Optical observations of Planck galaxy clusters with RTT150 telescope

Planck collaboration,

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PSZ1 catalogue

Total — 1227, confirmed — 861, known — 683, new — 178, candidates — 366

— new clusters should be confirmed and their redshifts should be measured
— extensive optical follow-up programme, see Planck collaboration, 2013, arXiv:1303.5089
Russian-Turkish 1.5-m Telescope (RTT150)

- Produced at LOMO, St.-Petersburg, Russia
- Installed at Bakyryltepe, Turkey, first light in 2000
- Operated by KFU, IKI and TUG
- More than 100 dark and grey nights (KFU and IKI time) allocated for Planck SZ sources during last 3 years
Russian-Turkish 1.5-m Telescope (RTT150)

TFOSC — TUBITAK Faint Object Spectrograph and Camera

similar to, e.g., ALFOSC at NOT and others
6-m telescope of SAO RAN (BTA)

SCORPIO spectrograph and camera

Afanasiev & Moiseev, 2005
Optical identifications of galaxy clusters

The procedure is based on 400d X-ray galaxy cluster survey

(Burenin et al., 2007, the data were used in Vikhlinin et al., 2009)

\[ DSS, \ z = 0.227 \]

\[ SDSS, \ i', \ z = 0.436 \]

\[ RTT-150, \ i, \ z = 0.83 \]

The field size — 1 Mpc
Direct images

PSZ1 G098.24-41.15, $z = 0.4362$
Direct images

PSZ1 G100.18-29.68, $z = 0.485$
Identification examples

PSZ1 G084.04+58.75, \( z = 0.731 \)
too distant, not detected in SDSS

PSZ1 G048.22-65.03, \( z \approx 0.42 \)
no SDSS data
Clusters at low $b$

PSZ1 G060.12+11.42, $z \approx 0.30$

low $b$ (not detected in DSS), no SDSS
Fossil groups

PSZ1 G076.44+23.53, \( z = 0.169 \)

fossil group
Multiple and projected clusters

5 out of 47 newly identified clusters, while only \(\approx3\%\) of clusters are found at \(<10'\) separation in 400d and SPT surveys — Planck cluster selection function is affected?
Photometric redshifts

\[ \delta z / (1 + z) \approx 0.03, \text{ calibrated using 400d survey data (Burenin et al., 2007)} \]
Spectroscopic redshifts

RTT150, 20 min

up to $z \approx 0.4$
Spectroscopic redshifts

6-m BTA, 30 min
The number of observed clusters

PSZ1 catalogue:

SZ sources — 1227,
to be observed in optical — ≈500

Observed with RTT:

Observed — ≈130, new clusters — >50, redshifts measured >60

i.e. ≈20–25% of all required observations

List of telescopes

- IAC80, 0.8-m
- Nordic Optical Telescope, 2.56-m
- Isaac Newton Telescope, 2.54-m
- Gran Telescopio Canarias, 10.4-m
- Telescopio Nazionale Galileo, 3.58-m
- William Herschel Telescope, 4.2-m
- New Technology Telescope, 3.58-m
- ESO 2.2-m
- Very Large Telescope
- Russian-Turkish Telescope (RTT), 1.5-m
- Bolshoy Telescop Azimutal’ny (BTA), 6-m
- + Calar Alto 2.2-m telescope (recently)

— follow-up programme for PSZ1 is almost finished
— follow-up programme for PSZ2 was not started yet (?) . . . may be completed in a few years
Conclusions

- Optical observations with RTT150 and BTA telescopes provide a significant part of all required observations of Planck SZ sources.

- The programme of optical observations of galaxy clusters from Planck survey can be completed in a few years.