

Contents

Preface	2
List of Figures	7
List of Tables	9
1 Introduction	10
1.1 <i>COBE FIRAS</i> Data Overview	10
1.2 Pass 4 Improvements In Data Products	11
1.3 Explanatory Supplement Organization	11
2 Instrument Description	13
3 Mission Profile	16
4 Pre-Calibration Data Processing	21
4.1 Ingest	21
4.2 Quality Checking	22
4.3 Sorting	25
4.4 Coaddition	29
5 Calibration of <i>FIRAS</i> Data	36
5.1 Apodization and Padding	36
5.2 Channel Specific Items	38
5.3 Instrument Calibration	39
5.3.1 Electronics Transfer Function	40
5.3.2 Bolometer Parameters	40
5.3.3 Emissivities	42

5.3.4	Temperature and Phase Corrections	43
5.4	Temperature Scale Calibration	46
5.4.1	Frequency Scale Calibration	46
5.4.2	Temperature Calibration	46
5.5	Calibration Performance	47
5.6	Application of Calibration Models	48
6	Destripping of <i>FIRAS</i> Data	52
6.1	Destriper Model	52
6.2	Observation Weights	53
6.3	Destriper Model Functions	54
6.3.1	Special Time Period (Tophat) Functions	55
6.3.2	Time Functions	59
6.3.3	Source Gradient Functions	60
6.3.4	Moon Contamination	62
6.3.5	Dihedral Functions	62
6.3.6	Bolometer Functions	64
6.3.7	Vibrations	65
6.4	Algorithmic Considerations	67
6.5	Destriper Project Data Sets	68
7	Errors and Uncertainty Estimation	69
7.0.1	Sensitivity	69
7.0.2	Formal Calibration Uncertainty	69
7.1	The Detector Noise	70
7.1.1	The D Matrix	70
7.1.2	The C Matrix	71

7.2	The Emissivity Uncertainty	74
7.2.1	The Destriper and P_0EP_0 Offset Errors	74
7.2.2	β Uncertainties	76
7.2.3	Gain Uncertainties	77
7.3	The Bolometer Model Uncertainties	77
7.3.1	JCJ Offset	79
7.3.2	JCJ Gain	79
7.4	The Temperature Noise	82
7.4.1	Resistor Noise	83
7.4.2	Calibration Noise	83
7.4.3	Resulting Noise	84
7.4.4	Hot Horns	84
7.4.5	Recommended PUP	85
7.5	The Temperature Uncertainty	85
7.6	Full Uncertainties	86
7.7	χ^2 Distributions of Combined Skymaps	87
7.8	“ <i>FIRAS</i> Extra Factor” Errors	90
7.8.1	The Destriper Model	90
7.8.2	Channel Consistency	98
7.9	Unmodeled Systematic Errors	99
7.9.1	Vibration	99
7.9.2	Phase Corrections	99
7.9.3	Pointing Errors	100
7.9.4	The Beam Profile	101
7.10	Propagation of Errors	102

8	Modeling <i>FIRAS</i> Spectra	106
8.1	Zodiacal Emission Model	106
8.2	CMBR Determination	107
8.2.1	Temperature Maps	107
8.2.2	Considerations When Modeling Cosmological Parameters	110
8.3	Galactic Dust Parameter Maps	111
8.4	Spectral Lines	114
8.4.1	Generating Line Profiles	114
8.4.2	Modeling Spectral Lines	118
9	Reference Data sets	122
9.1	ASCII Format Reference Data sets	122
9.2	VAX Binary Format Reference Data sets	125
10	Reading <i>FIRAS</i> Data	127
10.1	Reading <i>FIRAS</i> FITS Files	127
10.2	Reading <i>FIRAS</i> Native VAX Binary Format Files	127
10.3	Using Skycube Data	128
11	References	133
12	Appendices	135