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# Unique interplay between superconducting and ferromagnetic orders in EuRbFe<sub>4</sub>As<sub>4</sub>

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## Abstract

© 2018 American Physical Society. Transport, magnetic, and optical investigations on EuRbFe<sub>4</sub>As<sub>4</sub> single crystals evidence that the ferromagnetic ordering of the Eu<sup>2+</sup> magnetic moments at  $T_m=15$  K, below the superconducting transition ( $T_c=36$  K), affects superconductivity in a weak but intriguing way. Upon cooling below  $T_m$ , the zero resistance state is preserved and the diamagnetic response is only slightly affected by the emerging ferromagnetism; a perfect diamagnetism is recovered at low temperatures. The infrared conductivity is strongly suppressed in the far-infrared region below  $T_c$ , associated with the opening of a complete superconducting gap at  $2\Delta=10$  meV. A gap smaller than the weak-coupling limit suggests strong orbital effects or, within a multiband superconductivity scenario, the existence of a larger yet unrevealed gap.

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