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FIRST REPORTED OBSERVATION OF ASTEROIDS 2017 SV39, 2017 ST39, AND 2017 TS7

A. Simon [1,2] and V. Troianskyi [3,4]

[1] Astronomy and Space Physics Department, Taras Shevchenko National University of Kyiv, Glushkova ave., 4, Kyiv, 03022, Ukraine, *andrew_simon@univ.kiev.ua*

[2] National Center «Junior academy of sciences of Ukraine», 38-44, Dehtiarivska St., Kyiv, 04119, Ukraine

[3] Department of Physics and Astronomy FMPIT of Odesa I. I. Mechnykov National University, Pastera Street 42, 65082 Odesa, Ukraine, *v.troianskyi@onu.edu.ua*

[4] Department of Physics and Methods of Teaching, Faculty of Physics and Technology, Vasyl Stefanyk Precarpathian National University, Shevchenko Street 57, 76000 Ivano-Frankivsk, Ukraine

ABSTRACT. In this paper, we show the result of the joint use of the AZT-8 telescope, the Astrometrica software, and the Väisälä method. The paper considers in detail several of the discovered (rediscovered) asteroids: SV39, 2017 ST39, and 2017 TS7 from a long list of small bodies of the Solar System.

Keywords: Minor planets, asteroids, observational.

АНОТАЦІЯ. У цій статті ми показуємо результат спільного використання телескопа AZT-8, програмного забезпечення Astrometrica та методу Вяйсяля. В роботі вказані основні характеристики телескопа AZT-8, що знаходиться в Астрономічній обсерваторії Київського національного університету імені Тараса Шевченка. Докладно розписано метод визначення координат об'єктів на кадрах за допомогою програмного пакету Astrometrica та вказано переваги використання методу Вяйсяля для визначення первинної орбіти небесного тіла. У статті детально розглядаються кілька перевідкритих астероїдів: SV39, 2017 ST39 і 2017 TS7 з довгого списку малих тіл Сонячної системи. Астероїд 2017 SV39 спостерігався 28-го вересня 2017 року, але не був підтверджений іншими обсерваторіями. Астероїд Головного поясу 2017 ST39 спостерігався 28-го вересня та 2-го, 9-го, 10-го жовтня 2017 року; в результаті виявився раніше відкритим астероїдом під номером 536266. Астероїд Головного поясу 2017 TS7 спостерігався 9-го та 10-го жовтня 2017 року; в результаті виявився раніше відкритим астероїдом під номером 540584.

Ключові слова: Малі планети, астероїди, спостереження.

1. Introduction

The Kyiv Comet Station has a long history of patrol observations as well as targeted observation campaigns. Throughout the execution of diverse observational programs, the observatory archive has amassed a substantial volume of scientifically valuable information.

Amidst the ongoing fascination with the exploration and examination of Solar System entities, our endeavor is to extract the utmost additional information from the acquired observations, utilizing contemporary processing tools. In this manuscript, we will delve into the quest for moving objects within a sequence of panoramic images capturing the starry sky. These images were garnered during the observation using the AZT-8 telescope.

2. Observations and data reduction

Observations in Kyiv were made with the AZT-8 telescope (Fig. 1) of the astronomical observatory of the Kyiv Shevchenko National University, which is installed at the Kyiv Comet Station [code: 585]. The AZT-8 reflector, a serial telescope from the Leningrad Optical Mechanical Association. As an imaging detector the FLI PL4710 camera with 63.5 mm Shutter, providing a field of view of 16.2'×16.7' and an image scale of 0.948 arcsec/pixel, was used.

We did standard data reduction (i.e., dark subtracting and flat-fielding); for details, see Oszkiewicz et al., (2019; 2020; 2021; 2023).

2.1. Astrometry

After all standard reductions for single images were done, we started to combine images in order to decrease the value of limiting magnitude on the sum image and so to have a possibility to detect fainter objects. Preliminary information about proper motion of possible asteroids were taken from the Gaia Follow-Up Network for Solar System Objects webpage and was applied during single images stacking. Due to special conditions of observations, all frames had an exposure of 30 seconds and we used from 10 to 100 images depending of brightness of possible asteroid for stacking. Thus time intervals between stacked images and asteroids positions can vary from 5 to 50 minutes.

Images stacking and further astrometrical measurements were done with the use of Astrometrica software.

2.2. Väisälä method

The Väisälä method, as highlighted by Troianskyi et al. (2023b), proves highly valuable in numerous scenarios. Its application becomes particularly prominent when dealing with a brief observing arc that lacks the duration necessary to ascertain the "true" orbit and forecast the object's position over the ensuing week or so. Additionally, this method facilitates the derivation of a reasonably accurate primary orbit, laying the groundwork for subsequent enhancement through one of the iterative methods. Notably, the method finds active utilization in the quest for the primary orbit of small celestial bodies within the Solar System when confronted with limited observational data at the Minor Planet Center (MPC).

3. Results

All objects in this section were observed in the Gaia Follow-Up Network for Solar System Objects. During these observations we had a possibility clearly identify three new asteroids. Two of these asteroids, after recalculating their orbits, were assigned to already discovered objects.

3.1. Asteroid 2017 SV39

Firstly was observed during 28th / 29th of September 2017 night on Kyiv comet station (585). As a result, observations of 8 positions, which cover 35-minute time intervals, were added to the MPC database. In MPS 828365 object received the designation 2017 SV39. Unfortunately, no other observations for this potential asteroid were provided and published on the MPC services.

3.2. Main-belt asteroid 2017 ST39

First observations of this asteroid were done during 28th/29th of September 2017 night on Kyiv comet station (585). Collected data give us a possibility to determine 18 positions of the asteroid for this night and prepared very well for the next observations that were conducted during 02nd/03rd of October 2017 night with 3 more positions, during 09th/10th of October 2017 night with 14 positions and during 10th/11th of October 2017 night with 7 positions. All these observations were published in MPS 891037, MPS 828365 and objects got assignation 2017 ST39. Later it appeared that we rediscovered an object already know under assignations 2007 HU101 and 2015 CX48. This asteroid received its number 536266 and now belongs to the asteroids from the Main Belt.

3.3. Main-belt asteroid 2017 TS7

First observations of this asteroid were done during 09th/10th of October 2017 night with 15 positions and during 10th/11th of October 2017 night with 9 positions (MPS828378). After orbit recalculations by MPC IAU services it appeared that we had rediscovered an object already know under assignations 2000 WN134, 2007 XY37, 2010 RD162 and 2015 DH168. This asteroid received its number 540584 and now belongs to the asteroids from the Main Belt.

Additional observations (MPS 928677) of this object were made on the OMT-800 telescope (Andrievsky et al., 2013; Troianskyi et al., 2014).

Figure 1: AZT-8 telescope

4. Conclusion

The combined use of the AZT-8 telescope, Astrometrica software, and the Väisälä method showed good results in the search for small bodies in the Solar System (2017 SV39, 2017 ST39, 2017 TS7).

Astrometric observations are very important for further research (numerical integration of orbits) of small bodies of the Solar System (Troianskyi & Bazyey, 2018; Troianskyi et al., 2022; Troianskyi et al., 2023a).

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