

KATARZYNA SADECKA

+48 508 378 370 (PL)

katarzyna.sadecka@pwr.edu.pl | sadkat27@gmail.com

AREA OF INTEREST AND EXPERTISE

Electronic and optical properties of 2D crystals, focusing on mono- and bilayers of transition metal dichalcogenides and graphene. Optical response of 2D heterostructures towards single photon emitter applications. Topological effects manifesting in the excitonic spectrum of 2D materials. Computational methods of density functional theory.

EDUCATION

- PhD studies | Physical Sciences** currently
Optical properties of correlated electrons in two-dimensional crystals
Supervisors: Prof. Arkadiusz Wójs, Prof. Paweł Hawrylak
Wrocław University of Science and Technology, University of Ottawa
- Master's degree | Physical Sciences** July 2021
Optical response of bilayer transition metal dichalcogenides Wrocław, Poland
Supervisor: Prof. Arkadiusz Wójs
Wrocław University of Science and Technology
- Engineer's degree | Physical Sciences** February 2019
Construction of tight-binding models for 2D semiconductor crystals Wrocław, Poland
Supervisor: Prof. Arkadiusz Wójs
Wrocław University of Science and Technology

PUBLICATIONS

- Y. Saleem, K. Sadecka, M. Korkusiński, P. Hawrylak, Nano Letters 23, 2998-3004 (2023)**
"Excitons in Gated Bilayer Graphene Quantum Dots"
- M. Bieniek, K. Sadecka, L. Szulakowska, P. Hawrylak, Nanomaterials 12, 9, 1582 (2022)**
"Theory of excitons in atomically thin semiconductors: tight-binding approach"
- K. Sadecka, Acta Physica Polonica A 141, 2 (2022)**
"Inter- and Intralayer Excitonic Spectrum of MoSe₂/WSe₂ Heterostructure"
- M. J. Winiarski, K. Kozieł, K. Sadecka, P. J. Dereń, Solid State Communications 314, 113936 (2020)**
"The substitution effects on electronic structure of Ba₂MgWO₆ double perovskite oxide"

SKILLS

- Programming:** Fortran (advanced), MATLAB (advanced), Python (basic), C++ (basic), Bash (basic)
- Experience in using computer clusters | the job scheduler:** Slurm and PBS
- Knowledge of computational methods of density functional theory | Abinit (advanced), VASP (basic)**
- Experience in the field of condensed matter physics, especially:**
- tight-binding approximation, k-p methods and Bethe-Salpeter theory,
 - excitons and trions in monolayers of semiconductor transition metal dichalcogenides (tight binding models for solving the Bethe-Salpeter equation and predicting the exciton fine structure),
 - optical response of transition metal dichalcogenide bilayers (studies from the point of view of electronic, excitonic and topological properties),
 - excitonic properties of bilayer graphene quantum dots (predicting the exciton fine structure using the Bethe-Salpeter equation),
- Graphing and Analysis:** OriginLab, Gnuplot
- Document Creation:** LaTeX, Microsoft Office

PROJECTS AND RESEARCH

Electronic and optical properties of correlated electrons in two-dimensional crystals and quantum dots

Wrocław University of Science and Technology, University of Ottawa

Topological effects in excitonic spectrum in two-dimensional crystals

Wrocław University of Science and Technology, University of Ottawa

Optical response of monolayers and heterostructures of transition metal dichalcogenides

Wrocław University of Science and Technology, University of Ottawa

***Ab initio* based tight binding models for excitons in 2D semiconductor transition metal dichalcogenide crystals**

Wrocław University of Science and Technology, University of Ottawa

Electronic structure of Ba_2MgWO_6 double perovskite oxide | *Abinit*

Institute of Low Temperature and Structure Research, Polish Academy of Sciences

Summer 2019

SCIENTIFIC ACTIVITY

International Internships, Canada

March; May – June; August – December 2022
October – December 2021

Quantum Theory Group, University of Ottawa, Canada

International Scientific Visit, Germany

Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Germany

December 2021

HONORS AND AWARDS

Dean's Award for Scientific Achievements

Wrocław University of Science and Technology

November 2022

Attendance in International Summer School on HPC Challenges in Computational Sciences

GRNET and Partnership for Advanced Computing in Europe (PRACE)

19 – 24 June 2022

Scholarship of the Rector of the Wrocław University of Science and Technology

Wrocław University of Science and Technology

2018 – 2021

Scholarship for Academic Performance from Own Fund for Scholarships from Wrocław University of Science and Technology

Wrocław University of Science and Technology

May 2021
July 2020

Diploma of completion of first- and second-level studies with the grade: Excellent

Wrocław University of Science and Technology

February 2020
July 2021

CONFERENCES AND PRESENTATIONS

Electrically Tunable Excitons in Gated Bilayer Graphene Quantum Dots

EP2DS-25 and MSS-21

July 2023

Electrical Control of Interlayer Physics in Type-II TMD Heterostructures (Poster)

51st International School & Conference on the Physics of Semiconductors "Jaszowiec 2023"

June 2023

Fine structure of excitons in TMD type-II heterostructures (Poster)

Strongly Correlated Matter: from Quantum Criticality to Flat Bands

August 2022

Fine structure of excitons in TMD type-II heterostructures

2022 CAP Congress

May 2022

Fine structure of excitons in TMD type-II heterostructures (Poster)

International Workshop on Quantum Circuits in 2D Materials 2022

June 2022

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| Electronic properties and inter- and intralayer excitons in MoSe₂/WSe₂ heterostructure APS March Meeting 2022 | March 2022 |
| Excitons in Transition Metal Dichalcogenide Heterostructures 6th Polish Conference Graphene and other 2D materials | September 2021 |
| Excitons in Transition Metal Dichalcogenide Heterostructures (Poster) 49th International School & Conference on the Physics of Semiconductors "Jaszowiec 2021" | September 2021 |
| Optical response of transition metal dichalcogenide heterostructures Symposium Młodych Naukowców 2021 | August-September 2021 |
| Optical response of transition metal dichalcogenide heterostructures (Poster) Topological Matter School | August 2021 |
| Excitonic properties of low dimensional transition metal dichalcogenides International Conference for Physics Students | August 2021 |
| Optical response of bilayer transition metal dichalcogenides I Wydziałowa Integracyjno-Naukowa Konferencja Ogólnofizyczna: WINKO | April 2021 |
| Exciton properties calculations in 2D semiconductor crystals (PL) V Ogólnopolska Studencka Fizyczno-Optyczna Konferencja FOKA 2020 | December 2020 |
| Exciton properties calculations in 2D semiconductor crystals (PL) III Edycja Studenckiej Konferencji Nauk Ścisłych im. prof. Antoniego Hoborskiego | November 2020 |
| Ab initio based tight binding models for excitons in 2D semiconductor TMD crystals Phobia Annual Nanophotonics International Conference PANIC | October 2020 |
| Tight binding models for exciton properties calculations in 2D semiconductor crystals (PL) Symposium Młodych Naukowców 2020 | August 2020 |
| Construction of tight binding models for 2D semiconductor crystals Winter Kindergarten of Theoretical Physics 2020 | February 2020 |
| Tight binding models construction for 2D semiconductor crystals (PL) IV Ogólnopolska Studencka Fizyczno-Optyczna Konferencja FOKA 2019 | December 2019 |
| Tight binding models construction for 2D semiconductor crystals (Poster, PL) 45 Zjazd Fizyków Polskich | September 2019 |

COMMUNITY INVOLVEMENT

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|---|-----------------------------|
| Coordinator for promotion and social media ScienCon2022 International Association of Physics Students {iaps}: NC Poland | February 2021 – April 2022 |
| Member of the Journal Club PSS NABLA Wrocław University of Science and Technology | April 2021 – October 2021 |
| Coordinator for promotion and social media Physics Student Society NABLA Wrocław University of Science and Technology | October 2020 – October 2021 |
| Member of the organizing committee of the V Conference „FOKA” Wrocław University of Science and Technology | Winter 2020 |
| Member of the International Association of Physics Students {iaps} and Member of the International Association of Physics Students {iaps} NC Poland | October 2020 – now |
| Member of the Physics Student Society NABLA Wrocław University of Science and Technology | October 2019 – now |

LANGUAGES

Polish: native

English: ACERT: B2

German: Deutsches Sprachdiplom der Kultusministerkonferenz - Zweite Stufe: C1

Spanish: A1

French: A1