

Contents

Part I Star Formation, Evolution and Stellar Populations in Star Clusters

1	Stellar Evolution and Populations	3
1.1	The Early History of Researches on Star Clusters	3
1.2	A Simple Introduction on Stellar Evolution	6
1.2.1	The Main Sequence	6
1.2.2	The Turn-Off and Sub-giant Stage	8
1.2.3	The Red-Giant Stage	9
1.2.4	Stellar Age Versus Its Initial Mass	10
1.3	Simple Stellar Populations	11
1.3.1	Describing the Simple Stellar Population	12
1.4	Not-So-Simple Stellar Populations: Multiple Stellar Populations	13
1.4.1	Describing the Multiple Stellar Populations	14
2	Researches of Stellar Populations in Star Clusters	19
2.1	Stellar Populations: We Think We Know Until Everything Change	19
2.1.1	Why Most Clusters Should be Simple Stellar Populations?	19
2.1.2	Complicated Stellar Populations in Star Clusters	22
2.2	Proposed Scenarios	26
2.2.1	The Extended Main Sequence Turn-Off Regions in Star Clusters	26
2.2.2	Multiple Stellar Populations in Old Globular Clusters	29

Part II Researches on Stellar Populations in Massive Star Clusters

3	Binary Fraction in Young Massive Star Clusters	35
3.1	Introduction	35
3.2	Data Reduction	36
3.3	Isochrone Fitting	38
3.3.1	Detect Binary Stars in the CMD	40
3.3.2	Determine the Coordinates of Cluster Center	41
3.3.3	Artificial-Star Tests	42
3.4	Results Based on χ^2 Minimization	45
3.5	Physical Implications	49
3.5.1	Binary Segregation	49
3.5.2	Binary Dynamical Disruption	51
3.6	Summary on This Work	53
4	The Formation and Evolution of Blue Straggler Stars in Globular Cluster	55
4.1	Introduction	55
4.2	Data Reduction	57
4.3	Analysis and Results	58
4.4	Physical Implications	61
4.5	Conclusion	62
5	Multiple Stellar Populations in the Giant Branches of Galactic Globular Clusters	65
5.1	Introduction	65
5.2	Data Reduction and Analysis	66
5.3	Main Results	71
5.3.1	Sub-giant Branch Stars	71
5.3.2	Red-Giant Branch Stars	74
5.4	Physical Implications	78
5.5	Conclusion	85
6	Do Intermediate-Age Star Clusters Have Extended Star Formation Histories?	89
6.1	Introduction	89
6.2	Data Reduction	90
6.3	Main Results	91
6.3.1	NGC1651	91
6.3.2	NGC411	94
6.3.3	NGC419	99
6.4	Physical Discussion	102
6.5	Conclusion	104

**Part III Not-So-Simple Stellar Populations in Massive Star Clusters,
Where Do We Stand?**

7 Lessons Learned from This Thesis. 109

7.1 Do the Young Massive Clusters Harbor Multiple Stellar
Populations? 109

7.2 No Evidence of Multiple Stellar Populations in Intermediate-Age
Star Clusters 111

7.3 Do Globular Clusters have Another Origin? 112

7.4 Epilogue 115

References 119

Not-So-Simple Stellar Populations in Star Clusters

Li, C.

2017, XV, 132 p. 56 illus., 44 illus. in color., Hardcover

ISBN: 978-981-10-5680-2