

Abstract Submitted  
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**Mesoscopic Nonlinear Electrodynamic Response of the Two Band Superconductor MgB<sub>2</sub>**<sup>1</sup>

TAMIN TAI, University of Maryland-College Park, TENG TAN, XIAOXING XI, Temple University, BEHNOOD GHAMSARI, STEVEN ANLAGE, University of Maryland-College Park — Multi-gap superconductors are expected to have exotic physics associated with internal coupling between the multiple order parameters. 10 years after its discovery, MgB<sub>2</sub> is a two gap superconductor that still attracts much attention for both fundamental and practical reasons. A microwave measurement of the temperature dependent third harmonic response  $P_{3f}$  (T) is performed by applying a strong and localized (mesoscopic) RF magnetic field on high quality MgB<sub>2</sub> films. Comparing to the  $P_{3f}$  (T) result on Nb thin films, the low temperature nonlinearity of MgB<sub>2</sub> shows a complete harmonic cancelation at a temperature near the transition temperature of the proximity-induced  $\pi$  band. One possibility is that this phenomenon is due to an additional intrinsic nonlinearity arising from Josephson coupling between the  $\sigma$  and  $\pi$  bands. This nonlinear response then interferes with other nonlinear mechanisms coming from moving vortices and the intrinsic nonlinear Meissner effect of the two-gap system. To investigate further, we measure the magnitude and phase of the nonlinear response and compare to models of the three nonlinearity mechanisms.

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