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Canonical approach to the finite density lattice QCD with winding number expansion (I) Lee-Yang Zeros RYUTARO FUKUDA, Department of Physics, The University of Tokyo, ATSUSHI NAKAMURA, RIISE, Hiroshima University, SHOTARO OKA, Department of Physics, Rikkyo University, SHUNTARO SAKAI, Department of Physics, Kyoto University, YUSUKE TANIGUCHI, Institute of Physics, University of Tsukuba, ZN COLLABORATION
— In lattice QCD, the sign problem hinders us from calculating the grand partition functions at finite density. Based on this present situation, our collaboration employs the canonical approach to overcome the difficulty of the sign problem: it reconstructs the grand partition functions at any valued of finite chemical potential by the fugacity expansion in terms of the canonical partition functions. We evaluate the fermion determinant through the new hopping parameter expansion which exactly treats the spatial hopping contribution. We construct the grand canonical partition functions with this new method and discuss its validity. Then, we study the Lee-Yang zeros to analyze the phase structure on temperature-chemical potential plane using the complexified fugacity expansion of the grand canonical partition functions.

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