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Quasi-frozen spin concept at NICA for EDM search and its matrix analysis

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The basic idea to search for the Electric Dipole Moment (EDM) of charged particles in a storage ring was first proposed by the BNL. It assumes observation of the vertical buildup of beam polarization caused by the EDM in a so-called Frozen Spin (FS) lattice. The latter is composed of electrostatic deflectors to keep the momentum of the beam aligned with the direction of a polarization vector. However, this concept can be realized only for particles with positive magnetic anomaly (G), e.g., protons, and requires a lattice to be designed specifically for this purpose.

To perform the EDM experiments with particles characterized with positive and negative G one can use Quasi-Frozen Spin (QFS) lattice. It can be realized on the basis of the existing synchrotron, e.g. NICA, with magnetic arcs and additional E+B elements at straight sections. So, that the net in-plane rotation of the spin-vector in the arcs is compensated in the E+B deflectors.

The main features of the QFS lattice were calculated in the spinor formalism, such as a spin-tune and a direction of the invariant spin axis. As the radial field perturbations play a crucial role in the EDM measurement procedure, the difference of FS and QFS lattices was investigated in this regard. The data for estimation of the QFS resonance strength are also presented.

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