THE Q FACTOR: A COMPARISON BETWEEN CHIRPED PULSE AND CAVITY FOURIER TRANSFORM MICROWAVE TECHNIQUES

KEVIN O. DOUGLASS, GORDON G. BROWN, BRIAN C. DIAN, SCOTT GEYER, BROOKS H. PATE,
Department of Chemistry, University of Virginia, McCormick Rd., P.O. Box 400319, Charlottesville, VA 22904.

A thorough comparison between the Balle-Flygare cavity spectrometer and our new Chirped Pulse Fourier Transform Microwave (CP-FTMW) spectrometer will be presented. We will discuss the gains and limitations of the Q in regards to sensitivity and resolution. A Q of 4000 (UVA cavity spectrometer) gives a signal-to-noise enhancement of 60 for a single shot (500 kHz) whereas the CP-FTMW method (Q=1) requires Q more shots to obtain the same signal-to-noise but now obtains the rotational spectrum over the full bandwidth of the spectrometer (7.5 - 18 GHz). After 10000 averages (50 minutes for 100 kHz resolution) the CP-FTMW technique obtains similar signal-to-noise (within a factor of 2) as the cavity FTMW technique with 10 averages. In under an hour we obtain a spectrum that would take the cavity machine 15 Hours. The advantages of each spectrometer and the types of problems each technique is best suited for will be discussed.