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The teacher and his follower

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This paper is devoted to the 105th anniversary of Professor P.P. Parenago and the 80th anniversary of Dr. F.A. Tsitsin.

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The scientific conference held at the Moscow University's Sternberg Institute on June 15–16, 2011 was dedicated to just these two dates.

What did these two Moscow astronomers have in common, so different in their temperament and work style as well as in the sphere of their scientific interests?

Professor Pavel Parenago (Fig. 1) was a natural purposeful observer and researcher, basing his discoveries on his own observations.

Dr. Felix Tsitsin (Fig. 2) was far from observational astronomy, he was more of an original theoretical thinker with a huge range of scientific interests and personal nonstandard ideas. Both of them were specialists in stellar dynamics, both dedicated their lives to the education of new generations of specialists in studies of the Universe, and each of them was an exemplary Human being/personality – Human with a capital "H". Their destinies are united by two words: an extraordinary Teacher and an "unusual" Follower. The first one opened to his follower a door to serious scientific literature. The second one, who outlived his much missed professor for almost half a century, not only continued his research, but also analyzed his work and honoured his memory in a number of publications as a historian of astronomy, revealing an unexpectedly significant role his teacher's results played also beyond stellar astronomy.

Pavel Petrovich Parenago was born on 20(7) March, 1906 in Ekaterinodar (Krasnodar) and died on 5 January, 1960 in Moscow. He was a Moscow State University (MSU) professor since 1938, corresponding member of the USSR Academy of Sciences since 1953, founder of the Moscow school of stellar astronomy. In 1929, he graduated from MSU's Faculty of Mechanics and Mathematics. Still a student, he started working at MSU's Astronomy and Geodesy Research Institute (AGNII). In 1931, AGNII entered the newly created Sternberg Astronomical Institute (SAI), and his life was linked with SAI ever since. He got his Doctor of Science degree in physics and mathematics in 1935. Since 1940 and to his last days, Parenago headed the

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Figure 1 Pavel Petrovich Parenago (20(7)/03/1906, Ekaterinodar (now Krasnodar) – 05/01/1960, Moscow), Professor of Moscow State University (1938), corresponding member of the USSR Academy of Sciences (1953), founder of the Moscow school of stellar astronomy.

Stellar Astronomy chair at MSU created by him. During the Second World War, he served as aviation meteorologist.

The main direction of his scientific work were studies of the structure and kinematics of the Galaxy and its subsystems. He also studied the dynamics of stellar systems and variable stars: he had already started observing them as a fifteen-year-old amateur. His essential contribution to stellar astronomy was in his unique methodology of systematizing huge quantities of observation material, partly obtained by himself. This kind of dedicated attentive work created a strong basis for future discoveries in the field of the structure of our Galaxy as well as of other galaxies. He studied about 600 variable stars of different types, established their photometric and kinematical characteristics, statistic relations between different parameters. These results were fundamental for future research into general problems of the galactic structure. He compiled a catalogue of principal characteristics of Galaxy's star population: parallaxes, proper motions, radial velocities, spectral types, etc. Summarizing and analyzing this vast material, he was able to reach important conclusions: among others, to reveal the existence of an independent sequence of sub-dwarfs (stars with a deficiency of heavy chemical elements), located in the Hertzsprung–Russell (H–R) diagram below the main sequence of most stars. Together with Prof. B.V. Kukarkin,

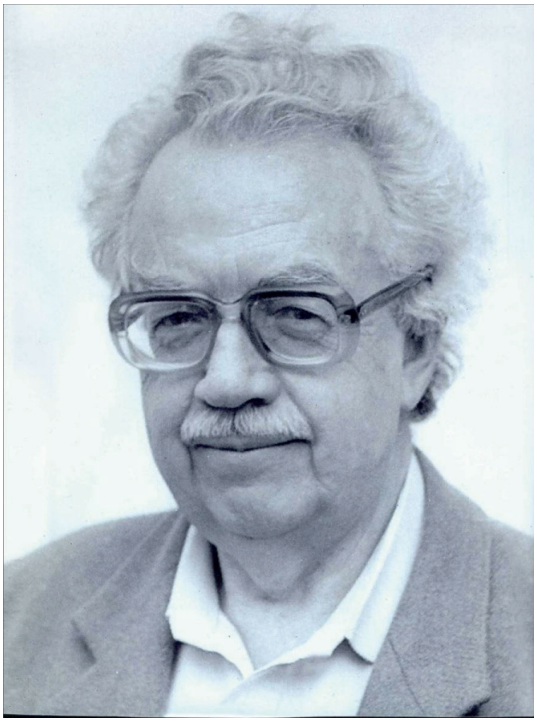


Figure 2 Felix Aleksandrovich Tsitsin (01/06/1931, Kukoboy, Yaroslavl Region – 01/01/2005, Moscow). One of P.P. Parenago's last outstanding students and followers, who closely collaborated with him.

P.P. Parenago developed the vision of the Galaxy as a synergy of star subsystems of various nature and with different features, studied its structure and kinematics. In collaboration with Prof. A.G. Massevich, he discovered (1949–1950) that each sequence of the H–R diagram exhibits its own relation between masses and luminosities of stars (Massevich & Parenago 1950). Parenago developed methods for determination of the luminosity function; he was one of the first to evaluate the total number of the Galaxy's stars on the basis of star counts. He determined parameters of the Sun's galactic orbit (Parenago 1939) and then suggested a simple model of galactic potential based on observations of stellar velocities (Parenago 1950), which "opened new possibilities for studying the distribution of matter and its motion within the Galaxy" (F.A. Tsitsin). Parenago was the first to discover that the velocity dispersion of stars increased with the spectral type (the kinematical heterogeneity of the local sample of dwarf stars). This result (Parenago's most important, according to the current head of the Galaxy Department, Prof. A.S. Rastorguev) is interpreted as a secular heating of the galactic disk with transient density waves and giant molecular clouds and is called "Parenago discontinuity" in stellar-astronomy textbooks. In 1940, he proposed a theory of light absorption by dark nebulae and suggested methods of taking this effect into account within the framework of the hypothesis of dust matter distribution in flat-parallel layers (Parenago 1940). Parenago paid special attention to system-

atic determination of spectral types and velocities of stars in the field of the Orion Nebula, which attracts astronomers' attention as the closest area of continuing star formation already for a long time. These results are a part of the world heritage of stellar astronomy, they are widely cited. His pedagogical and organizational activities deserve special attention. He started teaching stellar astronomy in the MSU in 1934; his university course of stellar astronomy, the first one in the world literature, appeared in 1938; as already mentioned, in 1940 he founded the stellar astronomy chair at MSU. He was known as a particularly attentive teacher. Many of his students became well-known experts in stellar dynamics and kinematics. In 1953, Parenago organized a Stellar Astronomy Commission at the Astronomical Council of the USSR Academy of Sciences and headed it till his last days. In the same year, he was elected corresponding member of the Academy of Sciences. He left a substantial heritage: several hundreds of scientific papers and books. He was the first to be awarded, in 1948, an F.A. Bredikhin prize of the Academy of Sciences. A minor planet No. 2484 and a crater at the back side of the Moon are named after him.

Felix Alexandrovich Tsitsin (1 June, 1931, Kukoboy, Yaroslav Region – 1 January, 2005, Moscow) was the last Parenago's student closely related to him. Felix Tsitsin discovered his interest in astronomy still at school. Quite often, he even replaced the school physics (and astronomy) teacher to tell his classmates about stars, life in the Universe, about space travels considered science fiction at that time. At fifteen, he was so impressed by the first publications of the famous USSR Academy member O.Yu. Schmidt on cosmogony theory that he sent his critical comments to the author. Surprisingly, he received a rather enthusiastic answer from Schmidt, who appreciated the consistency of schoolboy's thoughts and advised him to pursue his studies and a career in science.

In 1949 Felix Tsitsin finished (cum laude) a mathematical school in Yarosalvl and then, in 1954, he graduated from the MSU Faculty of Mechanics and Mathematics, Astronomy Department. His first job was a junior researcher at the Laboratory of Novae and Gas Nebulae. But very soon, the head of the laboratory, Prof. B.A. Vorontsov-Veliaminov, noticed that the new colleague had nothing to do with the job and recommended the young man... to continue his PhD studies on stellar astronomy with Prof. Parenago.

Although he specialized in stellar dynamics, F.A. Tsitsin never lost interest in cosmogony. At the end of his life, in his monograph (Tsitsin 2009, published posthumous), he proposed the first detailed analysis of Schmidt's scientific thought and enriched it with his own theory on the origin of comets, developed with his colleagues. Throughout his life, he mentioned Prof. Parenago as his teacher in stellar dynamics.

Not surprisingly, his colleague Prof. V. Karpinsky had many reasons to call Felix "the most non-standard thinking student". For instance, while he was still at the University, Tsitsin proposed his own generalization of the operation of differentiation and integration of the fractional-order derivatives and multiplicities of integrals. It was found later that he suggested his own proof of the already existing (but completely forgotten) theory of a 19th-century Italian Tardi. As with many premature discoveries, its value was only understood in the 20th century for the new fractal theory of the Universe, the theory Tsitsin got involved with. By the way, discussing it with the well-known physicist Prof. I. Tamm, Felix was surprised to hear that it had also been the first mathematical step of Academy member A. Sakharov, Tamm's PhD

student before the war. Also, in 1953, during one of Parenago's seminars, Tsitsin proposed to replace the complicated proof of "Fessenkov's theorem", used in the Galaxy structure studies, by his proof consisting of only two simple differential-equation lines. Impressed, Parenago immediately proposed that he should write an article about it for the Astronomical Journal and promised to publish it promptly (which he did: Tsitsin 1954). This was Tsitsin's first published work. In the 1950s, together with his friend A.M. Mikisha, he improved the estimate of the Galactic nucleus mass. In the 1960s, Tsitsin explained the reason for negative densities in Parenago's theory of stellar systems, pointing out a logical contradiction in the fundamentals of classical stellar dynamics. In the 1970s, he proposed a generalization of Fessenkov's theorem, basic for determination of flattening of the Galaxy. Considering Parenago's role in this discovery, he proposed to name it "Fessenkov–Parenago theorem" (actually, it should be called "Fessenkov–Parenago–Tsitsin theorem").

Felix Tsitsin is known in the field of not only stellar systems' dynamics but also of its physical foundations. This was manifested in his PhD thesis (Tsitsin 1972). In the 1980s, together with his PhD student V. Sementsov, he obtained an important result in the field of stellar-systems' statistical mechanics: they built the first stellar-system thermodynamic model consisting of Newtonian (i.e. behaving according to Newton's gravitation theory) mathematical points, which had been considered impossible before then.

Still earlier, in the 1960s, and especially in the 1980s, F. Tsitsin was deeply involved in the critical revision of the foundations of thermodynamics. However, his DSc thesis (Tsitsin 1983) met with stubborn resistance of orthodox physicists who made numerous and rather controversial comments, and he never got this degree. Tsitsin planned to resume this research during his last years as the problem of thermodynamics of the Universe.

Felix Tsitsin paid special attention to the history and philosophy of science, as well as to thecosmogony of the solar (planetary and cometary) system (his new fundamental concept of comet cosmogony occupies a third of the above-mentioned monograph, Tsitsin 2009). In this very book he showed, in particular, that Parenago's (1939) work on the determination of the Sun's galactic orbit, periodically crossing the galactic plane, "played a decisive stimulating role, initiating a new stage of Schmidt's active work on planetary cosmogony" in spring 1942 (pp. 145–147, a completely forgotten historic fact).

Tsitsin prepared and delivered lectures on "Stellar system dynamics" and "Physical foundations of stellar system dynamics", and from 1977 to 1989, delivered a general course entitled "History of Astronomy". He was a co-author of the first (and still the only) Russian University book on the History of Astronomy (Eremeeva & Tsitsin 1989). Similar to his Teacher, Felix Tsitsin was an attentive elder friend to his students. He supervised student groups and accompanied them to summer practical courses at the SAI Crimean station. His students often won graduation competitions, and he even helped them to solve their family problems from time to time. Tsitsin's scientific and pedagogical work lasted for fifty years (1954–2004). For about ten years, he was a deputy head of the Astronomy department (years – alas – lost to his scientific research), and starting from 1983, a senior researcher of the SAI. He was a member of History and Methodology of Natural Sciences department at the MSU Council; of the all-Russian philosophical society; participated in a number

of Russian and international scientific conferences. He published over 150 scientific papers, though a large (and maybe most important) part of his scientific heritage remain as manuscripts. F.A. Tsitsin was honored as a Distinguished Scientist of the MSU.

The year following P.P. Parenago's sudden death, F.A. Tsitsin, together with his other colleagues and students, published a series of historical reviews of his short but substantial life (Tsitsin 1961 and other articles in the same issue). In his monograph on cosmogony, Tsitsin once again recalled his teacher not only as a stellar astronomy specialist but also as the one who played an unexpectedly significant role in planetary cosmogony (Tsitsin 2009, pp. 143–147).

In 2008, the same series (Studies in the History of Astronomy, Issue XXXIII, pp.300–358), proceedings of a memorial conference dedicated to the late Felix Tsitsin were published. On these pages, they met once again — the unique Teacher and one of his most brilliant Followers.

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