APPENDIX A

Table A: CCD camera ST-7E specification.

Physical Dimensions	
Optical Head	5 inches ⌀ x 3 inches 12.5 cm ⌀ x 7.5 deep 2 pounds/0.9 kg
CPU	All electronics integrated into Optical Head, No CPU
Mounting	T-Thread, 1.25" and 2" nose pieces included
Backfocus	0.92 inches/2.3 cm
CCD Specifications	
CCD	KodakKAF-0401E + TI TC-211
Pixel Array	765 x 510 pixels, 6.9 x 4.6 mm
Total Pixels	390,000
Pixel Size	9 x 9 microns
Full Well Capacity (ABG)	~50,000 e-
FullWell Capacity (NABG)	~100,000 e-
Dark Current	$1e^-$/pixel/sec at 0° C
Antiblooming	Standard (non ABG as option)
Readout Specifications	
Shutter	Electromechanical
Exposure	0.11 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	$2.3e^-$/ADU
Read Noise	$15e^-$ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Pixel Digitization Rate	Up to 420,000 pixels per second (30 kHz)
Full Frame Acquisition	~1 second
System Specifications	
Cooling – standard	Single Stage Thermoelectric, Active Fan,Water Assist Ready-45 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	5 VDC at 1.5 amps, ±12 VDC at 0.5 amp desktop power supply included
Computer Interface	USB
Computer Compatibility	Windows 95/98/NT/2000/Me/XP
Guiding	Dual CCD Self-Guiding

APPENDIX B

Table B1: Spectrograph specification.

Type	Specification
Dispersion	1.07 Å per pixel (600 lines per mm) or 4.3 Å per pixel (150 lines per mm)
Resolution	2.4, 10 or 38 Å Full Width at Half Maximum
Spectral coverage per frame	750 Å for high resolution grating, or 3200 Å for low resolution grating
Center Wavelength Selection	Calibrated Micrometer Adjustment
Wavelength Range	3800 to 7500 Å
Entrance Slit	18 micron (2.3 arcseconds wide with 160 cm focal length telescope).
Acceptance Angle	F/6.3 by F/10. F/6.3 recommended for maximum signal
Dimensions	10 x 12 x 20 cm
Weight	2.4 kg (with CCD ST-7E attached)

Table B2: Spectrograph's dispersing specification

Dispersion	
- 150 lines per mm (4.3 Å per pixel) - 600 lines per mm (1.0 Å per pixel)	
Slit Width	
- 18 microns wide (2 arcseconds at 80 inch focal length) Good for stars and nebulae - 72 microns wide (8 arcseconds at 80 inch focal length) Good for galaxies	
Acceptance cone angle: F/6.3 by F/10	
Resolution	
Narrow slit & 600 lines/mm	2.4 Å
Narrow slit & 150 lines/mm	10 Å
Wide slit & 600 lines/mm	10 Å
Wide slit & 150 lines/mm	38 Å
Sensitivity to Diffuse	
Narrow slit & 600 lines/mm	1.0
Narrow slit & 150 lines/mm	4.0
Wide slit & 600 lines/mm	4.0
Wide slit & 150 lines/mm	16.0