A 480 MHz CHIRPED-PULSE FOURIER-TRANSFORM MICROWAVE SPECTROMETER: CONSTRUCTION AND MEASUREMENT OF THE ROTATIONAL SPECTRA OF DIVINYL SILANE AND 3,3-DIFLUOROPENTANE

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A chirped-pulse Fourier-transform microwave (CP-FTMW) spectrometer based on the original Pate design[a] has been constructed to allow analysis of any 480 MHz region in the 7 – 18 GHz range. A 1 μs chirped-pulse (0 – 240 MHz) from an arbitrary function generator is mixed with output from a microwave synthesizer and used to polarize a supersonic gas expansion; the resulting free induction decay is collected over 20 μs and Fourier-transformed on a 500 MHz oscilloscope to produce a rotational spectrum. A variety of molecules have now been studied with this instrument and results will be presented for numerous conformers of divinyl silane (predicted $\mu_{\mathrm{total}} = 0.6 - 0.7$ D) and the more polar 3,3-difluoropentane (predicted $\mu_{\mathrm{total}} = 2.5 - 2.8$ D).

Two of the three possible conformers of divinyl silane were assigned (both having a C_1=C_2–Si–C_3 dihedral angle of -120° and a C_2–Si–C_3=C_4 dihedral of either 0° (C_1 symmetry) or -120° (C_2 symmetry)). For 3,3-difluoropentane, three of the four possible conformers were identified: anti-gauche (C_1), gauche-gauche (C_2) and anti-anti (C_{2v}). While rotational spectra for only the silicon isotopologues were observed for divinyl silane, measurement of the ^{13}C spectra of 3,3-difluoropentane allowed heavy atom structure determinations for the anti-gauche and gauche-gauche conformers. Initial assignments of all spectra were made on the CP-FTMW spectrometer, and a Balle-Flygare FTMW spectrometer was used to compare frequencies of measured transitions and also to provide Stark effect data. Substitution (r_s) and inertial fit (r_0) structures will be compared with computational data and instrumental details will be presented.

[a] G.G. Brown, B.C. Dian, K.O. Douglass, S.M. Geyer, S.T. Shipman, B.H. Pate, *Rev. Sci. Instrum.*, **79**, (2008), 053103.