



ЮЖНЫЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ  
Региональный математический центр  
SOUTHERN FEDERAL UNIVERSITY  
Regional Mathematical Center  
<https://rmc.sfedu.ru/>, Rostov-on-Don, Russia

## International scientific online seminar on Analysis, Differential Equations and Mathematical Physics

Supervisors: Prof. Alexey Karapetyants, Prof. Vladislav Kravchenko

**25th June 2020, 5 pm (UTC+3)**

### The Banach Gelfand Triple and its role in Classical Fourier Analysis and Operator Theory

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The concept of Hilbert spaces is one of the central schemes in Fourier Analysis or Functional Analysis. However, for the study of unbounded operators (e.g. for the solution of PDE) one has to resort to the Gelfand Triple, consisting of the Schwartz space, the Hilbert space  $L^2(\mathbb{R}^d)$  and the space of tempered distributions, with  $S \subset L^2 \subset S^*$ .

In the context of Time-Frequency Analysis and Gabor Analysis another pair, consisting of the Banach Algebra  $S_0(\mathbb{R}^d)$ ,  $L^2(\mathbb{R}^d)$  and the dual space  $S_0^*(\mathbb{R}^d)$ , the so-called «mild distributions» plays a similar role. The Fourier invariance of  $S_0(\mathbb{R}^d)$  allows to extend the Fourier transform to all of  $S_0^*(\mathbb{R}^d)$ , but also to derive a kernel theorem, i.e. a characterization of the bounded linear operators from  $S_0(\mathbb{R}^d)$  to  $S_0^*(\mathbb{R}^d)$  through distributional kernels in  $S_0^*(\mathbb{R}^{2d})$ .

The talk will try to illuminate the basic ideas of this new setting (avoiding both Lebesgue integration and topological vector space), but also indicate how it can be used to provide a valid mathematical model for many problems arising in the context of physics or engineering (linear translation invariant systems, convolution, transfer function, Dirac combs etc.). Thus it is a useful tool for research in time-frequency analysis, but also for the teaching of engineering classes.

Corresponding papers can be obtained from the author by request.

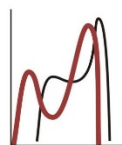
\*Seminar website: <https://rmc.sfedu.ru/seminar>. The seminar uses Microsoft Teams online platform. To join the seminar, please send a request to [pichugina@sfedu.ru](mailto:pichugina@sfedu.ru) (Olga Pichugina, scientific secretary).

The Seminar is organized by the Regional Mathematical Center of the Southern Federal University in collaboration with Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University and the special Interest ISAAC-OTHA group in Operator Theory and Harmonic Analysis.

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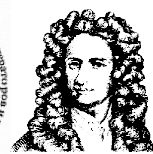
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