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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Ivan Gnusov

PhD Program: Physics

Title of Thesis: Spinor and vorticity control in polariton condensates

Supervisor: Professor Pavlos Lagoudakis
Co-supervisor: Assistant Professor Sergey Alyatkin

Name of the Reviewer: Dario Ballarini

I confirm the absence of any conflict of interest	**Date: 09-09-2023**

Reviewer's Report

The thesis exhibits a commendable level of quality and a well-structured organization. The introductory chapters lay a robust foundation by comprehensively explaining the physics of polaritons and outlining the experimental techniques. The methods employed in the dissertation are highly relevant to the research objectives. The experimental setup and techniques described in Chapter 3 are meticulously designed to address the specific phenomena under investigation. The chosen topic, focusing on spin and vorticity control in polariton condensates, is addressed systematically in the following chapters. The dissertation firstly focuses on the spin properties of polariton condensates in static confining potential, followed by the presentation of a clever technique for the realisation of rotating optical potentials.

The results obtained throughout the dissertation carry significant scientific weight. The investigations into spin dynamics, vortices, and optically driven spin precession are at the forefront of polariton condensate research. The observed spin coherence of at least 170 ns in Chapter 6 is a testament to the scientific significance of the findings. These results are in compliance with international standards and contribute to the current state of the art in the field of polariton condensates.

The practical applications stemming from this research are highly relevant, particularly in the domains of quantum computing and spintronics. Chapter 5's introduction of a novel approach for engineering linear polarizations and Chapter 6's exploration of GHz spin precession both hold promise for real-world applications. The potential impact of these findings on technology and industry is a notable aspect of the research's relevance.

The quality of associated publications is exemplary. The research has resulted in a series of publications in internationally recognized journals of high prestige. These publications are not only numerous but also maintain a high standard of quality, further enhancing the dissertation's credibility and impact.

This work showcases the huge potential for controlling spin and vortex properties within polariton condensates, unveiling the rich physics of this complex system. Its implications for future technological applications underscore its relevance and importance in the scientific community.

I only recommend a thorough review for any typographical errors and English grammar issues. Additionally, it would be beneficial to provide a clearer and more in-depth explanation and discussion of the compensation for experimental setup optical retardance described in section 5.6.

In conclusion, "Spinor and vorticity control in polariton condensates" demonstrates a high level of quality and a well-structured presentation. The chosen topic remains consistently relevant throughout the dissertation, and the methods used are appropriate and credible. The scientific significance of the results is unquestionable, aligning with international standards. Moreover, the potential applications and the quality of associated publications underscore the research's broader relevance and impact in the field of polariton condensates.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*