

# Seminar

**Institute of Applied Physics, KIT**

**Date: 30.07.2025, Time: 14:00**

**Place: seminar room 8.2 Physikhochhaus, KIT**

**Wolfgang-Gaede-Str. 1, 76131 Karlsruhe**

ZOOM LINK: <https://kit-lecture.zoom-x.de/j/68254879615?pwd=ILym7KOGwPTVGUVSQqsm6qaQcur8cZ.1>

## **Superconducting Base Elements for Brain-Inspired Neural Networks: Spintronic Innovations for Neuromorphic Computer**

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**Abstract.** With the growing energy demands of modern computers based on von Neumann architecture, the need for more energy-efficient computing solutions has become increasingly urgent. This has led to a shift towards non-von Neumann computing paradigms, particularly those inspired by the brain's neural network architecture. Artificial Neural Networks (ANNs), which emulate the structure and function of biological neurons and synapses, have gained significant attention in this context. These networks, when built on superconducting elements, promise a dramatic reduction in energy consumption, addressing the key limitations of current semiconductor-based computing systems. In this work, we investigate superconducting artificial neurons based on superconducting spin valves and artificial synapses composed of hybrid nanostructures. The study focuses on superconductor/ferromagnet layered hybrid nanostructures, highlighting their potential in superconducting spintronics and energy-efficient computing.

Results obtained in frame of projects “SPINTECH” (GAN<sup>o</sup>81144), and Megagrant (project No 075-15-2025-010)

**Keywords:** Superconductivity, Spintronics, Neuromorphic Computing, Artificial Neural Networks, Hybrid Nanostructure

**Prof. Dr. Anatolie Sidorenko** is expert in the field of nanotechnologies and functional superconducting nanostructures. He is leading researcher of the of Institute of Electronic Engineering and Nanotechnologies of Technical University of Moldova, author of over 500 scientific publications, 62 patents, the editor of 5 books published in “Springer”, the editor of three thematic series “Functional Nanostructures” in Beilstein Journal of Nanotechnology (Germany), associated editor of Moldavian Journal of the Physical Sciences, full member of Moldavian Academy of Sciences, member of Deutsche Physikalische Gesellschaft (DPG).