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To whom it may concern

With this letter, I would like to provide the evaluation of the proposed project “Radiochemistry and spectroscopy for astrophysics and nuclear medicine” proposed by Filosofov D. et al. at the Joint Institute for Nuclear Research (JINR).

Currently, the nuclear medicine field is booming with novel developments and advancements in targeted radionuclide imaging and therapy. Rapidly growing numbers of clinical trials on radiopharmaceuticals (^{177}Lu- and ^{225}Ac- PSMA, mabs, TOC, and others) and multi-billion dollars investments from the industry (e.g., Novartis, Bayer, and several others) provide evidence that the field has a bright future ahead. The development of efficient production and radiochemical separation strategies for securing clinical quantities of medical radionuclides is the key component for the success of the novel and existing radiopharmaceuticals. The Radiochemistry team at Laboratory for Nuclear Problems (LNP) at Joint Institute for Nuclear Research (JINR) led by Dr. Filosofov has decades of relevant experience in the design of production methods and technologies for fundamental nuclear physics and radiopharmaceutical science. Importantly, several key technologies which lead this field to success were developed by the JINR radiochemistry team or were involved members of this team. Two important examples which advanced the field are the development of ^{68}Ge/^{68}Ga generators for Positron Emission Tomography (PET) enabling cyclotron-independent sources available to hospitals around the globe. The JINR team was actively involved in the development and design of the generator in collaboration with Johannes Gutenberg University of Mainz, Germany (Zhernosekov et al. doi:10.2967/jnumed.107.040378). Another key radionuclide is ^{177}Lu which is used for targeted radionuclide therapy (TRT) and routinely used in the clinic for several drugs (e.g. octreotide and PSMA for neuroendocrine and prostate cancers respectively). Reactor production is the most suitable route for ^{177}Lu and irradiation of Yb provides a source of no-carrier-added Lu which is best suitable for radiopharmaceuticals. The main challenge, in this case, is the separation of two lanthanides (Lu and Yb) which was developed based on the experience of the team at JINR (Lebedev N. A. et al. https://doi.org/10.1016/S0969-8043(99)00284-5). Besides those two examples team at JINR was

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developing radiochemical separation and characterization of many promising diagnostic and therapeutic radionuclides (including but not limited to ^{225}Ac, ^{90}Nb, ^{119}Sb, ^{44}Ti/^{44}Sc, etc.). Importantly, the team has a platform (knowledge and facility) for the fundamental evaluation of physical and chemical properties of radionuclides and radiopharmaceuticals which is critical when developing new radiopharmaceuticals. With decades of collaboration with fundamental nuclear physics groups, the radiochemistry team is placed in a very unique position to have access to facilities (e.g., spectrometers, techniques, etc.) and knowledge from experts on nuclear decay and interactions at the atomic levels which can provide with important insides on the design of next generation of diagnostic and therapeutic radiopharmaceuticals. Specifically, significant importance is the approach to the study of post-effects of the decay in low energy spectra for nuclear medicine and fundamental physics. These studies will be possible due to the many years of expertise of the team on Auger spectroscopy and the availability of a unique spectrometer (ESA-50). Additionally, the proposed direction of purification for low-background measurement studies represents importance for nuclear medicine and will enable achieving high specific activity radiopharmaceuticals and provide access to high radiochemical purity radionuclides. Developed over the years techniques for the characterization of radionuclide complexes and the study environment of radiopharmaceuticals (e.g. perturbed angular correlation and electromigration) can provide important information on the complexation, stability, and characteristic of the complexes which can lead to the design of efficient and selective radiopharmaceuticals.

I would strongly recommend supporting the proposed project and enabling research that can advance not only the local scientific landscape in radiopharmaceutical science but will significantly contribute to the global advancement in nuclear medicine and fundamental nuclear physics. Supporting this project and enabling the infrastructure for production and the characterization of radiopharmaceuticals will form an important cluster for Life Sciences research at JINR, nationally and internationally.

Sincerely yours

Dr. Valery Radchenko

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