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

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A thorough comparison between the Balle-Flygare cavity spectrometer[a] 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.

[a] T. J. Balle, W. H. Flygare*Rev. Sci. Instrum.* **52**, 33-44 1981.