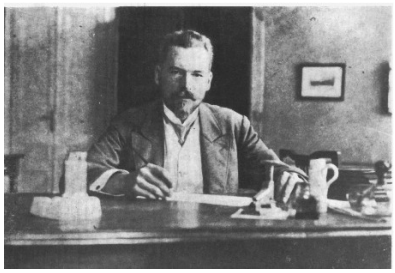

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Interplay of Katsura-Nagaosa-Balatsky mechanism and zigzag geometry of lattice bonds: exactly solvable model of the $S = 1/2$ XY magnetoelectric.

Tuesday, September 4, 2018 5:35 PM (20 minutes)

We consider exactly solvable model of the $S = 1/2$ XY one-dimensional magnetoelectric with zigzag geometry of the exchange interaction bonds between the spins. The system is supposed to exhibit the magnetoelectric effect due to Katsura-Nagaosa-Balatsky (KNB) mechanism, connecting the local bond polarization with the spin-current flowing through it. Mapping the quantum spin chain onto the spinless fermion system we presented the exact description of the zero-temperature as well as thermodynamic properties of the model. The main goal is the analysis of the interplay between the zigzag geometry of the bond and the KNB mechanism. We analyze the ground-state phase diagram of the model, zero and finite temperature magnetoelectric effect, obtain the magnetization and polarization curves versus magnetic and electric fields, as well as the parameters of anisotropic dielectric and magnetoelectric response. It is also shown that the electric field may enhance the magnetocaloric effect in the model. Some of our results are universal and can be extrapolated to the quantum spin chains with isotropic Heisenberg interaction between the spins. For instance, when the magnetic field is collinear with the bonds of the zigzag chain the direction of the polarization does not depend on the magnitudes of the magnetic and electric fields.

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