RCNP, OSAKA UNIVERSITY
NUCLEAR PHYSICS SEMINAR

Title: Development of the BNCT facility at Budker Institute of Nuclear Physics

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Date and Time: Nov 28th (Wed) in 2018 15:00 -

Place: Lecture Room 1 (on the 6th floor of RCNP main building

Abstract:

To enable the development of a promising cancer therapy, boron neutron capture therapy [1], an accelerator-based epithermal neutron source was designed and made at the Budker Institute of Nuclear Physics [2]. A stationary proton beam with 2 MeV energy, 7 mA current, 0.1% energy monochromaticity and 0.5% current stability is obtained in a electrostatic tandem accelerator with vacuum insulation, new type of particle accelerator. Neutrons are generated as a result of a ^{7}Li(p,n)^{7}Be threshold reaction by directing a proton beam to a lithium target with a diameter of 10 cm. The target is made of a thin lithium layer deposited on an efficiently-cooled substrate. Currently, neutrons are generated for multiple *in vitro* and *in vivo* studies, proton beam is used for radiation blistering study, for beryllium-7 migration study and the facility is improved for patient treatment at 2.3 MeV 10 mA proton beam. The effect of neutron radiation on different cell cultures incubated in boron medium is studied in cooperation with the Tsukuba University and the Institute of Molecular and Cell Biology. It was shown that the viability of U251 human glioma cells and T98G human glioblastoma cells was significantly inhibited [3]. The viability of tumor-grafted mice is studied in cooperation with the Institute of Cytology and Genetics and SPF-Vivarium. It was shown that irradiation led to a complete cure in mice grafted with human glioblastomas. The formation of blisters on the surfaces of selected metal targets is studied using 2 MeV protons in concert with a team of Okinawa Institute of Science and Technology [4]. It was found that the blistering threshold of the copper surface depends on the copper purity. Once blisters appear on the copper surface, further irradiation does not cause any more surface modification. Tantalum is much more resistant to the formation of blisters than copper. During tantalum irradiation, an increase in the sample surface temperature was detected. A new, long-life, thin neutron-producing target and beam shaping assembly [5] were manufactured and prepared for installation in the facility to obtain a therapeutic neutron beam that meets the requirements of BNCT to the greatest extent. The report describes the facility, presents and discusses the results of the research and declares plans.

References

[1] Neutron Capture Therapy: Principles and Applications. Eds.: W. Sauerwein et al. Springer, 2012.
[2] S. Taskaev, Physics of Particles and Nuclei **46** (2015) 956-990.
[3] E. Sato *et al.,* Journal of Radiation Research **59** (2018) 101-107.
[4] A. Badrutdinov *et al.,* Metals **7** (2017) 558.
[5] L. Zaidi *et al.*, Applied Radiation and Isotopes **139** (2018) 316-324.

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