

Abstract Submitted  
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**Robust nodal gap structure in  $\text{BaFe}_2(\text{As}_{1-x}\text{P}_x)_2$  with P doping revealed by magnetic penetration depth measurements** KENICHIRO HASHIMOTO, RYO KATSUMATA, SHO TONEGAWA, SHIGERU KASAHARA, TAKAHITO TERASHIMA, TAKASADA SHIBAUCHI, YUJI MATSUDA, Kyoto University, ALESSANDRO SERAFIN, ANTONY CARRINGTON, University of Bristol — A number of experimental studies show that the non-universal superconducting gap structures with and without nodes is realized in iron pnictides, depending on the doping materials and its doping level. It has been suggested that in a framework of  $s_{++}$  wave symmetry, vertical nodal gap structure occurs during the crossover from  $s_{++}$  to  $s_{+-}$  state due to the competition between the orbital and magnetic fluctuations as well as the impurity scattering effect. On the other hand, within the spin-fluctuation mediated pairing mechanism, three dimensional nodal structures is discussed. Therefore, it is important to uncover the doping dependence of the superconducting gap structure and its impurity effect. Here we report the magnetic penetration depth results measured down to 100 mK in the P-doped Ba122 system indicate robust nodal gap structure. We especially focus on doping evolution of the superfluid density with P doping. We also discuss the impurity effect introduced by Pb heavy ion beam respective to the in-plane.

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