Sintez telescope modernization

Nazarov S.V



History



Рис. 1.6. Схема телескопа АСТ-1200





MODERNIZATION



Scientific tasks

- AGN photometry
- Stars photometry
- GRB photometry
- Exoplanets transits photometry
- Search and monitoring programs

Applied tasks

- New devices testing
- Creation of remote and automatic control systems
- Web-based control system creation

Common parameters

- New main mirror diameter about 1m
- Focal distance 3m
- Field of view about 1-2 deg
- Limiting magnitude:
- White light 21-23m
- Photometry in filters 20m
- Spectral observations 15-18m

Small telescope



- Newton reflector 350mm/1765, guide 50/183mm
- Main camera QHY9 guide camera QHY5L-II M
- electric focus
- Filter wheel 7x1.25" C-B-V-R-I-OIII-Ha



WEB-control

РУЧНОЕ УПРАВЛЕНИЕ КОМПЛЕКСОМ АППАРАТУРЫ ОТЛАДОЧНЫЙ РЕЖИМ УПРАВЛЕНИЕ ТЕЛЕСКОПОМ СТАТУС ОБОРУДОВАНИЯ CEPBEP Alpaca/INDI ASP.NET 1.1-272 CB93b: 1.000 Открыть Закрыть Парковка Крыша + телескоп Стоп Погода: Приемлимо Воздух: 12.3° 99% Небо: -4.7° Ошибка: Все данные приняты Закрыть Стоп Крыша отдельно Открыть КРЫША Овен v1.18 СВЯЗЬ: 1.000 Состояние: Открыто Сила ВКЛ Питание монтировки Вкл Откл Разблокиро... Входы: 0x0 Выходы: 0x0 Рег: 0x41 0x3 Вкл Откл Перезапуск Питание аппаратуры ТЕЛЕСКОП Ra:2.1-657, Dec:2.1-657 СВЯЗЬ: 1.000 Часовое ведение: ВКЛ Парковка: Распаркован ПРОЧИЕ КОМАНДЫ JNow: Ra=05h47m52.0s , Dec=00°05'15.1" Земля: Ha=-01h56m56.4s, Dec=00°05'15.1" Освещение главное Вкл Откл [KAM] [KAM2] [BOCTOK] [BCËHE60] Подсветка Вкл Откл Откл Вкл Датчик осадков Грибок Тел.поднят UPS разряжен Ошибка 8 Авар.закр. Лазер Концевик Дождь

Телескоп "Синтез"

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WEB-control

http://sintez.alex13.ru

Телескоп "Синтез"

РУЧНОЕ УПРАВЛЕНИЕ КОМПЛЕКСОМ АППАРАТУРЫ

<u>СТАТУС ОБОРУДОВАНИЯ</u>

<u>СЕРВЕР АІраса/INDI ASP.NET 1.1-272</u> <u>СВЯЗЬ:</u> <u>1.000</u> Погода: Приемлимо Воздух: 12.3° 99% Небо: -4.5° Ошибка: Все данные приняты

КРЫША Овен v1.18 СВЯЗЬ: 1.000 Состояние: Открыто Сила ВКЛ Входы: ОхО Выходы: ОхО Рег: 0x41 0x3

ТЕЛЕСКОП Ra:2.1-657, Dec:2.1-657 СВЯЗЬ: 1.000 Часовое ведение: ВКЛ Парковка: Распаркован JNow: Ra=05h47m52.0s , Dec=00°05'15.3" Земля: Ha=-02h02m59.6s , Dec=00°05'15.3"

Тел.поднят

Авар.закр.

[KAM1] [KAM2] [BOCTOK] [BCËHEGO]

Грибок



Ошибка 8

Дождь

Концевик

Лазер

UPS разряжен

Control system



Control system



OBSERVATION S



As we observe with a telescope

- Open the roof and power on the mount (manual)
- Unpark the telescope and point to the object (NINA automatic)
- Astrometry of the first frame (NINA automatic).
- Synchronization of the telescope with the obtained coordinates (NINA automatic)
- Sharp pointing to the object (NINA automatic)
- Turn on autoguide (PhD2 automatic)
- Get the series of frames of the object (NINA automatic)
- Point the telescope to the next object (NINA automatic)
- Park telescope and warm camera (NINA automatic)
- Close the roof (industrial controller OVEN)

First light



December 2020

350/1767mm Camera QHY-9S M

Resolution 0,63"/px

Photometric error may 2021 350/1767mm Camera QHY-95 M





GRB 210610B



Date UT-start t-T0 Exp Filter OT Err UL(3sig) Obs. Telescope

2021-06-10 22:07:10 0.10293 5*300 R 17.20 0.03 20.5 CrAO Newton-0.35 2021-06-10 22:41:13 0.12658 5*300 R 17.28 0.08 21.1 CrAO Newton-0.35 2021-06-10 23:06:26 0.14409 5*300 R 17.28 0.06 21.1 CrAO Newton-0.35 2021-06-10 23:31:38 0.16159 5*300 R 17.29 0.06 21.1 CrAO Newton-0.35 2021-06-11 20:22:38 1.02165 8*300 R 19.58 0.10 21.2 CrAO Newton-0.35 2021-06-11 20:50:32 1.04103 6*300 R 19.50 0.09 21.2 CrAO Newton-0.35 2021-06-11 21:33:21 1.07077 17*300 R 19.69 0.09 21.5 CrAO Newton-0.35 2021-06-12 20:39:03 2.03479 14*300 R 20.57 0.189 21.5 CrAO Newton-0.35

GRB 210610B



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Astrometric monitoring

- Our first science aim in autumn 2020 was astrometric monitoring Uranus and Neptune satellites together with Pulkovo observatory. Main camera is QHY-9 with sensor KAF 8300M, pixel size 5.4 mkm, scale 630 mas/pix, field of view 35×26', typical exposure 45 sec. Total number of observations is 170 for Neptune and 500 for Uranus (october - december 2020).
- Limiting magnitude was 19m, astrometric errors not more 50mas.



New asteroid discovery

- On the night of march 11-12, 2021 we observe the antisolar point (opposite sun point). Exposures about 300 sec, unfiltered, bin 2x.
- Image processing: MaxImDI, IzmCCD, Mathlab. 10 known objects found and one unknown.
- We get new frames of march 15, send astrometry to MPC and get the registration of the new asteroid 2021 EP5.

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			55898			SZ00001 KC2021 03 11.99348 11 30 11.82 +03 10 20.2 SZ00001 KC2021 03 14.84883 11 27 07.57 +03 09 20.6	20.1 G	095 095
Sig=1	102.61 No	oise=1.31 SNR=7	8.29			SZ00001 KC2021 03 14.86288 11 27 06.69 +03 09 19.7 SZ00001 KC2021 03 14.87694 11 27 05.71 +03 09 19.4 SZ00001 KC2021 03 15 0284111 26 55 68 +03 09 16 9	20.5 G 20.3 G 20.2 G	095 095 095

Asteroid discovery soft

Calibration (dark, flat, bias applying)

- Astrometric solution (local astrometry.net solver)
- Images alignment (rotation, offset, polynomial transform)
- Background fitering (median and sigma-clipping)
- Stacking. Fast-moving object removing (satellites and so). Good image of stars as a result.
- Removing stars (from stacking pass) from all images
- Partial averaging (if there are too many images to process in one time)
- Calculation many sums of all images with different offsets. Offset adjusting. Determining possible asteroid-candidates.
- Selection of brightest candidates. Calculating SNR, Coordinates, Speed. Summing images with calculated offset.
- Known objects identification. Exporting results.

AGN observations

 In summer 2021 we started monitoring of BL Lac together with SPbSU. Total number of frames >900 (august - september 2021)



Our results

- 1. Mount, roof and sensors restored
- 2. 350mm telescope put into operation
- 3. Control system created
- 4. Photometric errors are defined
- 5. Scientific observations organized
- 6. Unknown asteroid discoveried



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Our plans

- 1. Full automation of the observations
- 2. Web-based telescope control
- 3. New camera and 2" filters
- 4. Manufacturing and installation of a meter main mirror



Thank you!



Nazarov Sergey Harchenko Alex Krivenko Sasha

Astrotourist.info astrotourist@gmail.com