Plausible loop currents in the GdBCO pseudogap phase

C. BOEKEMA, San Jose State University, T. SONGATIKAMAS, Santa Clara University, M.C. BROWNE, San Jose State University — For the cuprate pseudogap phase, Varma [1] predicts loop currents above $T_c$. We search for fields near 100 Oe, created by such currents in GdBa$_2$Cu$_3$O$_{7-\delta}$ (GdBCO). Using MaxEnt-Burg (ME) we analyze zero-field (ZF) muon-spin-rotation ($\mu$SR) data of underdoped ($\delta_1$; $T_c$ = 81 K) and optimal doped ($\delta_0$; $T_c$ = 93 K) GdBCO. [2] ME-$\mu$SR applied to ZF-GdBCO data yields $T$-dependent signals at 0-MHz ($f_0$) and 0.3-MHz ($f_1$) and hints of 1.4-MHz signals. To cancel any systematic ($f_1$) effect, we analyze $DS(t,T) = S(t,T>T_c) - S(t,T<T_c)$. This ME-Burg analysis of GdBCO($\delta_0$ & $\delta_1$) indicates weak signals near 1.4 MHz above $T_c$ (and $f_1$ disappears). These ME-peaks occur at $\sim$1.3 MHz (95 Oe) for GdBCO($\delta_1$) and $\sim$1.5 MHz (110 Oe) for GdBCO($\delta_0$). These $\mu$SR signals, plausibly due to fields created by loop currents, appear only above $T_c$. Below $T_c$, only ME background noise exist in $DS(t,T)$ transforms. The $\sim$1.4-MHz peak intensity to background ratio at its maximum is $\sim$5 for GdBCO($\delta_1$) and $\sim$4 for GdBCO($\delta_0$) at $\sim$10 degrees above $T_c$. Validating predicted loop currents is essential for understanding the pseudogap phase. Research supported by REU NSF & DOE LANL. [1] CM Varma, Phys Rev Lett 83 (1999) 3538; [2] T Songatikamas et al, J Supercond & Novel Magn 23 (2010) 793.