Anomalous behaviour of critical fields near a superconducting quantum critical point in BaFe$_2$(As$_{1-x}$P$_x$)$_2$\(^1\) C. PUTZKE, A. CARRINGTON, P. WALMSLEY, L. MALONE, H.H. Wills Physics Laboratory, University of Bristol, Bristol, UK, J.D. FLETCHER, P. SEE, National Physics Laboratory, Teddington, Middlesex, UK, D. VIGNOLLES, C. PROUST, S. BADOUX, Laboratoire National des Champs Magnetiques Intenses, Toulouse, France, S. KASAHARA, Y. MAZUKAMI, T. SHIBAUCHI, Y. MATSUDA, Department of Physics, University of Kyoto, Kyoto, Japan — BaFe$_2$(As$_{1-x}$P$_x$)$_2$ presents one of the cleanest and clearest systems in which to study the influence of quantum critical fluctuations on high temperature superconductivity. In this material a sharp maximum in the magnetic penetration depth has been found at the quantum critical point (QCP $x = 0.3$) where $T_c$ is maximal\(^1\). Specific heat and de Haas-van Alphen effect measurements\(^2\) show that this peak is driven by a corresponding increase in the quasiparticle effective mass. Based on these previous results a simple one-band theory would suggest that at the QCP we should expect a large increase in $H_{c2}$ and a corresponding dip in $H_{c1}$. Actual measurements of these critical fields, which we present here, shows quite different behavior which we suggest is caused by an anomalous enhancement in the vortex core energy close to the QCP.

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