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Charge density waves in iron-based superconductors studied by Mössbauer Spectroscopy

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ABSTRACT

This doctoral thesis is devoted to the study of the hyperfine interactions in the iron-based superconductors $Ba_{0.6}K_{0.4}Fe_2As_2$ belonging to the '122' family (superconducting transition temperature T_{sc} = 38 K) and $SmFeAsO_{0.91}F_{0.09}$ of the '1111' family (T_{sc} = 47 K). Above compounds have been studied by 14.41-keV Mössbauer transition in ^{57}Fe in the temperature range 4.2 – 300 K with the particular attention paid to the superconducting transition region. Charge density wave (CDW) and modulation of the electric field gradient (EFG) on the iron nuclei develop within those systems. The new type of hyperfine interaction modulation called electric field gradient wave (EFGW) is seen on the iron nuclei. The charge modulation is sensitive to the transition between normal and superconducting state as CDW and EFGW strongly vary at the superconducting gap opening. The way leading to the observation of the new type of the hyperfine interactions is discussed within this thesis. The change of modulation of the EFG during creation of the superconducting Bose condensate is discussed as well.