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PROGRAM I ABSTRAKTY

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The compound PrFeAsO is a parent compound of the iron-based superconductors belonging to the ‘1111’ family. It crystallizes in the tetragonal structure. An itinerant 3d magnetic order develops at about 165 K and it is accompanied by an orthorhombic distortion of the chemical unit cell. A complete longitudinal 3d incommensurate spin density wave (SDW) order develops at about 140 K. A region between above two temperatures is called a “nematic” phase with poorly understood microscopic magnetic properties. Praseodymium orders magnetically at about 12 K leading to the substantial transferred field on iron nuclei due to the large orbital contribution to the magnetic moment. A reorientation of the praseodymium magnetic moments was reported at still lower temperatures [1].

Mössbauer measurements were performed on the powder sample in the temperature range 4.2 – 300 K. Spectra develop shape typical for SDW magnetic order. Transferred field due to the praseodymium magnetic order is seen below 12 K. The shape of SDW is almost rectangular at low temperatures and transforms into roughly triangular form around “nematic” transition at about 140 K. Significant part of SDW along propagation direction is almost free of the ordered electronic spins above “nematic” transition, but still below transition to the magnetically disordered (non-magnetic) state. Hence, it is likely that somewhat “mysterious nematic” phase is a region of incoherent spin density wavelets typical for a critical region. On the other hand, one has to realize that this region is exceptionally broad on the temperature scale (more than 20 K) and the reasons for that are rather poorly understood. One possible hint could be strong scattering of the electronic spins on the large localized moments of praseodymium with significant orbital contribution.

Fig. 1. $^{57}$Fe Mössbauer spectra of PrFeAsO at selected temperatures.