

Contents

Abstract / Kurzzusammenfassung	i
List of Figures	v
List of Tables	ix
Zusammenfassung	xi
1. Introduction	1
2. Spectrometers	5
2.1. The Cologne Spectrometers	6
2.2. The FASSST Spectrometer	9
 I. Ethyl Methyl Ether (C₂H₅OCH₃)	 15
3. Ethyl Methyl Ether, an Asymmetric Top Molecule	17
3.1. Structure of <i>trans</i> -Ethyl Methyl Ether	17
3.2. Energy Levels of the Asymmetric Rotor	19
3.3. Asymmetry of Ethyl Methyl Ether	21
4. Internal Rotation of Ethyl Methyl Ether	29
4.1. Molecules with One Internal Rotor	30
4.2. Molecules with Two Internal Rotors	36
4.2.1. General Considerations for Dimethyl Ether	36
4.2.2. The Hamiltonian for Ethyl Methyl Ether	37
4.2.3. Localized Wavefunctions	39
4.2.4. Energy Levels and Potential Barriers	40
5. Spectral Analysis of Ethyl Methyl Ether	45
5.1. Spectral Analysis	48
5.1.1. Relative Line Intensities	50
5.1.2. Spectra and Molecular Parameters	52
5.2. Discussion	60

II. Hydrogen Cyanide Isotopomers (H^{13}CN, HC^{15}N, $\text{H}^{13}\text{C}^{15}\text{N}$)	65
6. HCN Isotopomers: Theoretical Considerations	67
6.1. Rotational Spectroscopy of the Ground Vibrational State	67
6.2. Rotational Spectroscopy of Excited Vibrational State	70
6.3. Hyperfine Structure (Hfs)	73
6.3.1. Electric Quadrupole Interaction H_{eQq}	75
6.3.2. Nuclear Spin Interaction H_{CI}	78
6.4. Sub-Doppler Spectroscopy	79
6.4.1. Line Broadening	79
6.4.2. Technique of Sub-Doppler Measurements	80
7. HCN Isotopomers: Analysis and Results	85
7.1. Spectral Analysis and Discussion	86
7.2. Molecular Constants for the Ground and First Excited State	91
III. Results and Prospects	95
8. Results and Prospects	97
8.1. Ethyl Methyl Ether	97
8.2. Hydrogen Cyanide	100
IV. Appendix	101
A. Assigned Transitions of Ethyl Methyl Ether	103
B. Assigned Transitions of H^{13}CN, $\text{H}^{13}\text{C}^{15}\text{N}$, and HC^{15}N	117
C. Additional Recorded Spectra of H^{13}CN	125
Bibliography	135
Acknowledgments	145
Curriculum Vitae	151