Report on the outcomes of a Short-Term Scientific Mission[[1]](#footnote-1)

Action number: CA18232

Grantee name: Iveta Semorádová

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| **Details of the STSM**  Title: Eigenfunctions and eigenvalues of Schrödinger operators with complex potentials  Start and end date: 14/03/2022 to 15/07/2022 |
| **Description of the work carried out during the STSM**  Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section. |
| *(max. 500 words)*  *During her stay, Iveta Semorádová engaged in the activities of the Department of Applied Mathematics. Specifically, she participated in two advanced mathematical lectures and the regular seminar of the department, familiarizing herself with the work of all the members of the department. She also presented a talk at this seminar, presenting her previous research and introducing herself to the workgroup.*  *The grantee worked on the proposed project in close collaboration with Petr Siegl.*  *The first part of the STSM was spent on research. Studying the Liouville-Green approximation method in all its forms. Properties of standard and modified Bessel equations and their transformations and how they can be used to generalize the Liouville-Green transformation to the method of Langer in a more general setting. Specifically, how the terms change if we allow for the potential or/and eigenvalues to be complex. An important part was to examine how to redefine key quantities such as “turning point” in a complex setting. Another question was the generalized definition of a function ζ, which is defined using the turning point and comprises the tricky term . Its asymptotic behaviour was studied also numerically for various scenarios.*  *This preparatory part took longer than expected, but it was crucial for obtaining a deeper understanding of the problem and navigating through its challenges.*  *The second part of the STSM was spent on generalizing the technical lemmas for complex parameter z. Specifically, we started with the bounded imaginary part of the parameter. Even for this case the proofs of key lemmas became significantly more complicated and required the development of new steps of the proofs.*  *One important part was to estimate the asymptotic behaviour of the proposed approximating functions. Asymptotic behaviour of modified Bessel functions with complex argument was used. And the weight functions used to estimate the behaviour were generalized for the complex argument ζ.*  *The other part was to estimate the behaviour of the function ζ, which is technically the most challenging part. Here we encountered some obstacles as some steps which are trivial in the real case become significantly more sophisticated in the complex case.*  *Only after the main theorem is properly generalized can we move to applications, as proposed in the work plan. Such will be done in future follow-up work.* |
| **Description of the STSM main achievements and planned follow-up activities**  Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.  *(max. 500 words)*  *The planned goal of generalization of the method of Langer was partially accomplished for a specific scenario of complex parameter with the bounded imaginary part. The target goal generalization of the method of Langer to a broad class of complex potentials is very ambitious and challenging and thus requires additional work.*  *The following Action objectives and deliverables were accomplished.*  *The objective to merge the research activities of groups that are currently separately working on spectral theory was fulfilled by deepening the cooperation between Prague, CZ, and Graz, AT, in spectral theory and mathematical physics. More specifically, Iveta Semorádová had enough time to get acquainted with the whole department and the research of its members, as well as present her results and scientific interests. The collaboration was initiated with the numerical mathematics part of the department as well.*  *Iveta Semorádová was the first female postdoc scientist in the department which contributes to the capacity-building objectives to improve gender balance in mathematical research. As an early career investigator from an inclusive target country (ITC), the grantee was supported on her first PostDoc stay.*  *The STSM, therefore, contributed to the objective to foster the exchange between ITC and non ITC researchers, with a special focus on early career investigators.*  *As a consequence of the STSM, the grantee was proposed 6 months postdoc position at TU Graz. This will allow Iveta Semorádová to finish the project together with the planned resulting publication in an impacted journal (several pages of which are already written).* |

1. This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant. [↑](#footnote-ref-1)