Mem. S.A.It. Suppl. Vol. 9, 478

Memorie della
Supplementi

The CCD cameras of RATS project

S. Scuderi[1], R.U. Claudi[2], F. Favata[3], G. Bonanno[1], P. Bruno[1], R. Cosentino[1,4], M. Belluso[1], A. Calí[1], M.C. Timpanaro[1], V. Chiomento[2], G. Farisato[2], A. Frigo[2], G. Gianesini[2], L. Traverso[2], M. Rebeschini[2], and D. Strazzabosco[2]

[1] Istituto Nazionale di Astrofisica – Osservatorio Astrofisico di Catania, Via Santa Sofia 78, I-95123 Catania, Italy
[2] Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Padova
[3] European Space Agency
[4] Fundacion Galileo Galilei – INAF Telescopio Nazionale Galileo

Abstract. We report on the characteristics and the performances of the CCD cameras that will be used by the project RATS (RAdial velocity and Transit Search) that is an italian-ESA collaboration whose main goal is the search of extrasolar planet using the transit method. We describe the characteristics of the variuos cameras and the first tests at the Asiago Schmidt telescope at Cima Ekar.

Key words. Stars: planetary systems – Techniques: photometry

1. Introduction

The RATS project (Scuderi et al. 2005) is a collaboration among the INAF sections of Catania, Napoli, Padova and Palermo the Physics and Astronomy Departments of Padua University and ESA whose main goal is the discovery of giant planets transiting solar type stars. The project will have a duration of five years during which the detection of at least ten new extrasolar planets is expected. Another important goal of the project is to test the strategy of observation, data reduction and archiving of the ESA planned mission Eddington.

2. The CCD cameras

As one of the goal of the project is to test the observational strategy of the Eddington mission, wide field imaging will be performed using one of the CCDs manufactured by e2v for the mission. This CCD will be loaned by ESA to the project consortium in late summer 2005. In the meanwhile we have started the project using two other CCDs. The first CCD camera is called ITANET camera and the second one SITe camera. Table 1 summarize the main characteristics of the CCD cameras which will be used during the project.

2.1. The ITANET Camera

The ITANET project Gandolfi et al. (2005) is an italian national project whose aim is the study of Near Earth Objects. The CCD camera, that has been completely designed and realized at the Catania Astrophysical Observatory (see Fig. 1), will be used by the RATS project too. Due to its small field of view and to its low

Send offprint requests to: S. Scuderi

Table 1. Charateristics of the CCD cameras

	ITANET	SITe	Eddington
Chip	KODAK KAF-4202	SITe-424A	e2v 42-C0
Format	2032 × 2044	2048 × 2048	2048 × 6144
Pixel Size	9.0 μm	24.0 μm	13.5 μm
Full Well	90000 e^-	200000 e^-	150000 e^-
Read-Out Speed	50 kpx/s	50 kpx/s	450 kpx/s
Read-Out Noise	8.4 e^- (50 kHz)	10 e^- (50 kHz)	5 e^- (450 kHz)
Read-Out Mode	Full Frame	Full Frame	Frame Transfer
Temperature	-40°C (Peltier)	-100°C (LN2)	-100°C (LN2)
Dark Current	2.5 e^-/pix/h	≤ 1 e^-/pix/h	2 e^-/pix/h
Dynamics	10000:1	20000:1	30000:1
Scale	0.9"/pix	2.3"/pix	1.3"/pix
Field of View	0.51°	1.31°	0.7 × 1.1°
Optical Filters	BVRI Johnson	None	None

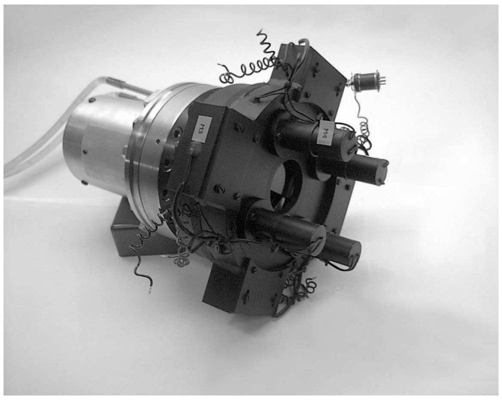

Fig. 1. A skecth of the ITANET camera showing the filter system and CCD dewar

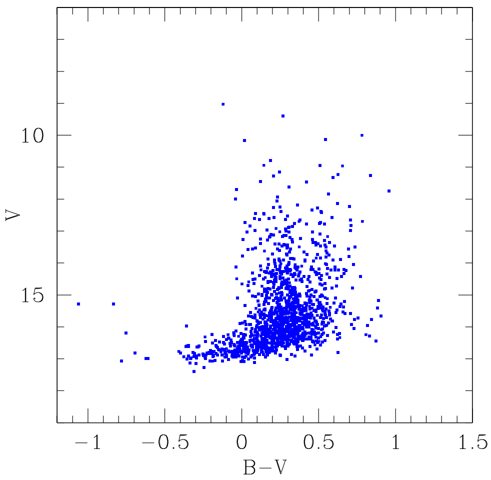

Fig. 2. The color magnitude diagram in the B and V Johnson filters for one of the RATS fields. Exposure times for the B and V images were 15 seconds.

quantum efficiency, the CCD is a bare front illuminated device, the camera will not be used for the survey itself. Instead as it will be the only one equipped with a set of BVRI Johnson filter will be very useful for the characterization of the fields selected for the RATS search. An example of this kind of analysis is shown in Fig. 2 showing a preliminary color magnitude diagram for one of the RATS field obtained during one the nigths of testing at the Schmidt telescope.

2.2. The SITe Camera

The SITe camera is based on the SITe-424A back-illuminated 2048 × 2048 device. The CCD has been characterized at the Catania Astrophysical Observatory and its quantum efficiency is shown in Fig. 4. The CCD has been mounted inside a LN2 dewar. Cold finger, wire cabling and mechanics (see Fig. 3)

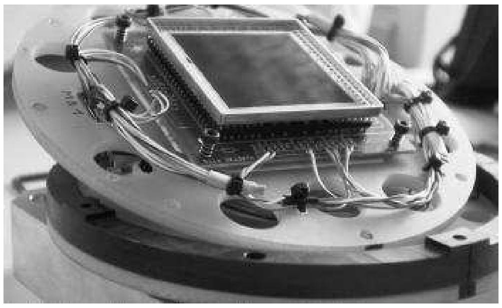

Fig. 3. The SITe CCD mounted on its cold finger before being placed inside the dewar

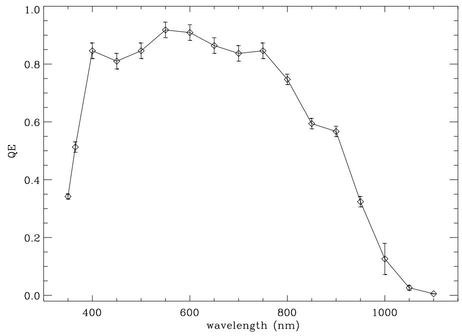

Fig. 4. The quantum efficiency curve of the SITe CCD obtained at the Catania Astrophysical Observatory

have been realized at the Padua Astronomical observatory. The window that seals the dewar is a field flattener lens with a 1500 mm focal length. Presently the camera is mounted on the Cima Ekar Schmidt telescope where is undergoing focusing optimization procedures. Scientific tests and measurements will start later in the summer.

2.3. The Eddington Camera

The final CCD camera will use one of the CCD chips developed by e2v for the focal plane of Eddington (see Fig. 5). The CCD is a back illuminated frame transfer device. ESA will loan one of these chips to the project after their characterization will be concluded. This should happen late in the summer 2005. All

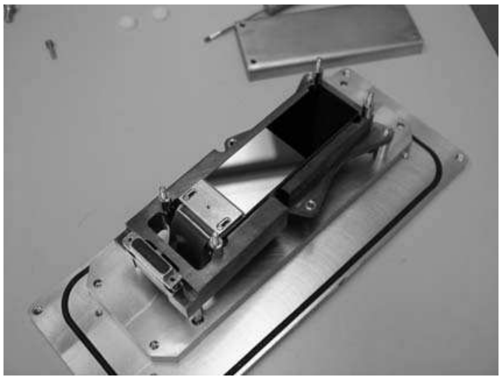

Fig. 5. The e2v 42-C0 Eddington CCD

the mechanical interfaces, necessary to integrate the CCD inside the dewar presently hosting the SITe CCD, are being realized in Asiago and Catania. We plan to have first light at telescope by the end of fall 2005.

3. The CCD controllers

To run the CCD cameras the RATS project will make use of the CCD controllers developed for the “Telescopio Nazionale Galileo” (TNG). At the moment we are using the old version of the controller based on transputer technology whose main limitation is the read-out speed that cannot be greater than 50 kpix/s. The “new generation” of controllers (Bonanno et al. 2004), that we plan to use for the Eddington CCD, will overcome this limitation allowing a rate up to 450 kpix/s.

References

Bonanno et al., 2004, in “Scientific Detectors for Astronomy”, eds, P. Amico, J.W. Beletic, J.E. Beletic, Kluwer Academic Publishers, 423.

Gandolfi et al. 2005, Mem SAIt, “ITANET CCD Camera for NEOs Photometric Observations”, these proceedings.

Scuderi et al, 2005, Mem SaIT, “The RATS project”, these proceedings.