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**Coherent Broadband Microwave Spectroscopy**

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Recent advances in high-speed digital electronics have made it possible to develop a new type of Fourier transform microwave spectrometer that provides true broadband detection. These spectrometer use linear sweep chirped pulses for polarization of the molecular sample. The subsequent broadband free induction decay is digitized with a high-speed (50 Gs/s) 8-bit digitizer and the frequency domain spectrum is obtained by fast Fourier transformation. Spectrometer designs covering the 2-8 GHz, 6.5-18.5 GHz, and 25-40 GHz frequency bands will be presented. The spectrometer design is applicable to both pulsed jet molecular beam sources and to low-pressure gas samples at room-temperature. Measurement approaches to enhance the spectrometer sensitivity and reduce sample consumption will be presented. The technological advances in core spectrometer components expected over the next few years will also be described. Applications of this measurement technique to problems in molecular structure determination, chemical kinetics of isomerization reactions, and unbiased searches for molecules in the interstellar medium will be uses to illustrate the advantages of the spectrometer design.