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Forward neutrons from 12C-12C and 40Ca-40Ca collisions in the SPD experiment as a probe of nucleon-nucleon correlations.

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The research program of the SPD experiment at NICA facility is focused on studies of collisions of polarized protons and deuterons [1,2]. Studies of collisions of non-polarized light nuclei, 12C and 40Ca, are also considered as a possible extension of the SPD research program [3]. The SPD setup will be equipped with a pair of Zero Degree Calorimeters (ZDC) for luminosity measurements and local polarimetry with forward neutrons. In studies of 12C-12C and 40Ca-40Ca collisions, ZDC can be employed to detect forward spectator neutrons as event triggers and determine the collision centrality. However, as it was demonstrated [4], the short-range nucleon-nucleon correlations in colliding nuclei can significantly change the yields of the spectator neutrons. It was also shown that accounting for intranuclear clustering decreases the yield of spectator neutrons [5].
In this work, 12C-12C and 40Ca-40Ca collisions at the SPD were simulated with the Abrasion-Ablation Monte Carlo for Colliders (AAMCC-MST) model with MST-clustering [4-7], which was validated for fragmentation of 16O [5,6]. In order to study the effect of α-clustering in 12C, the nuclear density profile of 12C was parametrized either as three α-clusters arranged into a triangle [8] or by the harmonic oscillator parametrisation. The short-range nucleon-nucleon correlations (SRC) in 12C and 40Ca were taken into account following Ref. [9]. The yields of forward spectator neutrons were calculated for 12C-12C and 40Ca-40Ca collisions at √sNN = 11 GeV. The centrality dependence of the neutron yields was proposed as a possible probe of the SRC in 40Ca and α-clustering in 12C. The obtained results can help in evaluating the performance of neutron ZDCs in future nucleus-nucleus runs at the SPD.

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Author: SVETLICHNYI, Aleksandr (MIPT, INR RAS)

Co-authors: PSHENICHNOV, Igor (Institute for Nuclear Research, Russian Academy of Sciences); Mr SAVENKOV, Savva (MIPT, INR RAS)

Presenter: SVETLICHNYI, Aleksandr (MIPT, INR RAS)

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