Mem. S.A.It. Suppl. Vol. 19, 368

Memorie della
Supplementi

The Astronomical Observatory of the Autonomous Region of the Aosta Valley

A professional research centre in the Italian Alps

P. Calcidese[1], A. Bernagozzi[1], E. Bertolini[1], A. Carbognani[1], M. Damasso[1,2], P. Pellissier[1], P. Recaldini[1], M. Soldi[1], and G. Toso[1]

[1] Fondazione Clément Fillietroz-ONLUS – Osservatorio Astronomico della Regione Autonoma Valle d'Aosta e Planetario di Lignan, Loc. Lignan 39, I-11020 Nus (AO), Italy, e-mail: `info@oavda.it`
[2] Università di Padova – Dipartimento di Astronomia, Vicolo dell'Osservatorio 5, I-35122 Padova, Italy

Abstract. The Astronomical Observatory of the Autonomous Region of the Aosta Valley (OAVdA), in the Alps at the border with France and Switzerland, is located in the Saint-Barthélemy Valley at 1675 m a.s.l. and 16 km from the town of Nus (AO). Managed by the Fondazione Clément Fillietroz-ONLUS with funding from local administrations, the OAVdA opened in 2003. For the first years its initiatives were focused on public outreach & education. Since 2006 the main activity has been scientific research thanks to an official agreement of cooperation established with the italian National Institute for Astrophysics (INAF). The OAVdA researchers, with Research Grants from the European Social Fund (EU-ESF), have been authors and/or coauthors of several papers on international journals. Here we present in detail the scientific projects developed at the OAVdA and describe some public outreach & education initiatives proposed at the OAVdA and the Planetarium of Lignan, also managed by the Fondazione Clément Fillietroz-ONLUS since 2009.

Key words. Sun: corona – Minor planets, asteroids: general – Stars: late-type – Stars: Planetary systems – Galaxies: active

1. Introduction

The Astronomical Observatory of the Autonomous Region of the Aosta Valley (OAVdA, see Fig. 1), in the Alps at the border with France and Switzerland, is located in the Saint-Barthélemy Valley at 1675 m a.s.l. and 16 km from the town of Nus (AO).

Managed by the Fondazione Clément Fillietroz-ONLUS, hereafter Fondazione, with funding from local administrations, the OAVdA opened in 2003. For the first years its initiatives were focused on public outreach & education. Since 2006 the main activity has been scientific research thanks to an official agreement of cooperation established with the italian National Institute for Astrophysics (INAF).

Send offprint requests to: P. Calcidese

Fig. 1. The Astronomical Observatory of the Autonomous Region of the Aosta Valley (longitude 7° 28′ 42″ E, latitude 45° 47′ 22″ N), described in the text, under the starry night sky of the Saint-Barthélemy Valley. The big dome at the centre of the structure hosts the 810 mm Main Telescope. Bottom right in the picture, the Scientific Platform is visible, where the 250 mm Maksutov telescopes and the 400 mm reflector are located. Here new scientific instruments are planned to be placed at the beginning of 2011. Bottom centre in the picture, the building of the Heliophysics Laboratory is recognizable for the little dome on the roof covering the 250 mm Heliostat mirror. The Teaching Platform, with seven 250 mm Cassegrain telescopes, lies behind the Heliophysics Laboratory and is not visible in the picture. (Credit: Paolo Calcidese/Fondazione Clément Fillietroz-ONLUS)

Our main scientific targets are: Active Galactic Nuclei (AGNs) as part of the international Whole Earth Blazar Telescope (WEBT) organization; asteroids in collaboration with the Minor Planet Center (MPC) in Cambridge (MA, USA) and the DLR-German Aerospace Center in Berlin (DE); solar corona (K-corona) with an innovative polarimeter designed for future space coronagraphic missions; photometric detection of transits of small-size extrasolar planets orbiting M dwarf stars in the solar neighborhood. All projects are carried on with the INAF-Astronomical Observatory of Turin (INAF-OATo).

In these fields the OAVdA researchers, now in the number of five and with Research Grants from the European Social Fund (EU-ESF), have been authors and coauthors of several papers on international journals as *Astronomy & Astrophysics*, *Icarus* and *The Astrophysical Journal*.

2. Scientific instrumentation

The most important research telescopes at the OAVdA are the Main Telescope, 810 mm f/7.8 Bowen-Vaughan reflector, equipped with a CCD camera FLI PL3041 back illuminated (2048 × 2048 array size, 15 μm pixel size) and the 400 mm f/8 Ritchey-Chretien reflector, equipped with a CCD camera FLI 1001E front illuminated (1024 × 1024 array size, 24 μm pixel size).

The former is hosted in the dome (diameter 7.5 m) at the centre of the OAVdA building, the latter is located in the Scientific Platform, the east wing of the OAVdA building.

Both are managed by the control and data acquisition system CompactRIO based on National Instruments (NI) technology. The system runs a software for the remote control of the telescopes through a graphical user interface developed with the NI LabVIEW programming tools. The algorithms integrated in the control system have been entirely developed by two members of the OAVdA Research staff, Albino Carbognani and Paolo Calcidese.

Research observations are carried also in the Scientific Platform with a 250 mm f/3.8 Maksutov telescope, equipped with a CCD camera Moravian G2 3200 (2184×1472 array size, 6.8 μm pixel size). An identical telescope, equipped with a CCD camera SBIG STV, has been used for the seeing monitoring with the Differential Image Motion Monitor method (DIMM).

The research telescopes are all equipped with filter wheels (Johnson BV and Cousins RI). New instruments are planned to be acquired at the beginning of 2011, which will help to further improve the quality of the scientific work at the OAVdA.

3. Research projects at the OAVdA

3.1. Solar corona

In 2006 members from OAVdA and INAF-OATo worked together for the calibration of EKPol, a Liquid Crystal Variable Retarder (LCVR) based polarimeter. Since then, the tool has been used in two science missions during the total solar eclipse of March 29, 2006 visible from the Sahara desert (Zangrilli et al. 2006; Abbo et al. 2008) and the total solar eclipse of July 11, 2010 visible from French Polynesia.

The study aims at investigating the electron density in the K-corona of the Sun through the analysis of the polarization status of its light emission.

Researcher responsible for the OAVdA Solar corona Project: Paolo Calcidese.

3.2. Active Galactic Nuclei (AGNs)

The OAVdA has been member of the WEBT consortium since June 2006. With the 810 mm reflector we monitor the optical counterpart of targeted AGNs in the B-V-R-I bands. The data collected in Saint-Barthélemy join those collected by other 39 telescopes at different longitudes all around the northern hemisphere (Raiteri et al. 2009; Böttcher et al. 2009; Vercellone et al. 2010).

Researcher responsible for the OAVdA AGN Project: Paolo Calcidese.

3.3. Asteroids

Asteroid research at the OAVdA started in 2006. At present time, they are focused on two different fronts, theoretical and observational.

Observations concern on Near-Earth Objects (NEOs) follow-up and photometry (MPC code is B04), photometry and light curve inversion of Main Belt Asteroids (MBAs), photometry of Trojan asteroids. A fundamental reason for observing Trojans is that they are relatively isolated by the interactions with MBAs, so differences among rotational properties of MBAs and Trojans can be due to different formation processes, evolution and internal structure (Mottola et al. 2010).

Theoretical work concerns the analysis of rotational properties of Trojans and MBAs. Considering the rotational properties and the light curve amplitude of C and S MBAs, it appears that there are no substantial differences between the samples of asteroids taken into account. This indicates a good homogeneity in the processes of collisional evolution. However, there are two different values for the transition diameter to Maxwellian distribution of the rotation frequency, respectively 48 and 33 km. This difference is under investigation (Carbognani 2010a,b).

Researcher responsible for the OAVdA Asteroid Project: Albino Carbognani.

3.4. Extrasolar planets

Since December 2008 the OAVdA, in collaboration with INAF-OATo, is actively involved in the field of extrasolar planets (Damasso et al. 2010a,b).

During 2008 a detailed feasibility study has been carried out to demonstrate that the OAVdA is a well-poised site where a long-term survey to detect photometric transits of small size extrasolar planets (mass range 2-10 M_{Earth}) can be based. The positive results of this study, obtained with the 250 mm Maksutov telescope, have been recently published (Damasso et al. 2010c).

Since December 2009 a preliminary photometric search for transiting exoplanets is ongoing by using three telescopes, targeting a small sample of high proper motion M dwarfs. This study has been regarded as a necessary, preparatory step toward a more complex long-term survey focused on much more large samples of M dwarfs using an array of new identical telescopes.

Researchers responsible for the OAVdA Extrasolar planets Project: Mario Damasso, Giorgio Toso, Andrea Bernagozzi.

4. Public outreach & education

Besides scientific research, the Fondazione is institutionally committed to organise public outreach & education activities (Bernagozzi 2010). The OAVdA is designed to offer tours for students from kindergarten to high school, teachers and public at large. During day-time visits, in the Heliophysics Laboratory Sun's observation are allowed by a 250 mm Heliostat mirror. Light from our star is projected on screens in visible light, through an Hα filter and a spectroscopic diffraction grating. During night-time visits people can observe the sky with seven identical 250 mm f/10 Cassegrain telescopes from the west wing of the OAVdA building, called the Teaching Platform. Scientific research made at the OAVdA contributes greatly to the development of high quality public outreach & education programmes (Cenadelli et al. 2009). Researchers devote 30% of their time to these initiatives. A strong cooperation with the Regional Board of Education of the Aosta Valley has been developed by 2006, according to the principle that knowledge students meet in school is the result of scientific researches made by scientists 10, 100, 1000 years ago... So knowledge they will meet in life tomorrow is the result of scientific researches that scientists are making today, including scientific research made at the OAVdA.

In July 2009 the Planetarium of Lignan (diameter 10 m, 67 seats) joined the OAVdA. During the International Year of Astronomy 2009 the OAVdA and the Planetarium, both managed by the Fondazione in Saint-Barthélemy, gathered together an attendance of 15,246.

Acknowledgements. E. Bertolini would like to thank the Regional Government of the Aosta Valley, the Town Administration of Nus, the Mont-Emilius Community for supporting the Fondazione Clément Fillietroz-ONLUS. A. Bernagozzi, P. Calcidese, A. Carbognani, M. Damasso, M. Soldi and G. Toso would like to thank the European Social Fund for the Research Grants supporting their scientific work.

References

Abbo, L., et al. 2008, 37th COSPAR Scientific Assembly Proc., 7
Bernagozzi, A. 2010, Highlights of Astronomy, 15, 646
Böttcher, M., et al. 2009, ApJ, 694, 174
Carbognani, A. 2010a, Icarus, 205, 497
Carbognani, A. 2010b, Icarus, 211, 519
Cenadelli, D., et al. 2009, European Journal of Physics, 30, 35
Damasso, M., et al. 2010a, Open European Journal on Variable stars, paper #122
Damasso, M., et al. 2010b, ASP Conference Series, 430, 420
Damasso, M., et al. 2010c, PASP, 122, 1077
Mottola, S., et al. 2010, submitted to ApJ
Raiteri, C. M., et al. 2009, A&A, 507, 769
Vercellone, S., et al. 2010, ApJ, 712, 405
Zangrilli, L., et al. 2006, SPSE 2006 Proc., 37