



On the 100th anniversary of Dmitry Viktorovich Korolkov

N. Nizhelsky

Special Astrophysical Observatory of the Russian Academy of Sciences,
Nizhny Arkhyz, 369167 Russia

DOI: 10.26119/2025-moc09
eLocator: moc09

EDN: pazcey

Abstract. Dmitry Viktorovich Korolkov (06.14.1925–01.10.1984) was a Soviet radio astronomer, Doctor of Sciences in physics and mathematics (1972). Dmitry Viktorovich was born in Gomel, Belarus. In 1942, he joined the Red Army as a volunteer and took part in the fighting of the Great Patriotic War. Dmitry Viktorovich was wounded twice and was demobilized in 1948. He was awarded State Awards – the Order of the October Revolution and the medals: For Battle Merit (twice), For the Defense of the Caucasus, and For the Victory over Germany (twice). D. V. Korolkov was the initiator of equipping the RATAN-600 radio telescope with highly sensitive receivers. First radiometers, including the cryogenic ones, were developed under his leadership. He was also a very cheerful and humorous person. This was evident from his funny drawings in wall newspapers.

Keywords: general: radio telescopes, continuum radiometers

I first met Dmitry Viktorovich on May 9, 1975. He was adjusting the antenna to the Sun at RATAN-600 feed cabin No. 1 (Korolkov and Pariiskii 1979). After our conversation, he tore off a piece of chart tape from the recorder, wrote down his address, and invited me and my wife to work. That was how our acquaintance with this remarkable man, and almost 50 years of work in the observatory, began.

Everything about him is unusual, even the facts of his biography. At the age of 17, he volunteered for the front in 1942 and took part in the unsuccessful Crimean Landing. Then, he said, he was enrolled in the reinforcements of the famous paratrooper detachment of Tsezar Kunikov, although that was after the brutal battles for Malaya Zemlya. They didn't accept everyone...

He graduated from the Leningrad Polytechnic Institute. Our colleague G. B. Gelfreich recalled that during his studies, student D. V. Korolkov failed the exam in radio engineering, and a few years later the same professor came to Korolkov to explain to him how it was possible to obtain a sensitivity several orders of magnitude better than the receiver's own noise, and the yesterday's student had to tell the professor about that very mysterious "radiometric gain" (the square root of receiver bandwidth multiplied by accumulation time). This was a completely new direction in radio engineering, and even in the 1970s everything related to radiometry was still printed in small print in textbooks on microwave electronics. He wrote in detail about radiometry and receiver designs in a section of the "handbook" for radio astronomers (N. A. Esepkina, D. V. Korolkov, Yu. N. Parijskij Radio telescopes and radiometers, Moscow, Nauka, 1973).

Dmitry Viktorovich was Head of the RATAN-600 Department of Radio Astronomy Instrumentation and supervised the development of the receiving equipment for solar observations, spectral studies, continuum, and antenna adjustments. In the absence of Yu. N. Parijskij, he always replaced him, solving all current problems. It can be said that he raised several generations of radiometry engineers for many scientific institutes in the country. He was not only my first supervisor but also a role model in everything: in work, in life, and in moments of rest.

Dmitry Viktorovich was phenomenal in his ability to convince and achieve results. I have seen his rationale for the construction of a new RATAN-600 Automation and Electronics Building: "But how can one justify such obvious things?! D. Korolkov." And in 1986 we had already moved to new laboratories. He planned there even a section for the technology of integrated circuits, which were so necessary for radio astronomy equipment.

Below, I will tell you about several developments of radio receiving equipment that he supervised. As a rule, he also participated in the most important works and experiments. At that time, there were still no suitable microwave transistor amplifiers, and the parametric amplifiers (paramps) were with the lowest noise. These were complex devices with ferrite circulators, the diodes worked on reflection, and they also needed microwave pumping. But paramps could be cooled down to cryogenic temperatures. The 3.9 cm radiometer, with which the first observation at RATAN-600 took place on July 12, 1974, was also based on parametric amplifiers with cooling. At first, liquid nitrogen was poured three times a day (8 liters of liquid nitrogen evaporated in 9–10 hours), then modern cryostats began to be used. There were also rules for constructing such radiometers: in each individual block there was no more than 20 dB of gain, the following stages were tunnel diodes, Gann diodes, and traveling-wave lamps. Klystrons were used as pumping, which required frequent adjustment. The modern radiometric module on HEMT microchips fits in the palm of your hand.

Korolkov D. led the creation of a highly sensitive cryogenic radiometer and the preparation of the RATAN-600 antenna for the first deep sky survey "Cold" (March 1978).

Sealing the slots and installing the grids covering the antenna foundation, as well as optimal irradiation of the antenna, made it possible to reduce its noise temperature by more than 10 K and reach 11.5 K. The 7.6 cm radiometer was built on the basis of a parametric amplifier pumped with Gann diodes (49 GHz) and cooled to 15 K by a closed-helium-cycle refrigerator. During the first survey of the sky, it was possible to obtain a then-record sensitivity of 5 mJy at 1 s of integration time.

His latest work concerned extremely deep two-dimensional sky surveys using a special conical secondary mirror and a highly sensitive cryogenic radiometer. In this observation mode, the entire

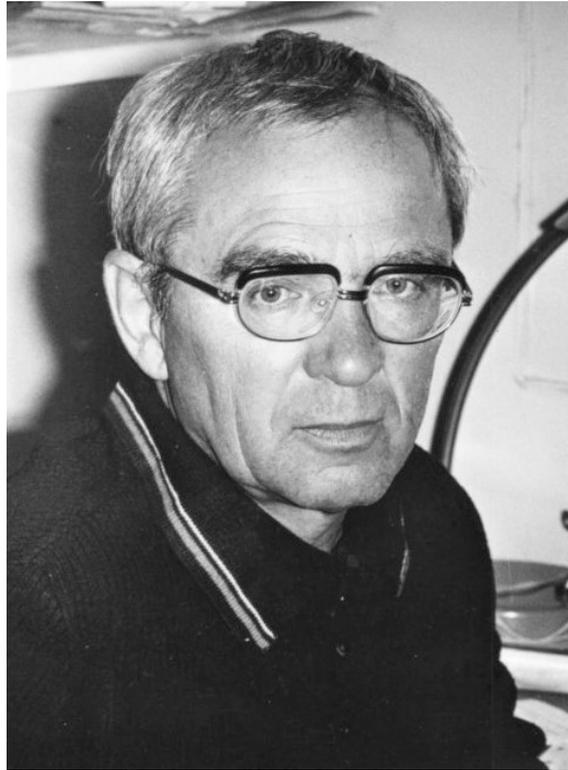


Figure 1. Dmitry Viktorovich Korolkov.



Figure 2. Generations of radiometer developers, D. V. Korolkov's fellows, at the RATAN-600 radio telescope.

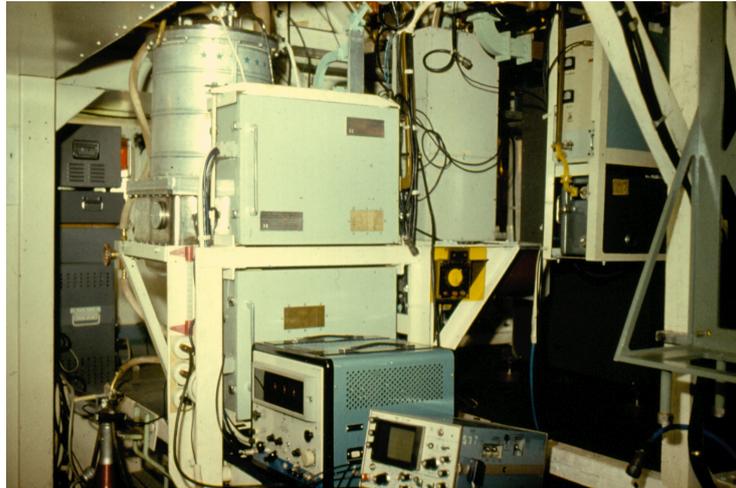


Figure 3. The first radiometers with parametric amplifiers at wavelengths of 3.9 and 2.08 cm.



Figure 4. Sealing the slots between the panels with aluminum foil to reduce noise at the Northern Sector of the antenna (D. V. Korolkov is on the right).

huge surface of the complete ring of the RATAN-600 antenna (about 14 000 square meters) was used, and it became possible to receive radiation from extremely weak radio sources. The first Zenith Field sky surveys were conducted after his death, in 1986.

The observations and life at the radio telescope were reflected in the issues of humorous wall newspapers. Dmitry Viktorovich had always been the editor-in-chief and the main artist, his comic drawings were always funny and kind. The most frequent hero of these drawings was the responsible scientist for RATAN-600, a corresponding member (and then a full member) of the Academy of Sciences Yury Nikolaevich Parijskij.

Every year, April 1st (Fool's Day) was celebrated with cocktails, jests, and practical jokes. Here is Order No. 13 of April 1st, 1981 on the transition of RATAN-600 to sidereal time: "The day that

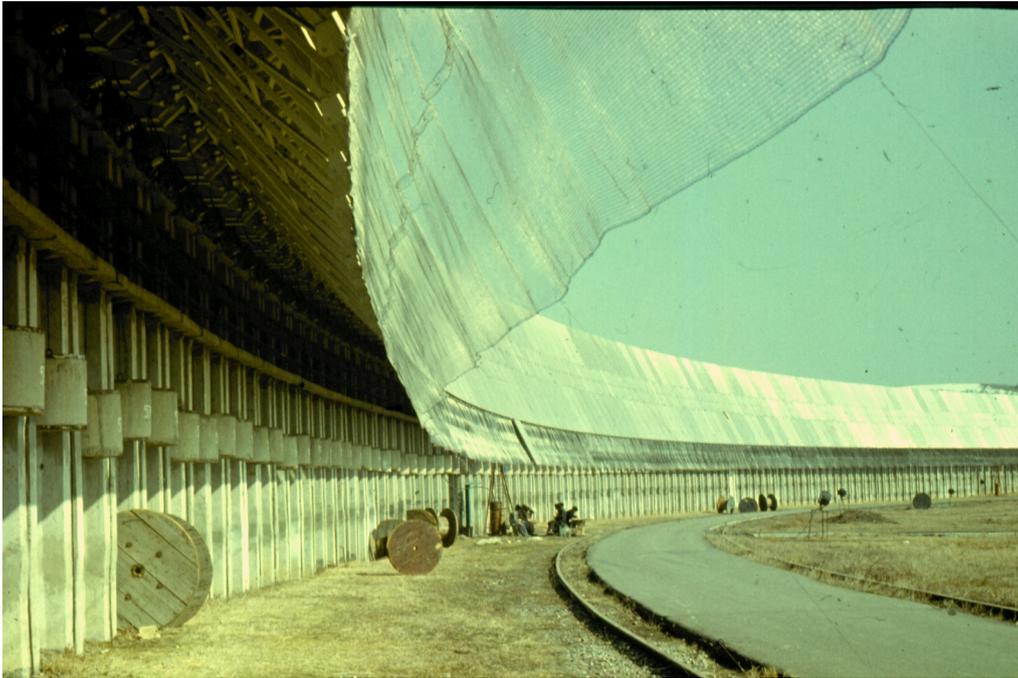


Figure 5. "Cooled" antenna.

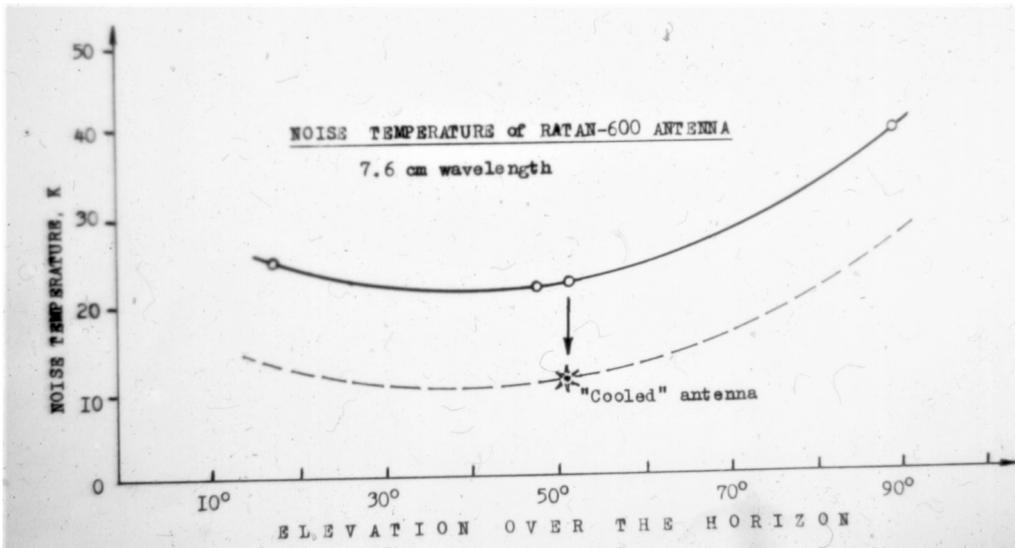


Figure 6. Noise temperature of the RATAN-600 antenna after the procedure of "cooling"

accumulates throughout the year due to the difference between sidereal and solar times will be set as an annual day off on April 1st."

Everyone who was lucky enough to work with Dmitry Viktorovich Korolkov will always have a bright memory of this extraordinary man and a wonderful teacher, who made a great contribution to the development of Russian radio astronomy.

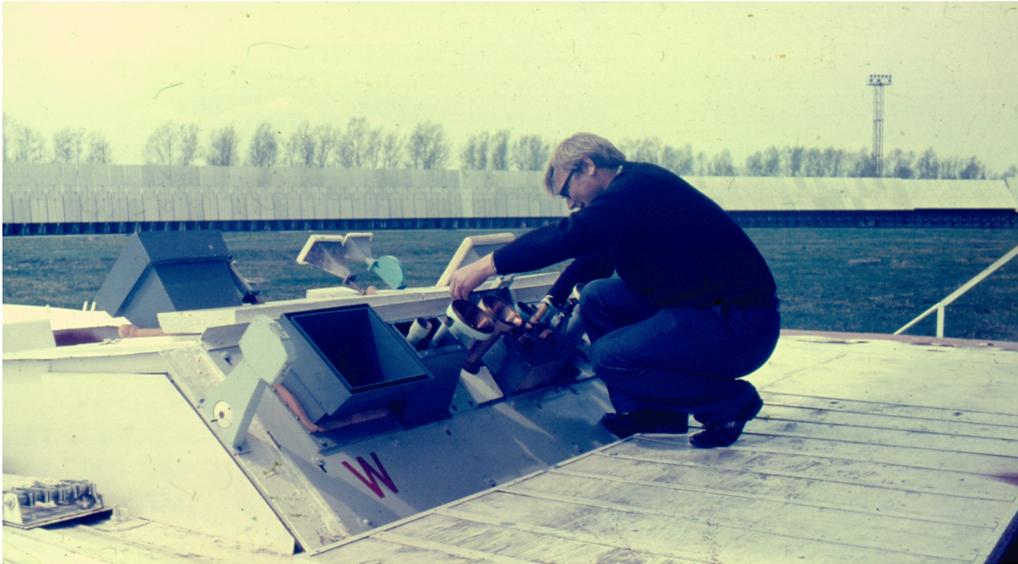


Figure 7. Focal line of secondary mirror No. 1 with the primary feeds.



Figure 8. Cryogenic radiometer at a wavelength of 7.6 cm.



Figure 9. Without waiting for computer processing of the obtained files, Yu. N. Parijskij discovered “sources,” “just noise,” and “events” in the diagram tapes of the first “Cold” survey. The “events” turned out to be the work of the paramp pumping control and the “gaiety” of radiometer cooling. We had to eliminate them urgently.

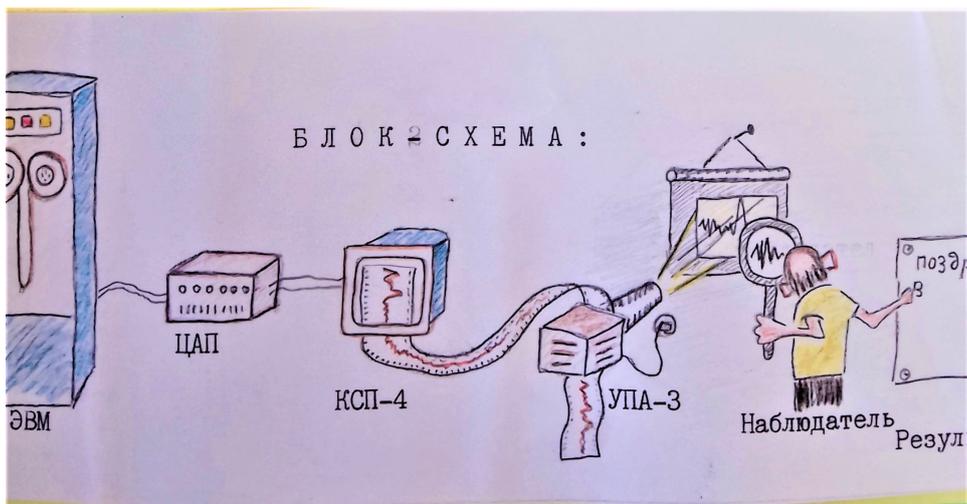


Figure 10. Another comic drawing is Yu. N. Parijskij’s processing of the “Cold” survey records using a children’s film strip projector. A comic copyright certificate, very similar to a real one, was also issued for this processing method.



Figure 11. An invitation to take advantage of a unique opportunity to look beyond the Border of the Universe!



Figure 12. The RATAN-600 precise time service.



Figure 13. Excursion to RATAN-600 for the Zelenchuk school-seminar on SETI at the Special Astrophysical Observatory (V. S. Troitsky, I. S. Shklovsky, D. V. Korolkov, October 1975).

References

Korolkov D.V. and Pariiskii Iu. N., 1979, *Sky and Telescope*, 57, p. 324