Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Intermodulation Spectral Analysis and The Intermodulation Lockin DAVID HAVILAND, Royal Institute of Technology (KTH), ERIK THÖLEN, DANIEL PLATZ, DANIEL FORCHHEIMER, CARSTEN HUTTER — High quality factor oscillators are very useful for sensitive measurement. A weak perturbation to the oscillator gives a large change of response near resonance, which is typically analyzed to first order as change in the linear response (e.g. shift of resonance frequency). In many cases the measurement can be greatly enhanced by detecting higher order nonlinear response. With a single drive frequency, high order non-linearity gives response at high frequency harmonics, which are filtered out by the high Q oscillator. With two drive frequencies, high-order nonlinear response can be crowded near resonance by intermodulation, or frequency mixing. The intermodulation spectrum near resonance is highly correlated and from its analysis one can reconstruct high-order non-linearity[1] without high frequency spectral data. We developed a general-purpose lockin measurement instrument and software analysis algorithms for preforming this type of measurement. The instrument drives a system with two pure tones while simultaneously measuring both quadratures of response at 32 intermodulation product frequencies.[2]

[1]C. Hutter et al. Phys. Rev. Lett. **104**, 050801 (2010)
[2]E. A. Thölen et al. submitted to RSI, arXiv:1008.2722

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Date submitted: 23 Dec 2010 Electronic form version 1.4