



Research Trip Summary Report

Task 2. Foreign mobility of WUST doctoral students

I. Data of the doctoral student

1. Full name: **Dąbrówka Biegańska**
2. Year of studies: **3.**
3. Educational discipline: **Physical Sciences**

II. Foreign research trip (research visit)

1. Research institute in which the foreign research was implemented: **Advanced Photonics Lab at the Institute of Nanotechnology CNR-NANOTEC (Lecce, Italy)**
2. Name and surname of the host person (mentor): **Dr Dario Ballarini**
3. Dates of the research trip: **13.09.2021 - 13.12.2021**
4. Title and date of a seminar delivered during the research trip: **"Elementary excitations of exciton-polariton condensates in a synthetic gauge field" - Advanced Photonics Lab group seminar, 20.09.2021**
5. Description of work carried out during the research trip:

During the internship two main projects were studied: investigation of exciton polaritons and their condensates in a synthetic gauge field, followed by study of universal scaling and coherence after a quench in an exciton-polariton condensate. The participant was involved in first participating and assisting and then performing by herself optical experiments, building and modifying the setup, designing the experiments to find the most suitable conditions, collecting and analysing the spectroscopic data, as well as in discussions and literature studies.

The participant:

- did literature studies on both studied topics,
- learned how to operate setups and the equipment at the host facilities,
- performed optical characterisation of the studied sample (polarisation-dependent and excitation dependent photoluminescence measurements),
- implemented beam structuring via optical elements and Spatial Light Modulator (SLM),
- used different schemes of excitation,
- performed resonant measurements and studied the polariton propagation subject to the synthetic gauge field,
- re-built the spectroscopic setup, with implementation and adjustment of Michelson interferometer, two lasers and a streak camera,
- performed real space and time-resolved photoluminescence measurements,
- studied and found conditions suitable for polariton condensation,
- studied and found conditions for a sudden quench of the condensate by a pulsed laser (by employing the optical Stark effect),



- carefully studied the coherence spatial shape time dependence of the condensate after a sudden quench,
- developed scripts to analyse the data, and used them for the processing and visualization of the results,
- performed detailed analysis of the coherence spatial shape time dependence on parameters such as: condensate density, condensate localization, pulse power, pulse energy, pulse position, at various studied timescales,
- discussed and summarized the results.

6. Description of the main results obtained:

The project was the first experimental study of coherence buildup and evolution after a fast quench of an exciton-polariton condensate. Changes in coherence spatial shape and coherence oscillations were found, that cannot be easily described by universal scaling. The use of the optical Stark effect to quench the condensate was implemented for the first time in a planar microcavity system (previously shown only for waveguide polaritons and not-condensed polaritons) and the effect of the laser pulse on condensate photoluminescence was closely studied.

7. Future collaborations (if applicable):

Shared work and discussions on the obtained results and preparation of a scientific publication.

8. Title and date of a seminar presenting the results of the trip delivered at Wrocław University of Science and Technology after returning from the research trip: "Coherence evolution of an exciton-polariton condensate after quench" – 1.03.2022, Seminarium Zaawansowane Metody Badania Półprzewodników.

III. Doctoral student's signature

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(Date)

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(doctoral student's signature)



IV. Confirmation and information from the host

1. Confirmation of compliance of the information contained in the report: I CONFIRM / ~~DO NOT CONFIRM~~. *(In justified cases, the confirmation of the host may be sent by e-mail to the Dean's Office of the Doctoral School email: interdocschool@pwr.edu.pl)*

2. Additional information and comments

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(Date)

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(signature(s) of Host)

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