Communications of BAO, Vol. 73, Issue 1, 2026, pp. 167–171

The Name of Pavel Petrovich Parenago in Science as a Part of Astronomical Heritage

I.V. Kuznetsova*

Sternber Astronomical Institute of Moscow State University, Moscow, Russia

Abstract

Astronomical heritage is a broad concept. It mainly includes objects related to astronomical observations, as well as places that contain evidence of traditional astronomical beliefs among local communities. Additionally, it now includes astronomical photographic plates that are being digitized to preserve their images. This article proposes a perspective on scientific phenomena named after Pavel Petrovich Parenago, a remarkable Russian astronomer, as part of the astronomical heritage.

Keywords: *astronomical heritage, stellar astronomy, Parenago paradox, Parenago formula, Parenago effect, Parenago ratio.*

The name of Pavel Petrovich Parenago, one of the founders of the Moscow School of Stellar Astronomy, which still actively working and continues the traditions laid down by the master both in Moscow and in other astronomical centers, named by many scientific phenomena. This name is now part of the astronomical heritage Pavel Petrovich Parenago wrote the world's first textbook on stellar astronomy. He is the author of the term "Stellar Astronomy" (Efremov (2006)). This alone makes his name a part of the Astronomical Heritage. In addition to the term itself, he developed the course in detail and taught this course at Moscow University since 1934. The course is still relevant under the name "Galactic astronomy".

How often do scientists' names remain in science? It turns out that this doesn't happen very often. Sometimes, names appear and then disappear unnoticed. Relationships and formulas are refined, theorems are generalized, and new names emerge. This work is dedicated to the question of how many scientific phenomena are called by the name of Pavel Petrovich Parenago, one of the founders of the Moscow school of stellar astronomy. There are several "Parenago paradoxes, Parenago plans, and formulas and relations named after him".

Parenago does not seem to be a Russian surname. Pavel Petrovich Parenago himself, with humor, explained the origin of his surname by saying that one of his ancestors had the nickname "Parenoy" and the next was already the son of "Parenoy", in the old way "son of P*A*renag*o*", and then the stress shifted to the end, and became "Paren*A*go".

The ancestors of the Parenago family served the Russian throne as nobles and received estates from the tsar in 1615 and in subsequent years. This is confirmed by a certificate from the Department of Estates and a copy of a resolution from the Voronezh Noble Assembly, which included the Parenago family in the 6th part of the old nobility (Russian State Historical Archive (1857)). The Parenago family coat of arms was very picturesque: it depicted a goose sitting on the grass with its head facing to the right on a blue field. The shield was topped with a noble helmet and a crown with ostrich feathers. The shield was edged with a blue border and a silver border (see figure 1).

My hero's biography is typical for a scientist. He was born on March 7 (20), 1906, in the family of a doctor in Ekaterinodar, now Krasnodar. The date of birth is also given in the old style, as the Julian calendar was used in Russia until 1917. Since 1912, the family has been living in Moscow. At school, the boy was interested in chemistry and astronomy. Already in 1919, he began astronomical observations using binoculars and a spyglass. In 1921, he joined the Moscow Society of Astronsfomy Lovers. Pavel became involved in the study of variable stars and mastered photometric methods. This interest defined the activities of the young observer for many years. In 1922, he enrolled in two faculties of Moscow State University: the Faculty of Chemistry and the Faculty of Physics and Mathematics.

*irinakuznetsova-64@mail.ru

doi: https://doi.org/10.52526/25792776-26.73.1-167

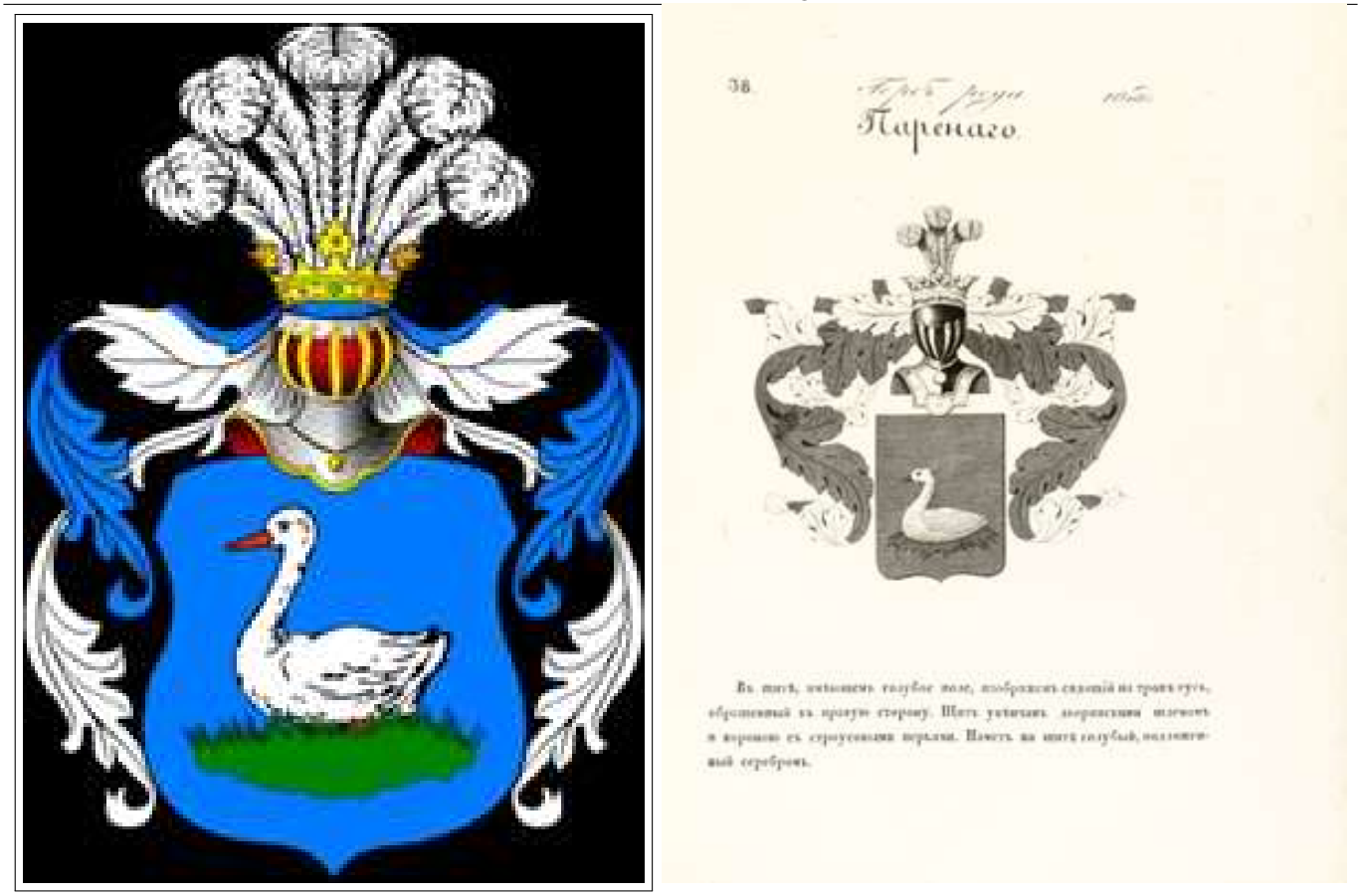

Figure 1. The coat of arms of the Parenago family.

At the same time, he began systematically observing variable stars. However, it became too difficult for him to study in two different faculties simultaneously. As a result, he had to leave the chemistry department. It is worth noting that his future family continued to share a common interest in chemistry. His son, Oleg Pavlovich Parenago, is a renowned Russian chemist and winner of the N.D. Zelinsky Prize, while his granddaughter, Olga Olegovna Parenago, is actively engaged in chemical research, just like her father. Let's go back to the stars.

From 1927 to 1931, Pavel Petrovich worked at the Krasnopresnenskaya Observatory, where he photographed the sky using an equatorial camera. He studied the images and made several tens of thousands of brightness estimates for nearly a thousand poorly studied or unstudied variable stars. In total, Pavel Petrovich studied at the university for seven years, in parallel with his work. In 1925, he became a researcher at the State Astrophysical Institute, and in 1927, he joined the Astronomical and Geodetic Institute at Moscow State University. As is well known, the merger of these two institutes with the Moscow State University's astronomical observatory led to the establishment of the Sternberg State Astronomical Institute at Moscow State University in 1931, and in 1932, P.P. became a senior researcher at the Sternberg Institute. At the time, the institute had a truly stellar team of researchers studying variable stars. Blazhko, Kukarkin, Zverev, Kulikovsky, and others. Even then, the surname Parenago became well-known in the astronomical scientific community.

After graduating from university in 1929, during the summer holidays, he began working with the archive of photographic plates at the Simeiz Observatory. It was during this time that he realized that personal observations alone were not sufficient for serious research. In our country, Parenago was a pioneer in the use of mass photographic heritage on glass plates. Since then, the use of glass libraries has become widespread. In his spare time at the Simeiz Observatory, he read all the major astronomical journals published after 1900, and his excellent memory made this reading very useful.

In 1932, according to the "Parenago Plan", researchers at the Sternberg Institute and the Astronomical Council of the Academy of Sciences organized the **Central Commission for the Study of Variable Stars**. This commission united all research on variable stars conducted in the USSR.

Later, P.P Parenago's activities were quite diverse: research, teaching, organizational, administrative, and publishing activities, work in the USSR and abroad, in the International Astronomical Union, and

doi: https://doi.org/10.52526/25792776-26.73.1-167

other organizations. Since 1934, P.P. has been the first person in our country to give systematic lectures on stellar astronomy. Prior to this, lectures on specific aspects of stellar astronomy were only held occasionally. At that time, stellar astronomy was generally limited to stellar statistics, but P.P. viewed it as a branch of astronomy that was just as important as astrometry, astrophysics, and celestial mechanics, with the primary goal of studying the structure and evolution of stellar systems. Thus, stellar dynamics is an integral part of stellar astronomy, and the most important objects are variable stars, special stars that we usually know much more about than stars of constant luminosity. He considered his greatest achievement in life to be the fact that he contributed to the introduction of this course in all universities with an astronomy department.

In 1934, Parenago and Kukarkin discovered a linear relationship between the amplitude of dwarf star flashes and the logarithm of the time between flashes. Parenago and Kukarkin applied this relationship to the star called Nova T Corona Borealis, T CrB). In 1866 it had only one flash, with an amplitude lower than the amplitudes of Nova Stars and closer to the Repeated Nova ones.

Pavel Petrovich Parenogo and his collaborator Boris Vasilievich Kukarkin took the risk of applying this dependence to T Corona Borealis and predicted its surge 60-100 years after the previous one, i.e. from 1926 to 1966. And it happend in 1946! The Kukarkin-Parenago dependence means that energy accumulates between flashes, and the longer it accumulates, the more powerful the flash becomes. Thus, the variability of Nova, recurrent Nova, and U Geminorum-type stars is associated with their binarity and occurs in the late stages of the evolution of close binary systems.

In 1935, Parenago became a Doctor of Sciences (the second highest scientific degree accepted in Russia) for his significant contribution to science without submitting and defending a doctoral dissertation.

In about 1936, P.P. Parenago and B.V. Kukarkin began thinking about creating a new department of Stellar Astronomy in Moscow University.

Back in the 1920s, Pavel Petrovich came up with the idea of collecting all the known information about all the known stars. When he processed the vast amount of data he had collected, he discovered that the kinematic parameters of early-type (B-F) and late-type (G-M) stars were similar within their respective groups, but there was a gap between them. This phenomenon later became known as the Parenago effect (also referred to as the Parenago gap in foreign literature) (Parenago (1950)). In the late 1920s, Pavel Petrovich spent a lot of time photographing the sky. It is likely that his work with photographic plates inspired him to collect all the known information about all the famous stars. In the early 1930s, Parenago and his team began compiling a database containing information about stars, including their brightness, proper motions, parallaxes, and radial velocities. Did they create several tens of thousands of cards, which formed the basis for the combined catalog of variable stars.

The illustration of the process of collecting stars in the catalogues of P.P. Parenago and B.V. Kukarkin takes us back to the distant times of Ancient Babylon. The stars that moved across the sky as a single group were called “rams”, and the wandering planets among them were called “goats” (bibu) these were more intelligent beings who served as guides for herds of sheep.Currently, wall newspapers have not been preserved, but in the past, they were a means of communication, criticism, and education in various groups. The wall newspaper at the Sternberg Astronomical Institute appeared in late 1944. Along with the texts of the newspaper “Vladilena” (named after Vladimir Lenin), it also featured drawings related to current events. The main illustrator was I.S. Shklovsky, who was not only a renowned astrophysicist but also a talented cartoonist with a keen eye for both the scientific and social aspects of the institute’s life.

When the card index covered all the variable stars known at that time, B.V. Kukarkin and P.P. Parenago were able to propose, at the first post-war meeting of the Executive Committee of the International Astronomical Union, to continue the work on the systematization and cataloging of variable star data that had previously been carried out by Germany in Moscow. The proposal was accepted, and in 1948, the first edition of the General Catalogue of Variable Stars was published in Moscow.

The Parenago effect was later confirmed on a more representative sample of millions of stars when processing the results of the Hyparchos and Gaia space missions.

Another area of Parenago’s research was the study of the structure of our Galaxy. This included not only the star counts that had been conducted before, but also the determination of the gravitational potential of the galaxy and the distribution of its mass. Parenago was the first who calculate the orbit of the Sun in the Galaxy before the Second World War, and in 1945 he studied the oscillations of stars (including the Sun) perpendicular to the Galactic disk.

These studies were followed by analytic research on the gravitational potential of the Galaxy. In this task, Pavel Petrovich considered our Galaxy as a stellar system with axial symmetry that is in statistical equilibrium. In this case, the distribution of stars is expressed through six constants, the integrals of motion,

doi: https://doi.org/10.52526/25792776-26.73.1-167

Figure 2. Drawing by I.S. Shklovsky from the 1947 issue of the Vladilena wall newspaper of the Astronomical Institute.

but only two of them can be found explicitly for the axisymmetric case. The equations describing this system can be solved analytically and provide a good description of the rotation curve in the vicinity of the Sun. While working on this problem, he came up with a result known as the Parenago Paradox: the density of stars far from the center of the Galaxy was negative. Another paradox associated with Parenago's name is that he was the first to question the enormous mass of our Galaxy's core (60 percent) in the Oort model.

In the 1930s, it became clear that there was light extinction in the Galaxy, causing a decrease in the brightness and a change in the colors of stars. This became one of the most important problems in stellar astronomy. Parenago's first work on interstellar extinction was done in the mid-1930s. By 1940, Pavel Petrovich assumed that the absorbing matter was distributed near the Galactic plane in the same way as the stars, i.e., according to the barometric law, with an exponential decrease in density with distance from the Galactic plane. It is often referred to as Parenago's formula, and it has become widely accepted.

A private but very important discovery made in 1950 by P.P. Parenago and A.G. Masevich was the Algol Paradox, sometimes also called the Parenago Paradox (Parenago & Masevich (1951)). According to theory, more massive stars evolve faster. In a binary system, the components are formed simultaneously, so the more massive star should be in a later stage of evolution. However, in the Algol system, the opposite is true: the less massive component has already left the main sequence, while the more massive component is still on it. Is this a paradox? In 1955, American astronomer J. Crawford provided an explanation for this paradox. The state of the binary system was attributed to the transfer of matter between its components. And these are not all the names. There is also the Ogorodnikov-Parenago potential, the Fesenkov-Parenago theorem, which is used in the calculation of stars, and the Kamma-Parenago function, which is used to describe the kinematics of a Galaxy (Kuznetsova & Prokhorov (2024)).

In 1953, P.P. Parenago was elected a corresponding member of the USSR Academy of Sciences, and in the same year, he organized the Commission on Stellar Astronomy under the Astronomical Council of the Academy of Sciences, which he headed until the end of his life. In 1954, P.P. Parenago became the first recipient of the Bredikhin Prize of the USSR Academy of Sciences. In 1955, the fist plan evolved into the 2-nd Parenago Plan which aimed to comprehensively study special regions of the Milky Way, including dark and bright nebulae, star clusters, and associations. The plan included the observation of 40,000 stars down to 13-th magnitude. Several observatories in the USSR joined the effort to implement this plan.

So, there are three Parengo paradoxes in astronomy. In addition to his name in the name of scientific phenomena, Parengo left behind a whole school of followers who continued his work (Vorontsov-Velyaminov et al. (1961)).

P.P. Parenago's printed legacy includes several hundred scientific papers and a number of popular science books (Lavrova (1961)).

It turned out that in 1958 and 1959, Parenago was the most cited author in the USSR, and even in 1965

(five years after his death), he was in third place.

Pavel Petrovich is an outstanding scientist and a wonderful person whose name belongs to the astronomical heritage. The name Parenago is also used for naming space objects .It was given to the asteroid 2484, discovered on October 7, 1928, by the Russian and Soviet astronomer Grigory Neuymin at the Simeiz Observatory, and it was named after P.P. Parenago on June 6, 1982. Additionally, the name Parenago was given to a crater on the far side of the Moon. According to the IAU rules, craters are named after deceased prominent scientists, engineers, and researchers who made significant contributions to their fields, although there are exceptions. Most of the new names were assigned in the 1970s, after the acquisition of images of the far side of the Moon.

In 1975, the ship Pavel Parenago was built in the Soviet Union. The ship was built in Gdansk, Poland. The ship was used by the Latvian Maritime Shipping Company until 2003.

It is impossible to tell the story of such a great person in a short article.

P.P. Parenago died of laryngeal cancer on January 5, 1960. Until the last weeks of his life, he continued to work. His life in astronomy, as a hardworking employee, an enthusiast, and an encyclopedist, is the best example for anyone who understands that without the accumulation of observational data, theory is powerless, and that without attempting to interpret this data based on existing theory, it remains a dead weight. Ultimately, it is the theory that determines which data are necessary at any given time.

We have only touched on the aspects of his work that are directly related to his name. His astronomical heritage is much greater than that. The questions he posed in science are still being refined using modern methods and much more extensive data.

Acknowledgements

The study was conducted under the state assignment of Lomonosov Moscow State University.

References

Efremov Y. N., 2006, Earth and Universe, 3, 57

Kuznetsova I. V., Prokhorov M. E., 2024, Astron. Rep. , 68, 97

Lavrova N. B., 1961, Historical and Astronomical Research, 7, 383

Parenago P. P., 1950, Asron. Zhurn., 27, 150

Parenago P. P., Masevich A. G., 1951, Publ. SAI, 20, 81

Russian State Historical Archive 1857, fond. 1343, inventory. 27, case. 876

Vorontsov-Velyaminov B. A., Kukarkin B. V., Kulikovsky P. G., et al. 1961, Historical and Astronomical Research, 7, 335