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Science with the refurbished Asiago 1.22m telescope

An overview of ongoing and future projects

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Abstract.
The Asiago 1.22m telescope began operations 70 yrs ago. It has always been primarily used for stellar spectroscopy. Telescope, dome and spectrograph have undergone a major refurbishment during the last 8 yrs (S. Ciroi, this volume). We review here how this impacted the output science and the type of research programs pursued with the telescope, and outline its perspective future use in the era of major all sky spectroscopic surveys (RAVE, Hermes-GALAH, Gaia-ESO, Gaia).

Key words: Telescopes - Instrumentation: spectrographs - Stars: peculiar - Stars: supernovae - Asteroids

1. Introduction

The 1.22m telescope is the historical instrument of the Asiago Astrophysical Observatory. Owned by the University of Padova and operated by the Department of Physics and Astronomy (UNIPD-DFA), the telescope was commissioned in 1942. At that time it was the largest instrument in Europe. In spite of its long life, the telescope is regularly scheduled and involved in a series of scientific projects related to the more recent topics of stellar and extragalactic astrophysics and solar system. Thanks to the strong sinergy and long lasting collaboration with the Astronomical Observatory of Padova of the Italian National Institute for Astrophysics (INAF-OAPD), the Asiago telescopes (1.22m telescope + 1.82m Copernico telescope + Schmidt 67/92 telescope) offer a large sample of observing facilities, from multiband photometry and astrometry to high-, medium- and low-resolution spectroscopy. The 1.22m telescope is equipped with a Boller and Chivens (B&C) spectrograph and an Andor Idus 512x2048px CCD. We refer the reader to the S.Ciroi contribution (these proceedings) for a more detailed description of the instrument. In this contribution we highlight some of the ongoing projects and we emphasize the role of the 1.22m telescope in the context of the present and future all-sky spectroscopic surveys.

2. The RAVE Peculiar Stars follow-up program

The RAVE (Steinmetz et al. 2006) Peculiar Stars (PCS) follow-up program is an ongoing project at 1.22m telescope + B&C carried out by UNIPD-DFA and the Faculty of Mathematics and Physics of the University of Ljubljana (Slovenia). INAF-OAPD and the 1.82m telescope (+ high-resolution R=20.000 Echelle spectrograph) are also part of the project. The program aims to confirm at different wavelength, resolution and epochs, candidate peculiar stars discovered on RAVE spectra by Matijevič et al. (2012), compare findings with available literature and eventually devote further study for objects unknown in literature or with questionable classification. In the next section we handle a curious case.

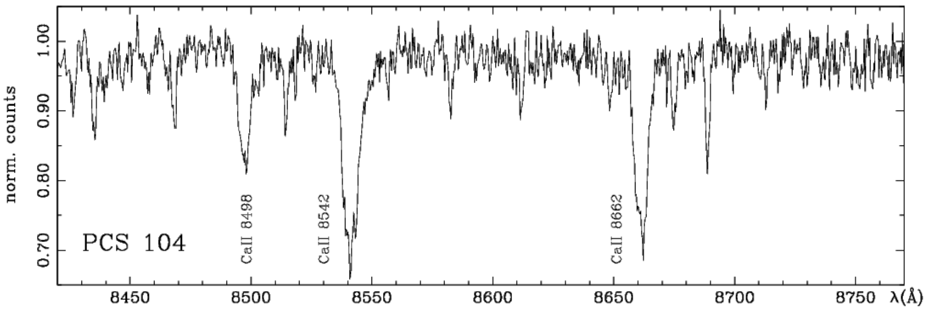

Figure 1. RAVE spectrum of the PCS 104 object collected on July 7, 2006. Lines of the Ca II triplet are identified.

2.1. The PCS 104 case

Fig. 1 shows the RAVE spectrum of a B=12.32 and V=11.32 object located at α=13 12 39.03 and δ=−23 44 22.6 (TYC 6699 173 1 from SIMBAD database). The spectrum was acquired on July 7, 2006. Though a bit noisy, the object, conventionally labelled as PCS 104 from the internal PCS catalog, does not show any peculiar feature at a first glance. However, inside the absorptions of the Ca II triplet, faint emissions seem to hide. The follow-up observations in the optical wavelength range collected on May 10, 2012 are self-explicative (Fig. 2), showing clear emissions in the core of the H & K calcium doublet.

A more detailed inspection of the other Echelle orders indicates also the binary nature of this target. The B&C spectrum obtained with the 1.22m telescope in the same night displays a normal K0V spectral classification. Drawing together our compelling findings we can argue that PCS 104 could be a RS CVn type star. No literature is available via CDS for this object and a detailed dedicated paper for this and other similar cases is presently in preparation.

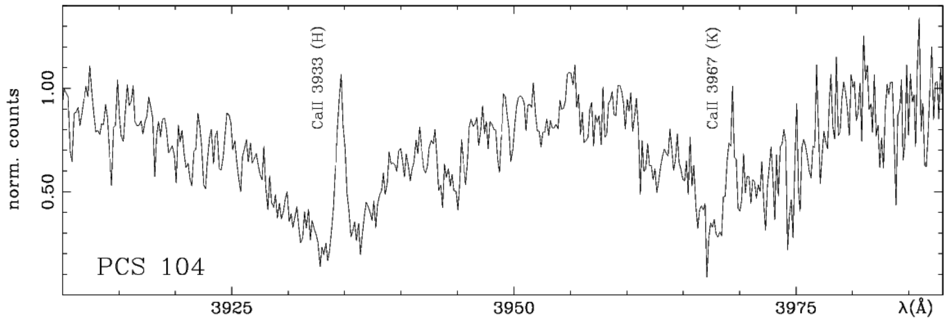

Figure 2. ECHELLE spectrum of the PCS 104 object collected on May 10, 2012 centered on the H&K Ca II doublet. Narrow emission lines superimposed on the larger absorptions are indicative of chromospheric spot activity.

3. Supernovae Classification

In 2011 the Padova-Asiago Supernova Group[1] started an observing program aimed to classify all transient objects accessible from the Asiago telescopes via a semi-automatic reduction pipeline and comparison against archive calibration data. Codes like GELATO (Harutyunyan et al. 2008) and SNID (Blondin and Tonry 2007) are used. The classification program mainly relies on the 1.82m Copernico telescope + AFOSC (Asiago Faint Object Spectroscopy and Camera) with the 1.22m representing a valid option for bright targets, expecially when the main instrument is not available. The number of SNe that have been classified since 2011 is impressive: 65 out of 193 (34% of the total number) between May and December 2011, 98 in 2012 over a total number of 246 (40%) and 33 till May 2013 over a total of 76 (43.4%). Fig. 3 shows an example of the semi-automatic procedure GELATO for the SN2012aw in M95. The spectrum was collected at the 1.22m telescope (+ B&C Spectrograph) in Asiago on Mar 19, 2012 (Siviero et al. 2012). The excellent fit with the archive spectrum of SN1999gi revealed the type-IIP nature of the SN. Once classified, SNe are continuously monitored by the Asiago telescopes. In particular the SN 2010A (Tomasella et al. 2013) and SN 2013aw (Dall'Ora, in preparation) have been intensively monitored by the 1.22m Asiago telescope.

4. Asteroid 2002GT and the SINEO Project

The 1.22m Asiago telescope was recently involved in a European Network led by the ESA's asteroid center in Italy aimed to coordinate the observations of

[1]http://graspa.oapd.inaf.it/asiago_class.html)

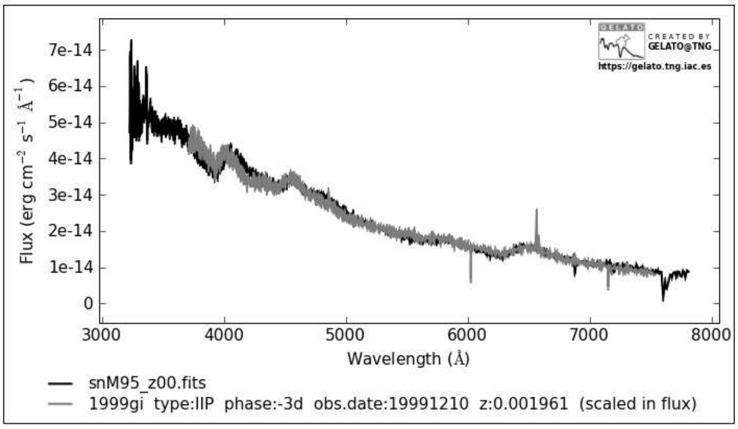

Figure 3. 1.22m + B&C spectrum of the SN 2012aw in M95 collected on Mar 19, 2012 and overplotted the 1999gi type-IIP.

the Asteroid 2002 GT (ESA SSA 2013) [2] during the recent close flyby of the Earth on June 26, 2013. 2002 GT was originally selected to be the target for the extended Deep Impact mission (renamed Epoxi) in 2020, so that the observations were of relevant interest to characterize the object before the encounter. Unfortunately the mission was officialy declared lost on September 16, 2013. In spite of the V=16.3 magnitude, the spectrum was exposed enough to allow a preliminary classification as Sq-type and admit the 1.22m telescope to take part in the SINEO Project (Lazzarin et al. 2008), one of the largest database of NEO spectra so far collected with the NTT-ESO and TNG-INAF telescopes. The low-resolution spectrum is shown in Fig. 4.

5. Conclusions

Due to easy accessibility, different set-ups and remote control, the 1.22m Asiago telescope will have a more and more promising future in the era of space (GAIA) or ground-based optical spectroscopic surveys (RAVE, ESO-GAIA, HERMES-GALAH). In this contribution we have shown that follow-up observations well fit the facilities offered by the 1m class telescopes, otherwise unreachable from larger and more tight scheduled instruments. Due to the limited amount of space we selected only three main topics, nonetheless many others are still carried out at the telescope, to mention some of them: multi-epoch spectrophotometric monitoring of Symbiotic Stars and Novae and other extra-galactical topics like

[2]http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness

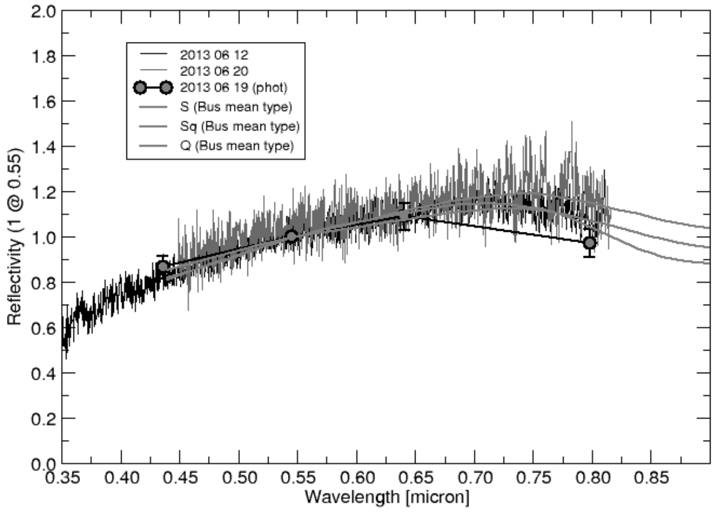

Figure 4. B&C spectra of asteroid 2002 GT. Averaged spectra relative to the S, Q and Sq types confirm that the Sq type best fits the observations.

reverberation mapping on type 1 AGNs for those we refer the reader to S.Ciroi's talk (this contribution).

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