

# List of Figures



1.1	Electromagnetic spectrum . . . . .	2
1.2	Atmospheric windows at different wavelengths . . . . .	3
1.3	Line strengths of different stars . . . . .	5
1.4	The near-infrared (1-5 $\mu\text{m}$ ) transmission of atmosphere over Mauna Kea . . . . .	11
1.5	The spectrum of total background radiation entering an infrared instrument . . . . .	14
1.6	A synthetic NIR spectrum reproduced from Lançon et al. (2007) . .	16
1.7	Distribution of ultra-violet libraries . . . . .	23
1.8	Distribution of stars in Jamar et al. (1976) . . . . .	24
1.9	Distribution of optical libraries . . . . .	25
1.10	Distribution of stars in Indo-US library (2004) . . . . .	26
1.11	Distribution of stars in Indo-US library in parameter space . . . . .	27
1.12	Distribution of infrared libraries . . . . .	28
2.1	Basic components of a spectrometer . . . . .	38
2.2	Stellar and sky spectrum in J band . . . . .	39
2.3	Star and sky spectrum in H band (early part) . . . . .	40
2.4	Star and sky spectrum in H band continued (later part) . . . . .	41
2.5	Star and sky spectrum in K band (early part) . . . . .	42

---

2.6	Star and sky spectrum in K band continued (later part) . . . . .	43
3.1	Distribution of stars in J band library by spectral type and luminosity class . . . . .	47
3.2	Distribution of stars in J band library by spectral type per luminosity class . . . . .	48
3.3	Plot of surface gravity ( $\log g$ ) vs. effective temperature ( $T_{eff}$ ) for J band stars . . . . .	50
3.4	Plot of metallicity ( $Fe/H$ ) vs. effective temperature ( $T_{eff}$ ) for J band stars . . . . .	51
3.5	Plot of Metallicity ( $Fe/H$ ) vs. surface gravity ( $\log g$ ) for J band stars.	52
3.6	Telluric absorption spectrum used for J-band wavelength calibration	53
3.7	Block diagram illustrating steps carried for comparison of GIRT J band spectra with the Wallace et al. (2000) . . . . .	55
3.8	Comparison of common stars from GIRT and Wallace et al.(2000) .	56
3.9	Sample spectra for supergiant stars . . . . .	57
3.10	Sample spectra for giant stars . . . . .	58
3.11	Sample spectra for dwarf stars . . . . .	59
4.1	Distribution of stars in H band library by spectral type and luminosity class . . . . .	79
4.2	Distribution of stars in H band library by spectral type per luminosity class . . . . .	80
4.3	Plot of surface gravity ( $\log g$ ) vs. effective temperature ( $T_{eff}$ ) for H band stars. . . . .	82
4.4	Plot of metallicity ( $Fe/H$ ) vs. effective temperature ( $T_{eff}$ ) for H band stars. . . . .	83
4.5	Plot of metallicity ( $Fe/H$ ) vs. surface gravity ( $\log g$ ) for H band stars.	84

---

4.6	OH airglow lines used for early H-band wavelength calibration . . .	86
4.7	OH airglow lines used for later H-band wavelength calibration . . .	87
4.8	Block diagram illustrating steps carried for comparison of GIRT H band spectra to the Meyer et al. (1998) . . . . .	90
4.9	Comparison of common stars from GIRT and Meyer et al. (1998) . . .	91
4.10	Sample spectra for dwarf stars . . . . .	92
4.11	Sample spectra for supergiant stars . . . . .	93
5.1	Distribution of stars in K band library by spectral type and lumi- nosity class . . . . .	113
5.2	Distribution of stars in K band library by spectral type per lumi- nosity class . . . . .	114
5.3	Plot of surface gravity ( $\log g$ ) vs. effective temperature ( $T_{eff}$ ) for K band stars. . . . .	116
5.4	Plot of metallicity ( $Fe/H$ ) vs. effective temperature ( $T_{eff}$ ) for K band stars. . . . .	117
5.5	Plot of metallicity ( $Fe/H$ ) vs. surface gravity ( $\log g$ ) for K band stars.	118
5.6	OH airglow lines used for early K-band wavelength calibration . . .	120
5.7	OH airglow lines used for later K-band wavelength calibration . . .	121
5.8	Block diagram illustrating steps carried for comparison of GIRT K band spectra to the Wallace et al. (1997) . . . . .	123
5.9	Comparison of common stars from GIRT and Wallace et al. (1997) .	124
5.10	Sample spectra for supergiant stars . . . . .	125
5.11	Sample spectra for giant stars . . . . .	126
5.12	Sample spectra for dwarf stars . . . . .	127
6.1	Comparison of GIRT and synthetic spectra for the star HR 1543 . . .	147
6.2	Comparison of GIRT and synthetic spectra for the star HR 1983 . . .	148

---

6.3	Comparison of GIRT and synthetic spectra for the star HR 2701 . .	149
6.4	Comparison of GIRT and synthetic spectra for the star HR 4945 . .	150
6.5	Scatter plot of classification of stars in J band GIRT library . . . . .	151
6.6	Scatter plot of classification of stars in H band GIRT library . . . . .	152