CONTENTS

Page

Acknowledgement iv

Abstract in Thai v

Abstract vi

List of Tables ix

List of Figures xi

Chapter 1 Introduction 1

1.1 Research Objectives 5

1.2 Research Plan and Scope 5

1.3 Research Usefulness 5

Chapter 2 Theory 7

2.1 Galaxy Groups, Clusters and Superclusters 7

2.2 Morphological Type and T-type of Galaxies 8

2.3 Redshift and Peculiar Velocity 16

2.4 Magnitude, Zero Point and Color Index 18

2.5 Surface Brightness of Galaxies and B_{25} Isophotes 19

2.6 Galactic Extinction 22

2.7 Hα Equivalent Width (EW(Hα)) and Star Formation Rate 22

2.8 Galaxy Environments and Interactions 24

Chapter 3 Observations and Data Analysis 30

3.1 Photometric Observations and Sample Galaxies 30

3.2 Zero Points 32

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

3.3 B_{25} Isophotes of the Sample Galaxies 35
3.4 Measurement of Magnitudes and Color Indices 35
3.5 Classification of Morphological Type of Galaxies 39
3.6 Calculation of Hα + [N II] Equivalent Width (EW(Hα + [N II])) 40
3.7 Calculation of Star Formation Rates 44
3.8 Estimation of Tidal Interaction Perturbation 47

Chapter 4 Results 52
4.1 Colors and Magnitudes 52
4.2 Color-T-type Relationship 54
4.3 Hα + [N II] Equivalent Width, Colors and T-types Relationships 55
4.4 Mass of the Sample Galaxies 57
4.5 Star Formation Rates 57
4.6 Perturbation Parameters of Tidal Interactions 61

Chapter 5 Discussion and Conclusions 64
5.1 Discussion and Conclusions 64
5.2 Further Work 67

Bibliography 68

Appendices 75
Appendix A Statistical Formula 75
Appendix B Observed Images of The Sample Galaxies From SDSS 77
Appendix C Available Spectral Line of The Sample Galaxies from SDSS 79
Appendix D Filter Transmission 81
Appendix E Available Data of The NGC 4213 Group Members from NED 82
Appendix F The Hα Luminosities and SFR by James et al. (2005) Method 83
Curriculum Vitae 84

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

LIST OF TABLES

Page

Table 2.1 Hubble morphological types and T-types 9

Table 3.1 Data observations at Thai National Observatory. 31

Table 3.2 Sample galaxies in NGC 4213 Group (from NED Database) 32

Table 3.3 Reference stars for determine the zero points 34

Table 3.4 B_{25} isophotes 35

Table 3.5 Galactic extinction of the sample galaxies in B, V and R bands from NED 37

Table 3.6 Apparent magnitudes of the sample galaxies in B, V and R bands 37

Table 3.7 Absolute magnitudes of the sample galaxies in B, V and R bands 38

Table 3.8 Color indices of the sample galaxies 39

Table 3.9 Morphological type and T-type of the sample galaxies 40

Table 3.10 Hα + [N II] equivalent width and signal to noise ratio 43

Table 3.11 Estimation of the [N II] correction ratio 45

Table 3.12 The [N II] corrected Hα flux counts and fluxes 46

Table 3.13 Hα luminosities and star formation rates (Lee's method) 47

Table 3.14 B-band luminosities and estimated mass of the galaxies 49

Table 4.1 Perturbation parameters of galaxy-group interactions 62

Table 4.2 Perturbation parameters of galaxy-galaxy interactions 63

Table E.1 The NGC 4213 Group members 82

Table F.1 Hα luminosities and star formation rates (James's method) 83

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

LIST OF FIGURES

Page

Figure 2.1 Optical image of Coma and Virgo clusters from ESO-DSS. 8
Figure 2.2 Hubble's tuning fork diagram 8
Figure 2.3 Optical image of elliptical galaxies from ESO-DSS 11
Figure 2.4 Optical image of lenticular galaxies from ESO-DSS 12
Figure 2.5 Optical image of spiral galaxies from ESO-DSS 13
Figure 2.6 Optical image of grand-design-spiral galaxy from ESO-DSS 14
Figure 2.7 The pitch angle of a spiral arm 14
Figure 2.8 Optical image of irregular galaxies from ESO-DSS 16
Figure 2.9 Diagram of the solid angle and surface brightness 20
Figure 2.10 Isophotes of the sample galaxy 21
Figure 2.11 Available spectral line of 2MASX J12152202+2359376 from SDSS 23
Figure 2.12 The morphology-density relation 25

Figure 3.1 The layout of the sample galaxy images 31
Figure 3.2 Transmissivity profile of the [S II] filter 43

Figure 4.1 The diagram of B-V color against B-band absolute magnitudes 52
Figure 4.2 The diagram of B-R color against B-band absolute magnitudes 53
Figure 4.3 The diagram of V-R color against B-band absolute magnitudes 53
Figure 4.4 The $B-V$ color versus T-type diagram 54
Figure 4.5 The diagram of Hα + [N II] emission equivalent width against color indices of the galaxies 55
Figure 4.6 Distribution of Hα + [N II] emission equivalent width as a function of T-types 56
Figure 4.7 The diagram of Hα + [N II] emission equivalent width against color indices 56

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Figure 4.8 The distribution of $\log(M_{\rm gal}/M_{\odot})$ against the T-types 57
Figure 4.9 The comparison of star formation rate between two methods 58
Figure 4.10 Distribution of star formation rate versus Hα equivalent width 59
Figure 4.11 Distribution of the $nSFR$ against $B-V$ color index 60
Figure 4.12 Distribution of the $nSFR$ against T-types 60
Figure 4.13 Distribution of the $nSFR$ against Hα equivalent width 61

Figure B.1 The first frame of the sample galaxies 77
Figure B.2 The second frame of the sample galaxies 77
Figure B.3 The third frame of the sample galaxies 78
Figure B.4 The fourth frame of the sample galaxies 78
Figure B.5 The fifth frame of the sample galaxies 78

Figure C.1 Available spectral line of the sample galaxies 79
Figure C.2 Available Spectral line of the sample galaxies (continued) 80

Figure D.1 Transmissivity profile of the filters 81

Figure F.1 The comparison of EW(Hα) about two methods with respec to non-[N II] correction 83

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved