

"TRACKING AND ACCUMULATE"

The ST-7 camera head with incorporated

Texas Instruments TC-211 and the Kodak

Model ST-10XME is the flagship

Earth's natural satellite, June 21st 2013.

June 8th 2004. Venus transit across the

Solar disk at 11:02:11 UTC+1. Zeiss Ast-

rograph 115/1280 mm + Philips ToUcam

Observers: Vladimir Benišek, Tatjana Jakšić

web camera

The CCD observations of the Galilean satellites of Jupiter and satellites of Saturn which were co-

ordinated from IMCCE, France (mutual phenomena) were successfully performed from Belgrade

Zeiss Refractor 65/1055 with CCD camera is and was the perfect instrument for such purposes.

MEADE LX200GPS 16"

AOB, 04. 08. 2004.

enišek V., Protić-Benišek V. Benišek B.

Globular cluster M13 detected by CCD camera Apogee 47p during camera testing in Belgrade

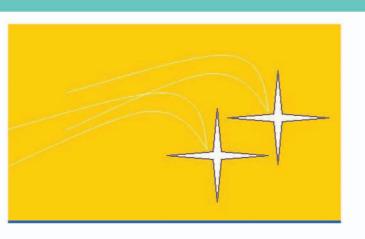
of the "ST" series of self-guiding

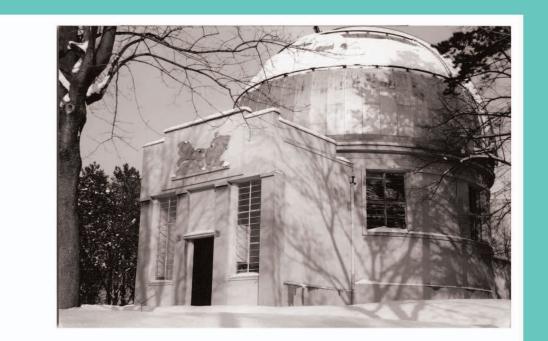
CCD cameras

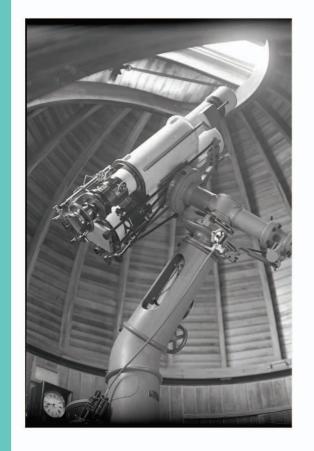
KAF-0400 detector











ST-6 Professional CCD Imaging Camera

Apogee AP47p with Marconi CCD47-10 CCD

These cameras were attached to various

06:14 06:43 07:12 07:40 08:09 08:38 09:07 09:36 10:04 10:33

May 7th 2003. The graph of Transit of Mercury

observed from Belgrade Observatory.

Observatory during several campaigns.

Bulgaria).

Extremely rare phenomena are always joy for astronomers, if the sky is clear!

instruments of Belgrade Observatory:

1024 x 1024 pixels (13x13 microns)

* Zeiss 65/1055 cm Refractor

* Meade 16" GPS-SMT

* Askania Equatorial 12.5/100 cm

* Zeiss Astrograph 16/80 cm and

(TI chip)

TWENTY YEARS OF CCD OBSERVATIONS OF SOLAR SYSTEM BODIES FROM THE BELGRADE **ASTRONOMICAL OBSERVATORY**

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The Belgrade Astronomical Observatory has a relatively long and continuous tradition in discovering and monitoring of Solar system minor bodies- even as far

back as 1935– almost full 80 years.

The first CCD observations began in 1994: SBIG ST-6 CCD camera was mounted on the Zeiss 65/1055 cm refractor telescope and in July of the same year disintegration of the comet Shoemaker-Levy 9 and impacts of its fragments into Jupiter's atmosphere were observed. The total of 233 CCD images was successfully obtained during the follow-up of this extremely rare phenomenon by applying a CCD technique for the first time in the history of the astronomical observaions at the Belgrade Observatory (Popović, L.Č. et al., 1995.).

Following observing activities using a CCD technique have taken place within a series of the Observatory's research projects:

- * Follow-up of the minor planets, especially NEAs and objects with unusual dynamic characteristics.
- * Monitoring of new and periodic comets
- * Observations of giant planets and their satellites
- * Participation in various international observational campaigns related to the specific phenomena in the Solar system: Mercury and Venus transits over the Sun, mutual events of Jovian and Saturnian satellites, partial and total Solar and Moon eclipses, etc.)
- * The minor planet photometry is the main subject of interest in our observational work over the recent decade (from 2006).
- * Photometric detections of exoplanetary transits.

EIGHT MONTHS OF LIGHTCURVES OF 1036 GANYMED Frederick Pilcher 4438 Organ Mesa Loop Las Cruces, NM 88011 USA Vladimir Benishek Belgrade Astronomical Observatory Volgina 7, 11060 Belgrade 38, SERBIA John W. Briggs **HUT Observatory H16** P. O. Box 5320

Eagle, CO 81631 USA Andrea Ferrero Bigmuskie Observatory via Italo Aresca 12, 14047 Mombercelli, Asti, ITALY Daniel A. Klinglesmith III, Curtis Alan Warren New Mexico Institute of Mining and Technology Etscorn Campus Observatory 801 Leroy Place Socorro, NM 87801 USA (Received: 29 March) Minor Planet 1036 Ganymed, the largest Mars crosser, made its closest approach to Earth in the 21st century in

2011 October, and was continuously observed over a path length exceeding 100 degrees from 2011 May to 2012 January. The shape of the lightcurve changed greatly during this interval, with a mean synodic period 10.3031 hours over the interval 2011 May to October and amplitude varying from 0.10 mag to 0.30 mag and increasing roughly linearly with increasing phase angle.

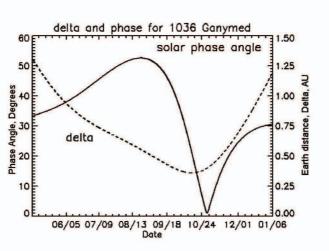
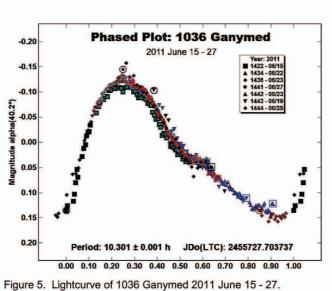


Figure 2. Phase angle and Earth distance Delta for 1036 Ganymed,

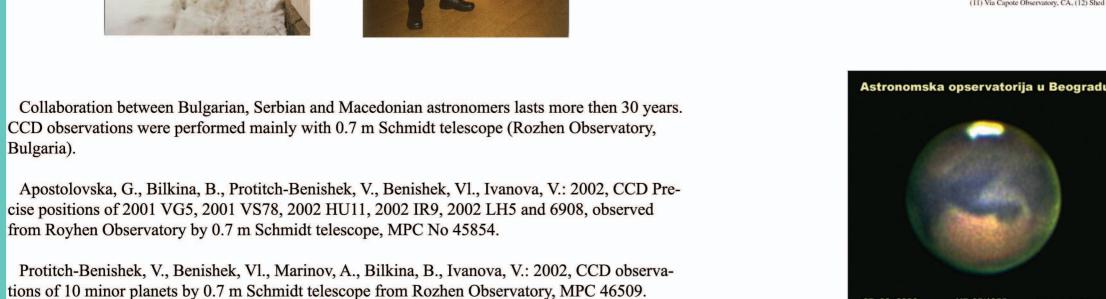


EPSC Abstracts Vol. 6, EPSC-DPS2011-429-1, 2011 EPSC-DPS Joint Meeting 2011 © Author(s) 2011

7. 08. 2003 VR 65/1055 V.Benisek, J.Gr

Spin-vector distribution of asteroids - the role of the YORP thermal effect

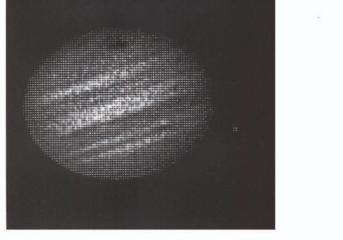
J. Hanuš (1), J. Ďurech (1), M. Brož (1), B. D. Warner (2), D. Higgins (3), J. Oey (4), F. Pilcher (5), R. D. Stephens (6), R. K. Buchheim (7), R. A. Koff (8), D. Polishook (9), V. Benishek (10), J. W. Brinsfield (11), R. J. Durkee (12), and mical Institute, Faculty of Mathematics and Physics, Charles University in Prague, V Holešovičkách 2, 1800 Prague, Czech Republic (hanus.home@gmail.com), (2) Palmer Divide Observatory, 17995 Bakers Farm Rd., Colorado Springs, CO 80908, USA, (3) Hunters Hill Observatory, Australia, (4) Kingsgrove, NSW, Australia, (5) 4438 Organ Mesa Loop, Las Cruces, NM 88011, USA, (6) Goat Mountain Astronomical Research Station, 11355 Mount Johnson Court, Ranche ticamonga, CA 91737, USA, (7) Altimira Observatory, CA, (8) Antelope Hills Observatory, CO, (9) Benoziyo Center fo Astrophysics, The Weizmann Institute of Science, Rehovot 76100, Israel, (10) Belgrade Astronomical Observatory, Serbia, (11) Via Capote Observatory, CA, (12) Shed of Science Observatory, MN, (13) Linhaceira Observatory, Portugal

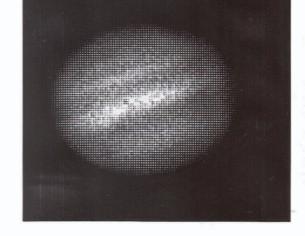


Protitch-Benishek, V., Benishek, Vl., Marinov, A., Bilkina, B., Ivanova, V.: 2002, 70 precise CCD astrometric positions of 18 minor planets, observed from Rozhen Observatory (Bulgaria), MPC No 45451 - 45452.

During the "Great Opposition" of Mars in 2003. thousands of CCD frames were recorded by Zeiss Refractor 65/1055 from Belgrade Observatory. The results of analysis were presented in Slovakia, XXVI ESOP 2007.

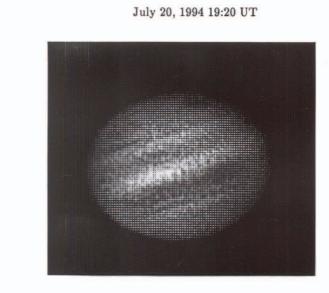
Original CCD images from Belgrade





July 20, 1994 18:52 UT

July 18, 1994 19:39 UT



July 25, 1994 18:53 UT

Disintegration of Comet Shoemaker-Levy 9 taken from www2.jpl.nasa.gov

PRECISE CCD ASTROMETRIC OBSERVATIONS OF MINOR PLANETS AND COMETS AT THE BELGRADE OBSERVATORY **DURING 1997**

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¹Astronomical Observatory, Volgina 7, 11160 Belgrade 74, Yugoslavia ²Faculty of Physics (student), University of Belgrade, 11000 Belgrade, Yugoslavia

(Received: March 3, 1998)

SUMMARY: 73 precise astrometric positions of seven comets and two minor planets from MPC critical list - 1093 Freda and 4954 Eric - were obtained with the CCD equipped Askania astrograph (13.5/160) of Belgrade Astronomical Observa-

The SBIG ST-7 and ST-8 CCD cameras were used in the observations.

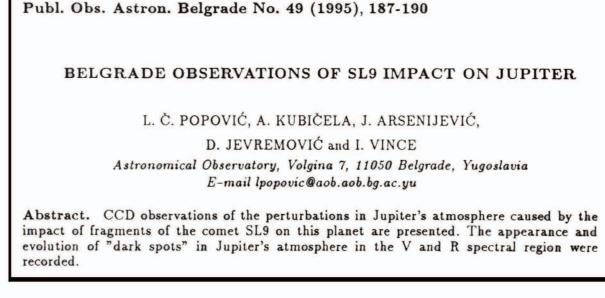
After several months of experimental work with CCD detectors, actual program of minor planets and comet observations, were continued. The high quality results were gathered and were possible, even with small telescopes working under such conditions as it was in the case of Belgrade sky.

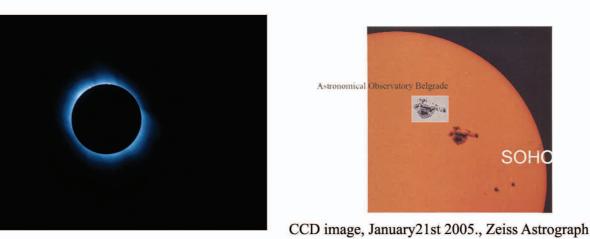
This paper was the first with follow-up results of minor planets and comets.

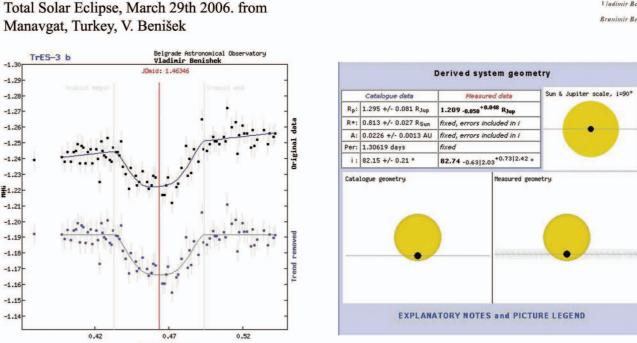
During the period 1996.-2000. 27 papers were printed in national and international journals, as well as in the Minor Planet Bulletins of MPC. That work was a part of the project "Astrometrical, Astrodynamical and Astrophysical Researches" supported by the Ministry of Science and Technology of Serbia.

*Serb. Astron. J. No 157 (1998), 115-118, as the first professional paper in CCD Astrometry of Solar system

The observations of impact of SL9 1993e were carried out from July 17th till August 8th from Belgrade

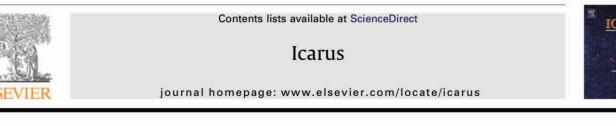






The observations of exoplanets are part of regular photometric program.

During the period 2000-2014 in International journals 98 professional and scientific papers were exposed. Some of them are very specific in analysis.



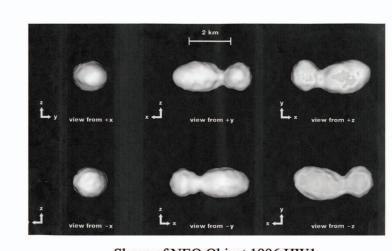
Radar and photometric observations and shape modeling of contact binary near-Earth Asteroid (8567) 1996 HW1

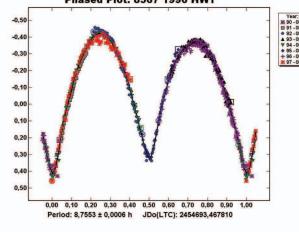
Christopher Magri ^{a,*}, Ellen S. Howell ^b, Michael C. Nolan ^b, Patrick A. Taylor ^b, Yanga R. Fernández ^c, Michael Mueller ^d, Ronald J. Vervack Jr. ^e, Lance A.M. Benner ^f, Jon D. Giorgini ^f, Steven J. Ostro ^f, Daniel J. Scheeres^g, Michael D. Hicks^f, Heath Rhoades^f, James M. Somers^h, Ninel M. Gaftonyukⁱ Vladimir V. Kouprianov^j, Yurij N. Krugly^k, Igor E. Molotov^l, Michael W. Busch^m, Jean-Luc Margot^m, Vladimir Benishekⁿ, Vojislava Protitch-Benishekⁿ, Adrian Galád^{o,p}, David Higgins^q, Peter Kušnirák^p,

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ARTICLE INFO Article history: Received 30 September 2010 Revised 10 February 2011 Accepted 21 February 2011 Available online 4 March 2011 Keywords: Asteroids Photometry Radar observations

ABSTRACT We observed near-Earth Asteroid (8567) 1996 HW1 at the Arecibo Observatory on six dates in September 2008, obtaining radar images and spectra. By combining these data with an extensive set of new lightcurreconstruct the object's shape and spin state. 1996 HW1 is an elongated, bifurcated object with maximum diameters of $3.8 \times 1.6 \times 1.5$ km and a contact-binary shape. It is the most bifurcated near-Earth 8.76243 ± 0.00004 h and the pole direction is within 5° of ecliptic longitude and latitude (281°, -31°). Radar astrometry has reduced the orbital element uncertainties by 27% relative to the a priori orbit solution that was based on a half-century of optical data. Simple dynamical arguments are used to demonstrate that this asteroid could have originated as a binary system that tidally decayed and merged.





Shape of NEO Object 1996 HW1

Triumph of Global Collaboration, The Minor

Planet Bulletin, Vol 39, No 2, pp 46-47.

SELECTED PAPERS:

Pilcher, F., Benishek, V., Ferrero, A., Hamanowa, H., Hamanowa, H., Stephens, R.: 2011, Rotation Period Determination for 280 Philia – A Triumph of Global Collaboration, Vol. 38, pp. 127-128.

Pilcher, F., Benishek, V., Briggs, J., Ferrero, A.: 2012, Eight Months of Lightcurves of 1036 Ganimed, The Minor Planet Bulletin, Vol. 39, No 3, pp 141-144.

Pilcher, F., Benishek, V., Hamanowa, H., Higgins, D: 2012, Rotation Period Determination for 180 Garumna:

Hanuš, J. et al. (Vl. Benishek co-author): 2011, Spin Vector Distribution of Asteroids - the Role of the YORP thermal effect, Joint Meeting Div. For Pl. Sciences of the AAS 3-7 Oct. 2011, Nantes, France, EPSC – DPS 2011 – 429, Book

Durech, J. et al. (Vl. Benishek co-author): 2011, New Physical Models of Asteroids Derived from Spars and Dense Photometry, , Joint Meeting Div. For Pl. Sciences of the AAS 3-7 Oct. 2011, Nantes, France, EPSC – DPS 2011 – 429, Book of Abs.

Pilcher F., Benishek, V., Ferrero, A., Klinglesmith, D. A., Pravec, P., Roy, R., Behrend, R.: 2013, New Photometry of 1473 Ounas, Minor Planet Bull., 40-3, 126-129.

Warner, B.D., Benishek, V.: 2014, Lightcurve analysis of the Near-Earth asteroid (162566) 2000 RJ34, MPB, 41-2, p.125.

Baker, R.E, Benishek, V., Pilcher, F., Higgins, D.: 2010, Rotation period and H-G parameters determination for 1700 Zvezdara: A Collaborative Photometry Project,

The Minor Planet Bulletin, Vol. 37., No.3, p. 81-83.

DETERMINATION FOR 1700 ZVEZDARA: A COLLABORATIVE PHOTOMETRY PROJECT Ronald E. Baker Indian Hill Observatory (H75) PO Box 11, Chagrin Falls, OH 44022 USA rbaker52@gmail.com Vladimir Benishek Belgrade Astronomical Observatory Volgina 7, 11060 Belgrade 38 SERBIA Frederick Pilcher 4438 Organ Mesa Loop Las Cruces, NM 88011 USA David Higgins Hunter Hill Observatory 7 Mawalan Street, Ngunnawal ACT 2913 **AUSTRALIA**

The main-belt asteroid 1700 Zvezdara was observed from 2009 August - November in order to determine its synodic rotation period (P) and amplitude (A) as well as its absolute magnitude (H) and phase slope parameter (G). The following values were found: $P = 9.114 \pm$

(Received: 15 January)

0.001 h; A = $0.10 \pm 0.02 \text{ mag}$; H = $12.447 \pm 0.019 \text{ mag}$; and $G = 0.072 \pm 0.019$. The main-belt asteroid 1700 Zvezdara was originally discovered at the Belgrade Astronomical Observatory (BAO) on 1940 August 26 by Serbian astronomer Pero M. Djurkovich using a photo-



visual Zeiss refractor with two 16/80 cm photographic cameras.

Comet ISON c2012s1, September 26th 2013., two months before its disappearance. CCD image by V. Benišek

