

## On the search for a Lifshitz point in $UPd_2Si_2$

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Spatially modulated systems are very common in nature. Modulated phases of various types have been observed in hundreds magnetic or ferroelectric crystals and Lifshitz points have been suggested for many of them. The phase diagrams of these systems reveal multicritical points separating the higher temperature disordered phase and the low temperature commensurate and incommensurate phases, however, the strong evidence that such a point exhibits Lifshitz type critical behavior is available only for one magnetic system, MnP. The present work on  $UPd_2Si_2$  has been motivated by previous data on this material. The data showed that  $UPd_2Si_2$  possesses four magnetic phases. Three ordered phases, antiferromagnetic (AFI), commensurate (LSW - Longitudinal Spin Wave structure) characterized by a propagation vector  $\mathbf{Q} = (0, 0, \frac{2}{3})$ , and incommensurate (ICLSW) meet at a triple point. As stated Honma et al. a probable second triple point where LSW, ICLSW, and P phases meet could not be determined by the investigation presented in their paper. The available data for the phase transition lines near this possible triple point seems to be inconsistent with LP, because the phase transition between paramagnetic and LSW phases has been suggested to be of first order. However, we have suspected that a closer study in the middle range of the magnetic field, neglected in the previous papers, might lead to the opposite conclusion. Accordingly high-quality single crystals of  $UPd_2Si_2$  have been studied by means of heat capacity and magnetization measurements. The obtained data has yielded a  $H - T$  phase diagram that significantly differs from those reported before in the literature. The main finding is identification of a multicritical point that seemingly exhibits Lifshitz characteristics. A simple phenomenological model of phase transitions near this special tricritical point is provided