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A feasibility study into the Quasi-Frozen Spin regime of operation of the NICA storage ring

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This study is motivated by the search for the electric dipole moment (EDM) of elementary particles. The most promising idea in that regard is the "Frozen Spin"concept first proposed by the BNL. This concept, however, requires the building of a brand-new facility devoted to the EDM-search. NICA is not such a facility, hence the need for a modification compatible with the existing optics; one that wouldn't disrupt the ring's capability for parallel experiments. Such a modification is the "Quasi-Frozen Spin"idea, realized by adding transport channels, bypassing the ring's straight sections. Wien-filters are placed in these channels in order to compensate spin-rotations caused by the ring's arc dipoles, thus making its net spin-transfer matrix unitary. Even though, during its movement along the beam line, the beam's polarization vector deviates from alignment with the momentum vector, this motion is regular and fits within one beam revolution, allowing for the buildup of the EDM-signal. The present study shows that the "Quasi-Frozen Spin"-specific optics is consistent with the existing NICA lattice and that the modified structure is capable of maintaining a requisite spin-coherence time.

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Footnotes

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