

ABEL VISITING SCHOLAR PROGRAM

Matrix Negative Order KdV Equations, Uzbekistan, Germany



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Host: **Thomas Kriecherbauer**, Universität Bayreuth, Germany

CONTEXT

Research in nonlinear integrable systems in Uzbekistan is actively developing, but access to advanced methods and international collaboration remains limited. In particular, the inverse scattering transform for negative order matrix nonlinear equations are not widely accessible. This creates challenges for young researchers in engaging with cutting-edge mathematical research and participating in global scientific networks.

CDC SUPPORTED ACTIVITY

The activity consisted of a research visit to Universität Bayreuth, Germany, from April 3 to April 30, 2023. The research focused on the integration of the negative-order matrix KdV equation using the inverse scattering method. Key activities included the study of direct and inverse scattering problems for matrix Sturm-Liouville operators, analysis of the time evolution of scattering data, investigation of soliton solutions in the commutative case, and regular discussions and collaboration with Prof. Thomas Kriecherbauer.

IMPACT

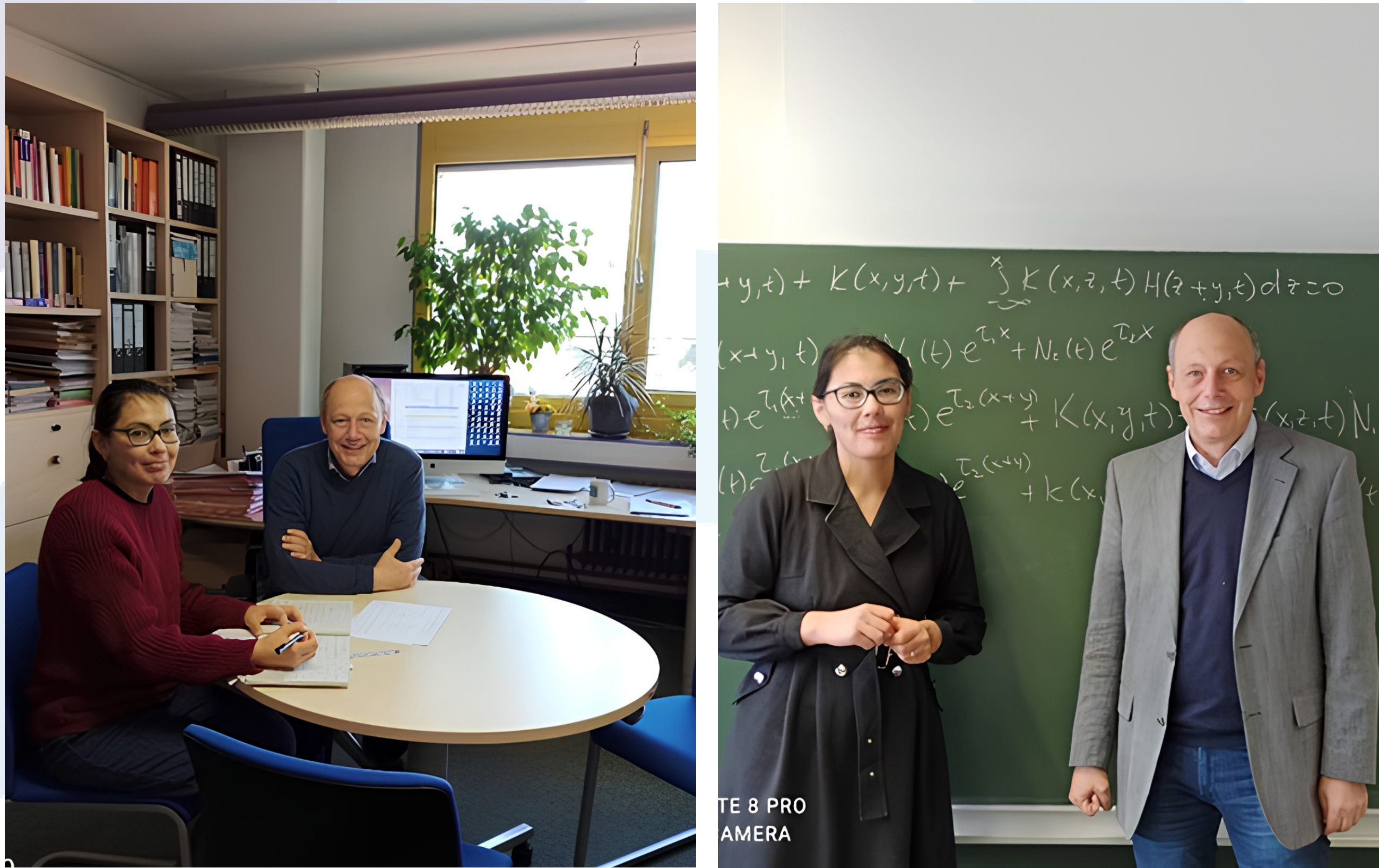
Through the Abel Visiting Scholar Program, I significantly strengthened my research expertise in inverse scattering theory, integrable systems, and spectral analysis. The visit provided an excellent opportunity to engage in intensive scientific discussions, study modern analytical techniques, and develop new approaches related to the matrix negative-order Korteweg-de Vries equation and associated inverse scattering problems. Collaboration with Prof. Thomas Kriecherbauer greatly improved my ability to conduct independent mathematical research, formulate rigorous analytical arguments, and apply contemporary methods in integrable systems and mathematical physics.

The academic environment at the host institution also enabled me to broaden my international research network and gain valuable experience in collaborative scientific work at a high international level. The knowledge and experience gained during the visit have strengthened my professional development, improved my research capacity, and enhanced my ability to supervise and mentor students and young researchers in Uzbekistan.

Overall, the Abel Visiting Scholar Program has had a lasting impact on my academic growth by equipping me with new research skills, international collaborations, and modern mathematical techniques that continue to influence both my scientific work and my contribution to the mathematical community in Uzbekistan.

OUTCOMES AND ACHIEVEMENTS

- Joint research paper published in Wave Motion journal
 - T. Kriecherbauer, G.U. Urazboev, A.K. Babadjanova, "On the matrix negative order Korteweg-de Vries equation — the commutative case," Wave Motion, Volume 138, 2025, 103562, ISSN 0165-2125, <https://doi.org/10.1016/j.wavemoti.2025.103562>.
- New research results on matrix negative-order KdV equations
- New research directions identified for future work
- Long-term collaboration established with Universität Bayreuth



REFLECTIONS

This experience was an important step in strengthening international collaboration and advancing mathematical research in Uzbekistan. On a personal level, the collaboration significantly broadened my scientific perspective and improved my ability to work within an international research environment. Direct interaction with experienced researchers allowed me to deepen my understanding of inverse scattering theory, integrable systems, and modern analytical methods, while also increasing my confidence in conducting independent research at an international level. Through participation in seminars, discussions, and joint research activities, I gained access to new ideas, research methodologies, and academic connections that would have been difficult to establish locally.

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