Contribution ID: **7** Type: **Invited talk**

How to observe vacuum decay in low-energy heavy-ion collisions

It is known that in slow collisions of two bare nuclei with the total charge number exceeding the critical value, Z_1+Z_2 > Z_c =173, the initially neutral vacuum can spontaneously decay into a charged vacuum and two positrons. The detection of spontaneous emission of positrons would be a direct proof of this fundamental phenomenon. However, the spontaneous emission of positrons is usually masked by the dynamic (induced) emission of positrons, which is caused by a rapidly changing electric field created by colliding nuclei. For many years, it was believed that vacuum decay can only be observed in collisions with nuclear sticking, when the nuclei are bound for a period of time due to nuclear interactions. But to date, there is no evidence that nuclear sticking occurs in such collisions of heavy ions. In our recent papers [1-4] it has been shown that vacuum decay can be observed without any sticking of nuclei. This can be done by measuring the probabilities of the creation of positrons or positron spectra for a given set of nuclear trajectories. The results of this study will be presented in the talk.

This work was carried out with the financial support of the RSF grant No. 22-62-00004.

[1] I.A. Maltsev, V.M. Shabaev, R.V. Popov, Y.S. Kozhedub, G. Plunien, X. Ma, Th.~Stoehlker, and D.A. Tumakov, Phys. Rev. Lett. 123, 113401 (2019)
[2] R.V. Popov, V.M. Shabaev, D.A. Telnov, I.I. Tupitsyn, I.A. Maltsev, Y.S. Kozhedub, A.I.~Bondarev, N.V. Kozin, X. Ma, G. Plunien, T. Stoehlker, D.A. Tumakov, and V.A.~Zaytsev, Phys. Rev. D 102, 076005 (2020).
[3] R.V. Popov, V.M. Shabaev, I.A. Maltsev, D.A. Telnov, N.K. Dulaev, and D.A. Tumakov, Phys. Rev. D 107, 116014 (2023).
[4] N.K. Dulaev, D.A. Telnov, V.M. Shabaev, Y.S. Kozhedub, I.A. Maltsev, R.V. Popov, and I.I. Tupitsyn, Phys. Rev. D 109, 036008 (2024).

Primary author: SHABAEV, Vladimir (St. Petersburg State University)

Presenter: SHABAEV, Vladimir (St. Petersburg State University)