Bahçeşehir University, Istanbul, Turkey
Analysis & PDE Center, Ghent University, Ghent, Belgium
Institute Mathematics & Math. Modeling, Almaty, Kazakhstan

"Analysis and Applied Mathematics"

Weekly Online Seminar

Seminar leaders:
Prof. Allaberen Ashyralyev (BAU, Istanbul),
Prof. Michael Ruzhansky (UGent, Ghent),
Prof. Makhmud Sadybekov (IMMM, Almaty)

Date: **Tuesday, December 20, 2022**
Time: 14.00-15.00 (Istanbul) = 12.00-13.00 (Ghent) = 17.00-18.00 (Almaty)

Zoom link: https://us02web.zoom.us/j/6678270445?pwd=SFNmQUIvT0tRaH-lDaVYrN3l5bzJVQT09, **Conference ID:** 667 827 0445, **Access code:** 1

Speaker:

Prof. Dr. Vsevolod Sakbaev
Keldysh Institute of Applied Mathematics Russian Academy of Science, Russia

Title: On the Properties of Solutions of Nonlinear Schrodinger Equation

Abstract: We consider the transformation of the initial data space of the Cauchy problem for the focusing nonlinear Schrodinger equation with power nonlinearity in potential ([1]-[3]). Also we study properties of the initial-boundary value problem for a nonlinear Schrodinger equation including terms with delay of time argument.

First, we prove the local existence for Cauchy problem and for initial problem. After that we study the phenomenon of global existence of a solution of the Cauchy problem for small power of nonlinearity. In the case of large power of nonlinearity the phenomenon of rise of a solution gradient blow up during a finite time is proven. In last case we study qualitative properties of a solution when it approaches to the boundary of its interval of existence. Same properties are studied for the initial problem.

The relation of the gradient blow up phenomenon with the self-focusing and the destruction of pure quantum state are described [2]. Moreover, we define a solution extension through the moment of a gradient blow by means of the random process with values in the set of pure quantum states. We show that this extension describes the destruction of a solution as the destruction of a pure quantum state and the transition from the set of pure quantum states into the set of mixed quantum states [3].

References:

[1] *A.D. Grekhneva & V.Zh. Sakbaev, Dynamics of a Set of Quantum States Generated by a Nonlinear Liouville–von Neumann Equation. Computational Mathematics & Mathematical Physics,* ***60****:8 (2020), 1337-1347.*

[2] *L.S. Efremova, A.D. Grekhneva, V.Zh. Sakbaev, Phase flow generated by Cauchy problem for nonlinear Schrodinger equation and dynamical mappings of quantum states. Lobachevskii Journal of Mathematics,* ***40****:10 (2019), 1455-1469.*

[3] *V.Zh. Sakbaev & A.D. Shiryaeva, Blow-Up of States in the Dynamics Given by the Schrödinger Equation with a Power-Law Nonlinearity in the Potential. Differential Equation,* ***58****:4 (2022), 498-508.*

Biography:

Vsevolod Sakbaev – is now a leading researcher of Keldysh Institute of Applied Mathematics and professor of mathematics at the Moscow Institute of Physics and Technology, Russia. He accomplished complete university career from teaching assistant to professor at Moscow Institute of Physics and Technology (MIPT), leading researcher of Keldysh Institute of Applied Mathematics (since 2020). V. Sakbaev has been continuously teaching (since 1997) all university courses in mathematics. In 2018-2020 he was vice-head of the department of general mathematics at the MIPT.

His main scientific results and contributions are within the following areas: boundary value problems for linear and nonlinear partial differential equation, differential and difference-differential operators, one-parametric semigroups of linear operators and its approximations, general theory of measure and integral, Feynman path integral, random operators and limit theorems for their compositions.

V. Sakbaev has published more than 50 articles in peer-reviewed journals and in total more than 100 scientific works. He supervised several PhD works. V. Sakbaev took part as the member of organizing and program committees in a lot of international conferences.