Fig. 2.

The question that seems appropriate to ask here is: does this mean that every time the sd-exchange interaction model was mentioned in the text of our review we should have provided references to the original papers?

The author of the letter writes “...it can be stated that a reader unfamiliar with original studies [2, 3], after reading review [1], may get a wrong impression about the priority of some results ...”

We regret if any of the readers of *Physics Uspekhi* (*Usp. Fiz. Nauk*) could have an erroneous idea about the prioritization. In our opinion, the citation of works [37, 54] (as numbered in the review, or references [2, 3] of Burmistrov’s letter) was sufficiently presented by us in review [1], but we are grateful to I.S. Burmistrov for additional clarifications for the readers of the *Phys. Usp.* (*Usp. Fiz. Nauk*) journal.

With respect,

*A.A. Pervishko, D.I. Yudin.*

## References

1. Pervishko A A, Yudin D I *Phys. Usp.* **65** 215 (2022); *Usp. Fiz. Nauk* **192** 233 (2022)
2. Ado I A, Tretiakov O A, Titov M *Phys. Rev. B* **95** 094401 (2017)
3. Ado I A, Ostrovsky P M, Titov M *Phys. Rev. B* **101** 085405 (2020)