

Contents

1	Introduction	1
1.1	CMB	2
1.1.1	CMB Anisotropies	3
1.1.2	Observational Status of the Temperature Power Spectrum	4
1.1.3	CMB Polarisation	5
1.1.4	Observational Status of the CMB Polarisation	9
1.2	Emission Mechanisms at GHz Frequencies	9
1.2.1	Synchrotron Radiation	11
1.2.2	Synchrotron Polarisation	12
1.2.3	Free-Free Emission	13
1.2.4	Free-Free Polarisation	15
1.2.5	Anomalous Microwave Emission	15
1.2.6	AME Polarisation	16
1.2.7	Thermal Dust	17
1.2.8	Thermal Dust Polarisation	18
	References	19
2	Analysis Techniques for <i>WMAP</i> Polarisation Data	25
2.1	<i>WMAP</i> 9-Year Data	25
2.1.1	<i>WMAP</i> 9-Year Maps	27
2.2	<i>WMAP</i> Sky Simulation	30
2.3	Smoothing	31
2.3.1	<i>WMAP</i> Noise Simulations	34
2.3.2	Optimal N_{side}	35
2.4	Unsharp Mask	38
2.5	Polarisation Bias	40
2.5.1	Symmetric Uncertainties	41
2.5.2	Asymmetric Uncertainties	43

2.5.3	Known Angle Estimator	44
2.5.4	Tests of the Estimators	46
2.5.5	Bias-Corrected Polarisation Maps	55
2.6	Polarisation Upper Limits from AME Regions	57
	References	61
3	WMAP Polarised Filaments	63
3.1	Polarised Large Scale Features	64
3.1.1	Continuum Loops in Polarisation	64
3.2	Polarisation Angle Along Filaments	67
3.3	Spectral Indices	74
3.3.1	T-T Plots of the Filaments	75
3.3.2	T-T Plots on Small Regions	76
3.3.3	Tests on Spectral Indices Values	81
3.4	Faraday Rotation	85
3.4.1	Faraday Rotation at the Galactic Centre	88
3.5	Polarisation Fraction	90
3.5.1	Full Sky Polarisation Fraction	91
3.5.2	Polarisation Fraction in the $20^{\circ}0 \leq l \leq 44^{\circ}0$ Range	95
3.6	Discussion	102
3.6.1	HI Morphology	102
3.6.2	The Origin of the Large Scale Polarised Loops	105
3.6.3	CMB Foreground Contribution	111
	References	114
4	QUIET Galactic Observations	117
4.1	The Instrument	117
4.2	Observations	121
4.2.1	Calibration	123
4.3	Data Reduction Pipeline and Map Making	126
4.3.1	Map Making	126
4.4	Test on Gaussianity on a CMB Field	129
4.5	QUIET CMB Results	133
4.6	Galactic Maps	135
4.7	Spectral Index of Polarised Emission	140
4.8	Polarisation Angles	141
	References	142
5	AME in LDN 1780	145
5.1	LDN 1780 Overview	145
5.2	AME Detection at 31 GHz with the CBI	147
5.2.1	H α Excess and Free-Free Level	147
5.2.2	IR Correlations	150
5.2.3	AME Emissivity	150

5.3	CARMA Data	152
5.3.1	Observations and Calibration	153
5.3.2	Imaging	155
5.4	Spectral Energy Distribution Over 1° Scale.	162
5.4.1	Data Used	162
5.4.2	Flux Densities Measurement	163
5.4.3	SED Fitting	167
5.5	Dust Properties at $2'$ Resolution.	170
5.5.1	IR Correlations	173
5.5.2	Spinning Dust Modelling	174
	References	182
6	Conclusions and Future Work	185
6.1	Conclusions	185
6.1.1	Polarisation De-Bias Method.	185
6.1.2	<i>WMAP</i> Polarised Filaments.	186
6.1.3	QUIET Galactic Maps	187
6.1.4	AME in LDN 1780	188
6.2	Future Work	189
6.2.1	Polarised Diffuse Emission	189
6.2.2	AME	192
	References	192
	Index	195

<http://www.springer.com/978-3-319-26262-8>

Diffuse Radio Foregrounds

All-Sky Polarisation, and Anomalous Microwave Emission

Vidal Navarro, M.

2016, XLIV, 196 p. 124 illus., 28 illus. in color.,

Hardcover

ISBN: 978-3-319-26262-8