

# Contents

<b>1</b>	<b>Introduction</b>	1
1.1	Evolution of Stellar Rotation Rates	1
1.1.1	Rotation on the Pre-main-Sequence	1
1.1.2	Main-Sequence Rotation	4
1.1.3	Differential Rotation in Other Stars	8
1.2	Measuring Stellar Rotation with <i>Kepler</i>	9
1.2.1	Kepler Photometry	9
1.2.2	Photometric Time Series Analysis	11
1.2.3	Measuring Rotation from Surface Variability	13
1.2.4	Measuring Rotation from Asteroseismology	14
1.3	Applications of Rotation Measurements	24
1.3.1	Gyrochronology	25
1.3.2	Impact of Rotation on Stellar Evolution	27
1.3.3	Solar and Stellar Dynamos	28
	References	29
<b>2</b>	<b>Paper I—Rotation Periods of 12,000 Main-Sequence <i>Kepler</i> Stars</b>	37
2.1	Summary of Paper I	37
2.2	Introduction	38
2.3	Measuring Stellar Rotation	38
2.3.1	Kepler photometry	38
2.3.2	Detecting Rotation Periods	39
2.3.3	Selecting Stable Rotation Periods	39
2.4	Consistency with $v \sin i$ Measurements	41
2.5	Rotation of Late Type Stars	43
2.6	Conclusions	44
2.7	Further Discussion of Chap. 1	45
	References	47

<b>3</b>	<b>Paper II—Rotational Splitting as a Function of Mode Frequency for Six Sun-like Stars</b>	51
3.1	Summary of Paper II	51
3.2	Introduction	51
3.3	Analysis	52
3.3.1	Observations	53
3.3.2	Power Spectrum Model	53
3.3.3	Fitting	55
3.4	Rotation and Inclination as a Function of Frequency	56
3.5	Further Discussion of Chap. 2	59
	References	60
<b>4</b>	<b>Paper III—Constraining Differential Rotation of Sun-like Stars from Asteroseismic and Starspot Rotation Periods</b>	63
4.1	Summary of Paper III	63
4.2	Introduction	63
4.3	Measuring Rotation Periods	64
4.3.1	Asteroseismic Rotation Periods	65
4.3.2	Surface Variability Periods	66
4.4	Comparing Asteroseismic and Surface Variability Periods	69
4.5	Gyrochronology	71
4.6	Conclusions	72
4.7	Further Discussion of Chap. 3	73
	References	74
<b>5</b>	<b>Discussion: Constraining Interior Rotational Shear</b>	79
5.1	Modeling Radial Differential Rotation	79
5.1.1	Computing the Mode Set Splittings	82
5.1.2	Using Only Seismic Data to Constrain the Radial Shear	83
5.1.3	Using Prior Information from Surface Variability	85
5.2	Conclusion	88
	References	88
	<b>Appendix A: Clusters Used in Fig. 1.1</b>	91
	<b>Appendix B: Detrending and Corrections in PDC/msMAP Data</b>	93
	<b>Appendix C: Measuring Rotation with Spectroscopy</b>	95
	<b>Index</b>	99

Differential Rotation in Sun-like Stars from Surface  
Variability and Asteroseismology

Nielsen, M.B.

2017, XVI, 101 p. 29 illus., 18 illus. in color., Hardcover

ISBN: 978-3-319-50988-4