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The life and scientific activity of Ukrainian astronomer V. M. Grigorevsky (1930-1981)

Abstract. *In 2020, the scientific community will celebrate the 90th birthday of Vitaly Grigorevsky – the Ukrainian astronomer, a specialist in satellite astronomy, a representative of a scientific school of an outstanding Ukrainian scientist, corresponding member of the Ukrainian Academy of Sciences, a director of the Odessa Astronomical Observatory – a professor Vladimir Platonovich Tsesevich. In the article on the basis of complex use of biographical method and methods of bibliographic and source analysis the basic milestones of life and scientific activity of Vitaly Grigorevsky are investigated. The Kherson, Odessa before-Chisinau, Chisinau and Odessa after-Chisinau periods of the scientist's life and work at the Odessa and Chisinau State University, Odessa Technological Institute named after M. V. Lomonosov. The basic directions of scientific researches of the scientist are defined: physical processes in semi-regular variable stars, photometric researches of artificial satellites of the Earth, research of geometry and motion of artificial satellites of the Earth and small planets, optimization of technological processes by mathematical methods with use of electronic computing methods. The contribution of Vitaly Grigorevsky to the formation and development of a new direction of scientific research in the 1960s - photometric observations of artificial satellites of the Earth is shown. The international aspect of Vitaly Grigorevsky's scientific and organizational activity and his work in the Commission on Multilateral Scientific Cooperation between the Academies of Sciences of Socialist Countries are covered. The activity of Vitaliy Grigorevsky as the initiator and coordinator of cooperative research in the field of photometric observations of artificial satellites of the Earth under the SPIN program was noted. The SPIN program included the stations of the People's Republic of Bulgaria, the Czechoslovak Socialist Republic, the Hungarian People's Republic, the German Democratic Republic, the Polish People's Republic, the Soviet Union and the United Arab Republic (Egypt). The little-known facts about the scientist's biography are covered.*

Keywords: *Odessa Astronomical Observatory; Chisinau; photometric observations; artificial Earth satellites; SPIN*



Introduction

Doctor of Physical and Mathematical Sciences, Professor Vitaly Grigorevsky (1930-1981) – the Ukrainian scientist who worked in the field of classical astronomy and satellite astronomy, a representative of the scientific school of the corresponding member of the Academy of Sciences of the USSR, Doctor of Physical and Mathematical Sciences

– Professor Tsesevich. With the advent of the space age, V. M. Grigorevsky was one of the initiators of photometric observations of artificial Earth satellites (AES) and made a significant contribution to the organization and development of photometric observations of AES in Ukraine and in many countries of Eastern Europe. However, scientific and scientific-organizational activity of V. M. Grigorevsky, with the exception of several works of his colleagues (Mandel, 1995; Karetnikov, 2005), has not received adequate coverage in domestic and foreign historiography.

The purpose of this study is to analyze the basic stages of life and scientific activity of the astronomer Vitaly Grigorevsky (1930-1981) and to reveal the conditions of the scientist's scientific outlook on the basis of the analysis of archival sources and published works.

Research methods

The methodological basis of the study was the principle of historicism, which provides consideration of the historical events under study in their relationship and development, and the principle of objectivity, orienting to a comprehensive analysis and reliable assessment of historical facts. The complex use of the biographical method and the methods of bibliographic and source analysis made it possible to explore the life and creative path of Vitaly Grigorevsky, to identify and characterize the main periods in the life and scientific activity of the scientist.

Results and discussion

Vitaly Mikhailovich Grigorevsky was born in Kherson on November 7, 1930 in the family of Mikhail Ivanovich and Nadezhda Ivanovna Grigorevsky (Archive of ONAFT, p. 5). This city has passed the childhood and youth of the future scientist, who have fallen on the difficult years of war, occupation and post-war famine. In early years V. M. Grigorevsky became ill with polio, the effects of which remained for life, but at the same time tempered his character and formed an extraordinary personality. V. M. Grigorevsky was a well-developed young man. He read a lot, was fond of poetry, music, opera, painting, sports (Mandel, 1995), studied foreign languages throughout his life - he was fluent in English, French, German, Moldavian (Archive of ONAFT, p. 3).

In 1949 V. M. Grigorevsky became a student of the mathematical department of the Faculty of Physics and Mathematics of Odessa University (Archive of ONAFT, p. 5). At the University of V. M. Grigorevsky became fascinated with the study of variable stars – this topic was developed in Odesa in 1944 by his scientific adviser

V. P. Cesevich and the vast majority of his students began their research with observations of variable stars (Hrushytska, 2017; Hrushytska, 2018). The first scientific work of V. M. Grigorevsky's "Minima X Trianguli" was published in the *Astronomical Circular* in 1952, when he was still a third-year student. While he was in student practice at the Abastuman Observatory (Georgia), V. M. Grigorevsky became interested in a new field of research at the time – polarimetric observations of stars, namely the darkening of the Beta Lyra variable. This research is dedicated to one of the first scientific publications of the scientist "Polarization of Light Beta Lear" (Mandel, 1995).

By the decision of the State Examination Commission of June 25, 1954, V. M. Grigorevsky was awarded the qualification of an astronomer and awarded the diploma with distinction № 926531 (Archive of ONAFT, p. 6). After graduation V. M. Grigorevsky remained at the university as a senior laboratory assistant at the Department of Theoretical Physics and Astrophysics, and in 1957–1960 he studied at the graduate school of the Department of Astronomy of Odessa State University (Archive of ONAFT, p. 5).

At first V. M. Grigorevsky was enrolled in a postgraduate course in the field of research - physical processes in semiregular variable stars. However, in 1957 there were events that rapidly changed the basic direction of his scientific research. At this time, the Odessa Astronomical Observatory (OAO) launched an active activity in preparation for participation in the International Geophysical Year (IGY) programs, in particular began training and, after launching the first Soviet satellite, actively participated in observations of artificial Earth satellites (AES) (Mandel, 1995).

The peculiarity of the AES, in contrast to the natural celestial bodies, was the relatively rapid change of orbital elements due to the resistance of the atmosphere and the deviation of the Earth's gravitational field from the spherical one. Studies have shown that atmospheric resistance is a complex function of many parameters, whose role could only be ascertained by high-precision satellite observations (Masevich, 1961).

Even during the observation of the first missile launcher of the first AES, many Soviet and foreign observers paid attention to the fluctuations of its brilliance with an amplitude of about 5-6 stars. Regular targeted photometric observations of the AES were initiated at the initiative of V. P. Tsesevich in OAO in December 1957 and V. M. Grigorevsky became one of the most active participants in this program.

In March 1958, other Soviet satellite tracking stations were included in these observations of the second Soviet satellite, and the brightness of the third Soviet satellite was observed literally all over the world - in the USSR, USA, Poland, Australia, Bulgaria, Germany, the Czech Republic and others (Grigorevskiy, 1968). V. P. Tsesevich, on the basis of the analysis of a number of observations of the glare of a rocket-carrier of the third Soviet AES, conducted at different stations, but concerning the same orbit coil, developed a theory that allowed to establish the true period of "tipping" of the rocket body and axis position "overturning" in space (Leikin, 1959). Optical observations of the satellites have been an important part of

the program of extra-atmospheric studies of the upper layers of the atmosphere and outer space, and since 1958 the topic "Optical observations of the AES" was included in almost all agreements on scientific cooperation between the Science Academies of socialist countries (Masevich, 1961).

In April 1959, V. M. Grigorevsky participated in the Second All-Union Meeting of Heads of Visual Observation Stations of the AES, which was convened by the Astronomical Council of the USSR Academy of Sciences to discuss directions for further work and exchange of accumulated experience, and was held in Moscow on April 15–17. V. M. Grigorevsky informed about preliminary results of processing of observations of light of the second Soviet AES (Leikin, 1959).

Next year V. M. Grigorevsky completed his postgraduate studies and received a diploma from the University of Chisinau, where he worked at Department of Applied Mathematics (Archive of ONAFT, p. 5).

In 1961, V. M. Grigorevsky headed the optical surveillance station of the AES at Chisinau State University. The station was equipped near the university, in the former city water tower, and is equipped with military binoculars TPZ and TKK, stellar maps of Mikhailov, chronometers, chronographs and other equipment. According to the accuracy of the obtained observation results, the Chisinau station was among the top ten best stations for monitoring the AES operating in the USSR. Later V. M. Grigorevsky has obtained permission for construction of the Astronomical Observatory of the university outside the city in the Codra Reserve (50 km from Chisinau) and for the purchase of the necessary equipment (The development of astronomy in the Moldavian SSR).

In 1962, V. M. Grigorevsky under the guidance of Professor V. P. Tsesevich defended his Ph.D. thesis on the subject of "Fluctuations in the brightness of elongated artificial satellites of the Earth." The defense took place at the Main Astronomical Observatory (MAO) of the USSR Academy of Sciences (Archive of ONAFT, p. 13). By the decision of the Council of MAO of the USSR Academy of Sciences of April 20, 1962 (Protocol No. 7) V. M. Grigorevsky was awarded the academic degree of Candidate of Physical and Mathematical Sciences and issued the Diploma of Candidate of Sciences MFM № 001385 (Archive of ONAFT, p. 7).

In 1963, V. M. Grigorevsky was the coordinator of one of the first US-based satellite research collaborations when it was organized to observe the filling of an American Exo-2 balloon with gas when it enters orbit. For this purpose V. M. Grigorevsky, under the auspices of the Astronomical Council of the USSR Academy of Sciences, organized expeditions to the places over which the first turns of the orbit of this AES lay (Mandel, 1995).

In Chisinau V. M. Grigorevsky supervised works on the list of the most important on the national subject, was a member of the Commission on Multilateral Scientific Cooperation between the AN of the socialist countries, he was elected a member of KOSPAR (UNESCO) and IAU MAC (Archive of ONAFT, p. 11). While V. M. Grigorevsky was working at Chisinau State University, he initiated international cooperative research in the field of photometric observations of the AES and proposed for this purpose the SPIN program. The main objective of this program

was to obtain photometric data on the deceleration of the GCC rotation by the Earth's atmosphere and magnetic field; study the changes in this slowdown due to changes in solar activity; determination of the density of the atmosphere by slowing down the rotation of the satellite. By order of the Multilateral Cooperation Commission of the Academy of Sciences of the Socialist countries V. M. Grigorevsky was appointed as a Coordinator of the work under this program in 1965 (Masevich, 1968; Grigorevskiy, 1968). In the same year, by Decision of the Higher Attestation Commission of March 13, 1965 (Protocol No. 14 / II) V. M. Grigorevsky was approved in the rank of associate professor in the Department of Applied Mathematics (Certificate No. 023980) (Archive of ONAFT, p. 8).

Cooperative photometric observations under the SPIN program were started in 1966. The observations were attended by the stations of the People's Republic of Bulgaria (No. 1102 – Stara Zagora), the Socialist Republic of Romania (No. 1132 – Cluj) and the Soviet Union (No. 1023 – Kiev, No. 1024 – Chisinau, No. 1027 – Krasnodar). In 1967, the composition of participants was expanded by stations # 1115 – Prague (Czechoslovakia), № 1185 – Rodevish (German Democratic Republic), № 1040 – Riga, and № 1092 – Kirov (USSR), but for a number of reasons the Cluj station left. In 1968, 6 more stations from Hungary, the GDR, the Polish People's Republic, the USSR and the United Arab Emirates joined the photometric observations. On the basis of the materials of the results of the GCC observations conducted at these stations, I. M. Panich, V. M. Grigorevsky and V. O. Vorobyova developed a method of visual photometric observations, which allowed to improve the accuracy of determining the values of the period of change in the brightness of the satellite (Panich, Vorobyova, & Grigorevsky, 1969).

In the first three years after the start of SPIN, the necessary material was obtained to observe the relationship between solar activity and changes in the rotation period of the satellites, as well as to study the orientation of the satellites. Theoretical studies of aerodynamic, electromagnetic and other forms of deceleration of satellites have considerably expanded. V. M. Grigorevsky and colleagues conducted the first specially installed parallel studies of the periods of rotation and processing of the satellite 65-11-4 based on the results of observations obtained in accordance with the international programs SPIN and INTEROBS (Masevich, 1968; Grigorevsky, Panich, & Vorobyova, 1968; Grigorevsky, Vorobyova & Panich, 1972).

The INTEROBS program was proposed by Hungarian astronomers M. Ill and I. Almar. It allowed the use of geometric methods in determining the coordinates of a low-orbiting satellite and with acceptable accuracy, then to determine the period of rotation of the satellite around the Earth at an interval of 1-2 days. This made it possible to investigate the relationship of short-term variations in atmospheric density with solar and geomagnetic changes (Masevich, 2005). Observations made by satellite from 1965-11-4 at the same time to the INTEROBS and SPIN programs provided a unique opportunity to simultaneously study changes in the orbital and rotational speeds of the same object, as well as to compare these changes with each other and with changes in solar activity and different geomagnetic characteristics (Grigorevskiy,

Kasimenko, Panich & Vorob'yeva, 1968). In 1968, a Satellite Observer Conference and Conference was held in Chisinau to discuss the goals and results of the SPIN program. A. G. Masevich, a Head of the Commission on Multilateral Cooperation of the Socialist Nations Academy of Sciences on the Problems of Scientific Research on the basis of the AES Observations (Shustov, Dluzhnevskaya, Rykhlova & Tutukov, 2018) approved the work of the staff of the Chisinau station monitoring the AES and the work of the station chief V. M. Grigorevsky. It was noted that the Chisinau station not only led and coordinated international work on the SPIN program, but also did a lot to implement it. Thus, more than half of all observations on the SPIN program in 1965–1968 were conducted in Chisinau, the staff of the station published dozens of theoretical and experimental works with the results of the SPIN (Masevich, 1968; Grigorevskiy, 1970).

In the report of the chairman of the organizing committee V.M. Grigorevsky noted that determining the orientation of the satellite according to photometric data, which was the content of most theoretical works, does not exhaust all the information that can be obtained from photometric studies of satellites. On this basis, the scientist identified a number of major problems that can be solved by satellite photometry, in particular:

- the study of the shape of the satellite surface;
- the study of reflective properties of the satellite surface and their changes over time based on colorimetric and polarimetric observations;
- the study of the vertical distribution of ozone in the Earth atmosphere, as well as the detection of aerosols of terrestrial and cosmic origin at different altitudes in the atmosphere – by photometric observations of satellites as they enter the Earth's shadow.

The determination of satellite orientation: in the case of light scattering on its surface; when the mirror is displayed; in the mixed case (non-spherical scattering indicator); with specially designed mirrors or converters. It has been noted that the determination of orientation by photometric data is the main method for inactive satellites (Grigorevskiy, 1968).

The use of photometric data allowed us to develop methods for determining the orientation of elongated and cylindrical satellites. The relationship of the satellite's rotation period with solar and geomagnetic factors was established and synchronous changes of the satellite's rotation period under the influence of variable solar activity were detected (Grigorevskiy, 1968; Shmelev, Grigorevskiy & Shmeleva 1969). The writings of Grigorevsky, Shmelev and Shmeleva (1968; 1973), Grigorevsky and Bukhbinder (1967) show that to determine the density of the atmosphere it is necessary to take into account the influence of the aerodynamic forces and the magnetic field of the Earth on the rotational motion of the AES and proposed methods for determining the density of the atmosphere.

The inclusion of Egyptian astronomers in the SPIN (Soviet Egyptian Tracking Station, OAR) program has provided photometric observations during the winter months and has the ability to investigate seasonal effects in slowing down the rotation

of satellites (Grigorevskiy, 1968). In 1970, V. M. Grigorevsky co-authored with G. M. Shmelev and V. O. Vorobyov published an article in Washington on the results of photometric observations under the SPIN program "Photometric Observations of Satellites and the SPIN Program" (NASA TT F-12. 1970. March. Washington. USA). And in 1971, at the 14th COSPAR meeting in Seattle, June 29, in Seattle, a report was co-authored with INTEROBS Program Coordinator in the USSR, USSR Astronomical Council Representative T. V. Kasimenko "Investigation of the Parameters of the Upper Atmosphere by Simultaneous Optical and Photometric Observations of Satellites" (Archive of ONAFT, p. 16, 17).

In 1970, V. M. Grigorevsky returned to Odessa University, where he worked as an associate professor of the Department of Astronomy, carried out active educational work with students, developed and read a new special course "Satellite Astronomy", which was based on the latest achievements of space exploration and contained the results of the work. In parallel in 1971-1976 Grigorevsky was the head of the monitoring station of AES №1036 at the Odessa State University Observatory. In OAO V. M. Grigorevsky started the AES Research Sector, which later gained the status of the Space Research Division, and headed until 1976 (Archive of ONAFT, p. 26; Mandel, 2005).

At the same time in Chisinau, Ion Panich was appointed as the head of the AES monitoring station, a former graduate student of V. M. Grigorevsky, who in 1973 under his leadership defended his thesis on photometric studies of the AES (The development of astronomy in the Moldavian SSR; Archive of ONAFT, p. 20)

Since 1969 V. M. Grigorevsky conducts active research work on the contractual topics. During the period 1969-1974 under the scientific guidance of the scientist, three contracts were executed, in the other two he participated as the responsible executor. In 1971-1975, V. M. Grigorevsky led a large contract work that was of defensive importance (Archive of ONAFT, p. 23).

In 1973, Grigorevsky defended his doctoral thesis on the theme: «Photometric observations of satellites and their application» (Karetnikov, Grigorevskiy, p. 348; Archive of ONAFT, p. 5). By the decision of the High Attestation Commission of September 13, 1974 (Protocol No. 27 c) V. M. Grigorevsky was awarded the degree of Doctor of Physical and Mathematical Sciences, and on October 21, 1974 was awarded the diploma of Doctor of Science at number MFM № 002207 (Archive of ONAFT, p. 9).

In 1976, V. M. Grigorevsky starts to work at the Odessa Technological Institute named after M. V. Lomonosov was appointed to the Department of Higher Mathematics until the end of his life, which ended in 1981. On September 1, 1976 he was elected as a professor, and since February 10, 1977 he was a head of the Department of Higher Mathematics (Archive of ONAFT, p. 20). By the decision of the Higher Attestation Commission under the Council of Ministers of the USSR of July 21, 1978 (Protocol No. 24) V. M. Grigoresky was awarded the academic title of Professor in the Department of Higher Mathematics (Certificate of Professor PR No. 004023) (Archive of ONAFT, p. 10).

At the Odessa Technological Institute named after V. M. Lomonosov V. M. Grigorevsky continued his active scientific work on the study of the geometry and motion of the AES and small planets, optimization of technological processes by mathematical methods with the use of electronic computing methods (Archive of ONAFT, p. 20). Applying the methods used to determine the periods of alternating stars and satellites to photometric observations of small planets, in particular, Eros, determined the periods of rotation of small planets relative to the center of mass and the orientation of the axis of rotation in space (Mandel, 1995). The scientist involved in the scientific work of the students of the institute and supervised the execution of the contractual topics (Archive of ONAFT, p. 20).

V. M. Grigorevsky lived in Odessa at: 39/2 V. Tereshkova Street, apt. 95. Wife – Valentina Vorobyova, born in 1933, worked as a research associate at the Odessa State University, participated in research with her husband and co-authored a series of collaborative scientific papers on photometry of AES (Archive of ONAFT, p. 4).

Conclusions

So, V. M. Grigorevsky made a significant contribution to the development of photometric studies of the AES in Ukraine. In the life and creative activity of V. M. Grigorevsky can be distinguished the Kherson, Odessa before-Chisinau, actually Chisinau and Odessa post-Chisinau periods.

In Kherson, the formation of the personality of the future scientist took place and the formation of a character tempered with the fight against severe illness, war fever and difficult post-war living conditions.

The before-Chisinau period of creative activity of V. M. Grigorevsky is affiliated with the University of Odessa, where he received his higher education and first work experience, he completed his postgraduate studies. It was during this period that his joint work with V.P. Tsesevich identified the main directions of scientific research of the scientist - the study of variable stars and photometry of the AES, which later became the main scientific direction from which V. M. Grigorevsky.

The Chisinau period in the creative biography of the scientist lasted almost 10 years (1960–1970) and was one of the most successful in scientific activity. During these years V. M. Grigorevsky finally formed as a scientist, successfully continued his work on photometric observations of the AES, gained invaluable experience of international scientific cooperation and recognition as one of the leading scientists of the world in the field of AES photometry.

In the post-Kishinev period of creative activity V. M. Grigorevsky worked at the Odessa University and the Odessa Technological Institute named after M. V. Lomonosov, broadening the direction of his own research. An important place in the scientific activity of V. M. Grigorevsky's research work was held on a contractual topic that was of defensive importance during this period.

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Життя й наукова діяльність українського астронома В. М. Григоревського (1930-1981)

Анотація. У 2020 році наукова громадськість буде відзначати 90-річчя з дня народження Віталія Григоревського – українського астронома, фахівця в галузі супутникової астрономії, представника наукової школи видатного українського вченого, члена-кореспондента Академії Наук УРСР, директора Одеської астрономічної обсерваторії, професора Володимира Платоновича Цесевича. У статті на підставі комплексного використання біографічного методу та методів бібліографічного й джерелознавчого аналізу досліджено основні віхи життя та наукової діяльності Віталія Григоревського. Розглянуто херсонський, одеський докишинівський, кишинівський і одеський післякишинівський періоди життя науковця та його трудову діяльність в Одеському та Кишинівському державному університетах, Одеському

технологічному інституті ім. М. В. Ломоносова. Визначено основні напрями наукових пошуків вченого: фізичні процеси у напівправильних змінних зірках, фотометричні дослідження штучних супутників Землі, дослідження геометрії і руху штучних супутників Землі і малих планет, оптимізація технологічних процесів математичними методами з застосуванням електронно-обчислювальних методів. Показано внесок Віталія Григоревського у становлення та розвиток нового для 60-х років минулого століття напрямку наукових досліджень – фотометричних спостережень штучних супутників Землі. Висвітлено міжнародний аспект науково-організаційної діяльності Віталія Григоревського, його роботу в Комісії з багатостороннього наукового співробітництва між Академіями Наук соціалістичних країн. Відзначено діяльність Віталія Григоревського, як ініціатора та координатора кооперативних досліджень у галузі фотометричних спостережень штучних супутників Землі за програмою SPIN, учасниками якої були станції Народної Республіки Болгарії, Чехословацької Соціалістичної республіка, Угорської Народної Республіки, Німецької Демократичної Республіки, Польської Народної Республіки, Радянського Союзу і Об'єднаної Арабської Республіки (Єгипет). Висвітлено маловідомі факти з біографії вченого.

Ключові слова: Одеська астрономічна обсерваторія; Кишинів; фотометричні спостереження; штучні супутники Землі; SPIN

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Жизнь и научная деятельность украинского астронома В. М. Григоревского (1930-1981)

Аннотация. В 2020 году научная общественность будет отмечать 90-летие со дня рождения Виталия Григоревского – украинского астронома, специалиста в области спутниковой астрономии, представителя научной школы выдающегося украинского ученого, члена-корреспондента Академии наук УССР, директора Одесской астрономической обсерватории, профессора Владимира Платоновича Цесевича. В статье на основании комплексного использования биографического метода и методов библиографического и источниковедческого анализа исследованы основные вехи жизни и научной деятельности Виталия Григоревского. Рассмотрены херсонский, одесский докишиневский, кишиневский и одесский послекышиневский периоды жизни ученого и его трудовая деятельность в Одесском и Кишиневском государственных университетах, Одесском технологическом институте им. М. В. Ломоносова. Определены основные направления научных изысканий ученого: физические процессы в полуправильных переменных звездах, фотометрические исследования искусственных спутников Земли, исследования

геометрии и движения искусственных спутников Земли и малых планет, оптимизация технологических процессов математическими методами с применением электронно-вычислительных методов. Показан вклад Виталия Григорьевского в становление и развитие нового для 60-х годов прошлого века направления научных исследований – фотометрических наблюдений искусственных спутников Земли. Освещен международный аспект научно-организационной деятельности Виталия Григорьевского, его работа в Комиссии по многостороннему научному сотрудничеству между Академиями наук социалистических стран. Отмечена деятельность Виталия Григорьевского, как инициатора и координатора кооперативных исследований в области фотометрических наблюдений искусственных спутников Земли по программе SPIN, участниками которой были станции Народной Республики Болгарии, Чехословацкой Социалистической республики, Венгерской Народной Республики, Германской Демократической Республики, Польской Народной Республики, Советского Союза и Объединенной Арабской Республики (Египет). Освещены малоизвестные факты из биографии ученого.

Ключевые слова: Одесская астрономическая обсерватория; Кишинев; фотометрические наблюдения; искусственные спутники Земли; SPIN

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