Title: Ultra-long-lived quasiparticles in FeSe revealed by broadband microwave spectroscopy
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Abstract:

FeSe, a compound which becomes superconducting below 9 K, is an ideal system for studying Fe-based superconductivity: it has a simple crystal structure, is superconducting at stoichiometric composition, and is available as high-quality single crystals. Here we report measurements of its surface resistance $R_s(\omega, T)$ from 0.1 to 20 GHz and from 1.2 to 10 K, performed using a home-built broadband microwave spectrometer. Using a phenomenological model, we have extracted the complex optical conductivity $\sigma(\omega, T)$ of FeSe. At finite temperature and frequency, the real part of the optical conductivity, $\sigma_1(\omega, T)$, is determined entirely by the response of quasiparticles which have been thermally excited out of the superconducting ground state. Thus, $\sigma_1(\omega, T)$ contains information on both the quasiparticle excitation spectrum and the quasiparticle charge dynamics. We find that σ_1 is strongly peaked below T_c, indicating a rapid collapse in quasiparticle scattering which outpaces the condensation of quasiparticles into the superconducting ground state. Only in Ortho-I $YBa_2Cu_3O_{6.993}$ has such a dramatic reduction in quasiparticle scattering been observed. The low-temperature scattering rate in FeSe is in fact several times smaller than that in $YBa_2Cu_3O_{6.993}$ and is indicative of ultra-long-lived quasiparticles [1].

[1] Turner, P.J. et al 2003 Phys. Rev. Lett. 90 237005