FIRST STEPS TOWARD A CCD-BASED SKY PATROL

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1. Definition of a Sky Patrol

A sky patrol aims to record, as often as possible, the whole sky visible from an observing site down to a certain magnitude in one or more optical or near-optical wavelength regions.

2. Scientific Justification for a CCD-based Sky Patrol

Main types of output:

1) **Recording of new events**: Novae, supernovae and CV outbursts, comets and asteroids (also NEAs),
2) **Monitoring of known objects** like variables in general, AGNs and solar-system objects.

Main targets of investigation:

1) Variable stars in general.
   - **Cataclysmic Variables**: Long-term light curves; monitoring the duration and shapes of outburst and quiescence phases; studies of superhump phenomena; discovering new CVs (important because of the small probability of success) (Canizzo et al. 1992).
   - **Novae:** Monitoring the sky for new novae down to 20^m or more. This would lead to a comprehensive picture of the real frequency of novae in our galaxy. Early discovery of nova outbursts is a unique opportunity to study the prenova and initial rise.
   - **X-ray binaries:** Study of Polars and HZ Her stars, particularly the different active and inactive states in the light curve; coincidence with X-ray satellite observations; observation of X-ray burster counterparts.
   - **T Tauri stars;** Investigation of the long-term behaviour: quasi-periodic oscillations and quiescence phases; studies of colour-index variations (Attridge 1992; Bouvier & Bertout 1989; Bouvier 1990).
   - **Flare stars:** Most outbursts of flare stars probably remain unobserved. A systematic sky patrol promises to yield unsurpassed statistics of flare events all over the sky.

H. T. MacGillivray et al. (eds.), Astronomy from Wide-Field Imaging, 33–35.

- **Multi-mode pulsating Variables:** some RR Lyrae and δ Cephei stars exhibit multi-mode pulsations, a phenomenon not well understood. Detection of new stars with this behaviour would be particularly important.
- **Pulsating Variables with short periods:** Owing to the duration of about 20-60 minutes of a typical photographic exposure, stars with periods less than 3 hours tend not to get discovered through photographic patrols. The shorter exposure times with CCDs of a few minutes offer a better time resolution and therefore promise a higher probability of discovering this type of variables.
- **Eclipsing binaries:** Study of periods changing over long time-scales; search for binaries with changing amplitude and conspicuous period changes as indicators of a third component or of mass exchange (Azimov et al. 1991; Fried 1991; Lehmann 1991; Mayer 1990).

2) AGNs.
   - Long-term light curves are known for only a few objects. A patrol down to 20^m offers the possibility of investigating several hundreds or thousands of Markarian Galaxies, BL-Lacs, Quasars and related objects (Carini et al. 1990, 1991, 1992; Webb 1991).

3) Solar-system objects.
   - **Comets:** Early discovery, rediscovery and detection of faint comets.
   - **Near-Earth Asteroids:** Because of the rapid angular motion and the faint light of these objects, they are difficult to observe. But owing to the extensive data bases, NEAs may also be observed accidentally.
   - **Saturn Trojans:** These objects, if they exist, may well be detected by chance.
   - **Chiron-like objects and far asteroids/comets:** In view of the recent discoveries of 1992 AD and 1992 QB1, there are grounds for believing that more of these objects could be found.

4) Counterparts of Satellite Events.
   - Current satellite (e.g. ROSAT, GRO) events (variable sources, transient events) whose true nature remains a mystery are of great interest for parallel optical investigations (Cheng Ho et al. 1992; Paciesas et al. 1992).

3. Proposal for an Actual System

The more detailed study in WGWFI Newsletter No. 3, p. 30, by the authors led to a proposal for a real specification. The system as a whole should consist of two components: **Low Resolution Sky Patrol** down to 16^m once per night and **Deep Sky Patrol** down to 20^m which covers the total sky once per month.

The following table shows the essential quantities of both components. We have chosen the pixel size to be 15 μm, the CCD size 2048 x 2048 and the read-out time 1 min.

https://doi.org/10.1017/S0074180900046982 Published online by Cambridge University Press

	Low Resolution Sky Patrol	Deep Sky Patrol
limiting magnitude	16^m	20^m
number of stars per □°	1,900	38,900
Δ''	83″	18″
sampling	5″/*px*	2″/px
Δ_{px}	17	9
field size	2°.8	1°.1
focal length	0.6 m	1.6 m
aperture (r = 4)	0.15 m	0.4 m
exposure time	3 min	16 min
frequency of patrol	1/night	1/month
number of cameras	30	26
data per night	31 GB	6 GB

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