GX892

OLLSCOIL NA hÉIREANN
GAILLIMH

NATIONAL UNIVERSITY OF IRELAND
GALWAY

SEMESTER I EXAMINATIONS 2002 -2003

Astronomy:- AT302

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| Time allowed TWO hours | Answer THREE questions |
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Q.1 (a) Briefly discuss the development of the following astronomical software packages or suites: MIDAS; IRAF; Starlink. [3 marks]

(b) Describe (in overview form) how IRAF and its ancillary packages are configured at the system level. In your answer, refer to the login.cl file, the extern.pkg file, and directory structures. [3 marks]

(c) Describe the features of IRAF which make it suitable for (i) automated batch-processing of data; (ii) interactive viewing of data. [4 marks]

Q.2 You have spent two nights observing with a 1.5m telescope, using CCD and BVRI filters for imaging and photometry. In addition to observations of science targets, you also obtained a full complement of calibration data: flat-fields, dark frames, and bias frames. Some of the flat-fields were partially saturated. Describe in detail the steps which you would take to perform the following processes:

(i) reduce the bias frames; [2 marks]
(ii) reduce the dark frames; [2 marks]
(iii) reduce the flat-field frames; [3 marks]
(iv) apply these three calibration products to one science frame. [3 marks]

Q.3 (a) Describe procedures for (i) scanning an astronomical photograph on colour film into a computer; (ii) subsequently isolating the colour channels of the photograph into separate FITS files. [4 marks]

(b) Compare the following tricolour and quadcolour composite-imaging methods: RGB; LRGB; LCMY. [3 marks]

(c) You have obtained three calibrated, registered, well-exposed images of a spiral galaxy – one in each of the U, V, and H-$\alpha$ filters. Justifying

choice of parameter settings, write down the IRAF command to create an RGB tricolour image of the galaxy, for each of the following purposes:

(i) you wish to emphasise the emission nebula regions; [1 mark]
(ii) you wish to emphasise the clusters of hot young stars; [1 mark]
(iii) you wish to emphasise the central bulge of the galaxy. [1 mark]

Q.4 Describe the process of performing crowded-field photometry, under the following headings:

(i) Automatic star detection [2 marks]
(ii) Aperture photometry [2 marks]
(iii) PSF-modelling [2 marks]
(iv) Profile-fitting photometry [2 marks]
(v) Calibration against photometric standard stars [2 marks]

**Note**: It is not necessary to use IRAF command syntax in your answer.

Q.5 (a) Discuss two different image deconvolution algorithms used in astronomy. Briefly compare their relative merits and disadvantages. [5 marks]

(b) In the context of the search for variable stars in crowded fields, describe (i) Phase Dispersion Minimisation (PDM) with PSF-fitting photometry as input; (ii) PSF-matching & image-subtraction. Why is the latter method more effective than the former method? [5 marks]