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HW 01: INTRODUCTION TO READING SCIENTIFIC PAPERS AND USING LaTeX

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1. INTRODUCTION

1. The Five C's

   (a) Category: The paper is a blend between a **measurement** and an **analysis** on an existing system. The researchers monitor the young cluster IC 348 in the Cousins I band with a 0.6 m telescope. General traits are extrapolated upon and the results relating to canonical views are discussed.

   (b) Context: This paper is related to general variability studies of pre-main sequence (PMS) populations. The young cluster IC 348 is thought to be an optimal candidate on the bases that it is nearby, extremely young, and relatively free of nebulosity which complicates photometric studies. Technical bases include advanced techniques including near-infrared studies, IR spectroscopy, and emission studies.

   (c) Correctness: Although the authors explain that the general cannon of PMS variability stand, the weak T Tauri stars (WTTS) controversially exhibit non-periodicity.

   (d) Contributions: This paper raises great questions about the non-periodic behavior of WTTS. These questions include, 1) Are these systems with a small amount of accretion 2) Are they stars with changing spot patters during the observational epoch?. Secondly, the content does well to state the observations that hold true to models and further proved them.

   (e) Clarity: The paper is well written, but some areas are highly specialized. Although sections are specialized, the author does well to extrapolate on certain ideas for the general audience to understand.

2. New Vocabulary

   (a) Photometry: The measurement of the brightness of stars and other celestial objects (nebulae, galaxies, planets, etc.).

   (b) Variable Star: Any star whose observed light varies notably in intensity. The changes in brightness may be periodic, semi-regular, or completely irregular.

   (c) FUors: FU Orionis objects that undergo accretion outbursts during which the accretion rate rapidly increases from typically 10^{-7} to a few $10^{-4}\,M_{\odot}yr^{-1}$ and remains elevated over several decades or more. Audard (2014)

   (d) EXors: EX Lup objects that are a loosely defined class of PMS stars, exhibit shorter and repetitive outbursts, associated with lower accretion rates. Audard (2014)

   (e) UXors: UX Orionis stars, intermediate-mass PMS stars displaying a peculiar kind of photometric variability. Their V-band light curves are characterized by sudden drops in brightness of up to 3 mag with durations of days to many weeks. Dullemond (2003)

   (f) CCD detectors: The charge-coupled device (CCD) uses a light-sensitive material on a silicon chip to electronically detect photons in a way similar to the photomultiplier tube. The principle difference is that the chip also contains integrated micro-circuitry required to transfer the detected signal along a row of discrete picture elements (or pixels) and thereby scan a celestial object of objects very rapidly.

3. Analyze Sections

   (a) Observations and Initial Reductions

      i. Observations between December 1998 to March 1999 with a 1024x1024 Photometrics CCD attached to the f/13.5, 0.6 m Perkin telescope at Van Vleck Observatory utilizing a Cousins I filter.

ii. Review of viewing procedures totaling 76 images with an effective integration time of 5 minutes each on 27 separate nights.

iii. Reduction to 6 potential comparison objects/stars.

(b) Transformation to a Standard System

i. Linear transformation from instrumental magnitude (i) to standard magnitude (I).

ii. Agreements with current accepted values comparing to local photometric system of Trullols and Jordi (TJ) and Herbig (H98).

Model	Magnitude (I)
Paper Results	11.99
TJ	12.02
H98	12.60

(c) Variability

i. Use of standard error (σ) to address variability.

ii. Brighter stars (I<13.5) – systematic effects coming mostly from flat-fielding errors and residual variability in the reference magnitude - to our photometric accuracy for even bright stars.

iii. Fainter stars (I>13.5) – random errors reflected by the influence of sky measurement errors on the photometry.

iv. Expectation confirmation for this sample:

- Absorption line stars show no evidence of variability, most CTTS and WTTS are variable stars.
- CTTS as a group are more variable than WTTS.
- **Not one of the stars found to be periodic is a known CTTS, whereas 17 of 19 are WTTS.**

(d) Periodic Variables

i. Use of older procedures to identify periodic variables, utilizing periodograms formed from the I magnitude time series for each and ever star (regardless of whether it showed a significantly non-zero value of σ_{var}).

ii. 17 of 19 stars are WTTS, and portray a surprising absence of CTTS even though they are as bright as WTTS.

iii. Supports general picture of variability of PMS stars that have evolved over time.

(e) Variability and IR Data

i. Comparisons of positions in the JHK bands of IC 348 (143 of 151 object matches).

ii. Almost no correlation between variability and IR excess emission (at least in I-K) in the sample.

iii. essentially no relation between excess IR emission and rotation period for IC 348.

iv. Reveals possible connection between rotation and disks.

4. ID Useful communications strategies

(a) The inclusion of equation regarding error and statistics is useful for visualizing techniques. Defining and providing references to model literature was vital for comparisons. The keywords are somewhat vague, and better keywords could be used. Content is quite specialized, but the author does well to map out procedures and techniques used.

5. Followup a citation

(a) UBVR1 PASSBANDS, Bessell, M.S. Bessell (1990)

i. Compares synthetic photometry with actual observations and with standard system magnitudes.

ii. Passbands of photometric systems enable color indices to be calibrated theoretically and to enable observations by different observers using different equipment to be made and compared with precision.

iii. Can be used with theoretical fluxes for calibration of temperature, abundance, and gravity.

iv. Cousins standards are good matches to the Johnson UBV system and the E-region standards are recommended as the most precise and internally consistent set of secondary UBVRI standards.

v. Transformation equations can be used at the large telescope and faint standards observed to provide zero-point corrections only, which increase the efficiency of observing and improve the reliability of CCD absolute photometry.

vi. **If users match passbands and use precise standards there is no reason why the broad-band UBVRI system cannot match the prevision of any of the narrow-band systems**.

REFERENCES

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