ALEXANDER Ya. ORLOV – WELL-KNOWN SCIENTIST AND RECOGNIZED ORGANIZER OF ASTRONOMICAL RESEARCH. LITTLE-KNOWN FACTS OF HIS LIFE

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ABSTRACT. Alexander Ya. Orlov is a well-known astronomer and geophysicist as well as a world-recognized organizer of scientific research in Russia, the USSR, and Ukraine. Orlov has formulated his main scientific ideas during the Odesa's period of life. He studied a tidal deformation of the Earth and its polar motion using the gravity and latitude observations. He has proposed new defenitions of a mean pole and a mean latitude, as wel as a new method for determing the Earth pole coordinates. To the end of 1940-ties, the Orlov's scientific ideas were implemented and stimulated a development of a research field, which is now called as Astro-geodynamics or Space Geodynamics. Among the representatives of the Orlov's scientific school are about 20 Doctors of Sciences and more than 40 Candidates of Sciences, including the members of Academy of Sciences of Ukraine and other countries. Among them are N.Stoyko-Radilenko (France), J.Witkowski (Poland), V.Zhardetsky (Yugoslavia-Austria-USA), D.Pyaskovsky, Z.Aksent'eva, E.Lavrentieva, N.Popov, E.Fedorov and A.Korol in Ukraine. The deserved followers of the Orlov's scientific ideas were also I.Androsov, I.Dyukov, K.Mansurova, B.Novopashennyj, N.V.Zimmerman in Russia and M.Bursa (Chesh Republic), who worked with him, as well as his sons, A.A.Orlov and B.A. Orlov.

The Orlov's life and scientific activity were fully described in many articles. For that reason in this paper we will focus on the little-known facts of the Orlov's scientific-organizational activity, for example, the Orlov's appointments as a director of observatories in Odesa, Poltava, m.Pip-Ivan, Pulkovo, and Kyiv; interesesting facts related to his membership in the Academies of Sciences of the USSR and Ukrainian SSR; organization of a large-scale program on the latitude observations and gravimetric survey. We describe briefly his life and his astrogeodynamic scientific school.

Key words: History of astronomy; Personalities: A.Ya. Orlov (A. Orloff): biography.

Figure 1: A.Ya. Orlov (1880, Smolensk – 1954, Kyiv).

1. Introduction

Alexander (Olexandr) Ya.Orlov is a well-known astronomer and geophysicist as well as a recognized organizer of scientific research in Russia, the USSR, and Ukraine. The Orlov's life and scientific activity were fully described in many articles (see, for example, Aksent'eva, 1961; Fedorov, 1980; Korsun', 2003) as well as were written himself (published in (Orlov, 1997)). His "Selected papers" were issued in 1961. Since 1980, the Special Orlov's conferences "Study of the Earth as a planet by methods of astronomy, geodesy and geophysics" were organized in Kyiv (1980), Poltava (1986), Odesa (1992), and Kyiv (2009) as well as the Special Orlov's sessions at the International conferences JOURNEES in Paris (1998) and St. Petersburg (2003). In our paper "A.Ya. Orlov and his astrogeodynamical scientific school" (Yatskiv, Korsun', Vavilova, 2005), we provided also the Orlov's biography and analyzed attentively his principal scientific ideas, which were developed later by representatives of his scientific school. For that reason in this article we will focus on the little-known facts of the Orlov's scientific-organizational activity describing briefly his life.

Table 1: The key stones of a biography by A.Ya.Orlov (Archive of the NAS of Ukraine. A.Ya.Orlov, Personal Dossier)

Years	Position	Place of work
1901	Assistant-astronomer at the Pulkovo Observatory (summer period)	Pulkovo
1902-1905	Post-graduated student at the St. Peterbourg University	St. Peterbourg
1903-1905	Foreign feloowship	
1905-1907	Assistant-astronomer at the Observatory of the Tartu University	Tartu
1907-1908	Assistant-astronomer at the Pulkovo Observatory	Pulkovo
1908-1912	Astronomer-observer at the Observatory of the Tartu University	Tartu
1912-1934	Professor and Director of Observatory, Odesa University	Odesa
1926-1934	Director of the Poltava Gravimetrical Observatory AS UkrSSR (part-time)	Poltava
1919-1922	Member of the Ukrainian Academy of Sciences	Kyiv
1927	Corresponding-member of the AS USSR	Moscow
1934-1938	Professor of the P.K. Shternberg State Astronomical Institute	Moscow
1934-1938	Professor of the Institute for Geodesy and Cartography	Moscow
1938-1941	Director of the Poltava Gravimetrical Observatory AS UkrSSR	Poltava
1939	Member of the AS UkrSSR (secondly elected)	Kyiv
1939-1941	Director (part-time) of the Carpatian Observatory	m. Pip-Ivan
1941-1943	Director of the Poltava Gravimetrical Observatory AS UkrSSR	Irkutsk
1943-1944	Director (part-time) of the Pulkovo Observatory	Pulkovo
1943-1951	Director of the Poltava Gravimetrical Observatory AS UkrSSR	Poltava
1945-1948	Director of the Main Astronomical Observatory AS UkrSSR	Kyiv
1951-1952	Director of the Main Astronomical Observatory AS UkrSSR	Kyiv

The key data of the Orlov‘s biography are given in Table 1 as it follows from his Personal file of life (Archive of the NAS of Ukraine. A.Ya. Orlov, F. 251, op. 293, Personal Dossier No. 4). Hereafter we will use the present-day names of organizations and cities indicating sometimes their previous names.

2. Orlov‘s activity in 1902-1912

In 1902, A.Ya.Orlov graduated from the St. Petersbourg University with a diploma of the first degree and was left to prepare for teaching. In a short time after this, in 1903, he went abroad for three year period being financially supported by his aunt, Mrs. E.Witte (who put Orlov in ward since 1891). Orlov has attended the lectures of the well-known scientists (Poincare, Angel, Picard and others) in Paris. Afterwards he worked at the Geophysical Observatory in Gottingen and studied celestial mechanics in Lund.

After returning from foreign trips to Russia, Orlov has occupied the assistant position at the Astronomical Observatory of the Tartu University and was soon appointed as an assistant editor of the “Seismic Bulletin” of the Russian Academy of Sciences (RAS). In 1907, he returned to Pulkovo for observations of latitude variations with zenith telescope. In 1908, Orlov published (on the proposal by Prof. A.F.Bredikhin) his first paper on the Perseid‘s observations in the Proceedings of the RAS.

In 1908, Orlov was elected as an astronomer of the Tartu University and moved to Tartu again. Here he conducted observations of plumb line variations using a horizontal pendulum. In 1910, he obtained a Master Degree in astronomy and geodesy for his work “The first series of observations of the deformations of the Earth under the influence of the lunar-solar tides with a horizontal pendulum in Yur‘yev (Tartu)”. In the same year he was elected as an assistant professor at the Tartu University and a member of the Standing Seismic Commission of the RAS.

In 1911, Orlov took part in the International Seismic Congress in Manchester, where he submitted the proposal for organizing a wide world net of gravimetric stations to observe the lunar-solar tides, including the Siberia region (Tomsk city), the USSR. This proposal was accepted, and Orlov was elected as a member of the International Commission for Study of elastic deformation of the Earth. Meanwhile, in 1911, Orlov traveled to the USA to visit the Yerkes Observatory for studying the comet’s plates taken by Bernard. The result of this work was published in several papers on the theory of cometary forms. Returning to Russia in 1912, Orlov (together with A.M.Chizhitsky and P.K.Sobolevsky) undertook the complicated expedition to Siberia for gravimetric measuring on the Tobol‘sk-Tomsk-Biisk route. At the same time a new gravimetric station was built in Tomsk according to the Orlov‘s plan (this station worked with some interruptions in 1912-1920).

3. Odesa's period of the Orlov's life (1912-1934)

The Orlov's scientific and organizational skills were recognized, and, on December 1912, he was elected as a professor of the astronomy department and director of the Astronomical Observatory of the Odesa University. Orlov pointed out in his biography: *"After what I saw abroad in Europe and America, the Odesa Observatory has made me a very bad impression. I wanted to create an observatory which will meet the contemporary level of science and wanted to bring it out of sleepy state"*.

Besides of the observatory governing Orlov found time for teaching astronomy at the University and for scientific work. He lectured spherical and theoretical astronomy, celestial mechanics and higher geodesy. In 1915, he made reduction of the Tartu, Tomsk, and Potsdam observations of the lunar-solar tides for deriving the elastic properties of the Earth, and obtained for this work a doctorate in astronomy and geodesy in St.Peterbourg. In 1916 and 1917, Orlov undertook two expeditions to determine the force of gravity in the Altai region. This hard expedition was conducted at the mountainous Altai at high altitudes, in rainy weather, and with poor communication conditions. Nevertheless, this work was completed in 1917, even during the Civil War. Remarks by Orlov: *"On the way back from the Altai to Odesa, I fell ill with typhus in a very severe form and after prolonged unconsciousness I woke up in a struggle for a new order of life"*. And in this "a new order of life" there have been significant events in a life of the country, and the Orlov's personal life.

The Orlov's activity in Odesa Observatory was recognized too. In 1919, he was elected as a member of the newly organized (in 1918) the All-Ukrainian Academy of Sciences (AS UkrSSR, at present, the National Academy of Sciences of Ukraine (NAS of Ukraine)). According to the plan proposed by its founding president, Vladimir Vernadsky, the Central Astronomical Observatory of Ukraine should be established in an academic structure. And Orlov has begun to fulfill this task. At the same time, he was appointed as a rector of the Kyiv University and professor of the Astronomical Observatory of this university (unfortunately, no documents have been found, which explain why Orlov had not served for these duties).

For implementation of a plan on the establishing an academic observatory Orlov has created the Astronomical Computing Bureau headed by the Kyiv astronomer M.Dichenko (Tchernega, 1969). The Bureau had a duty to choose the site for an observatory and to develop a plan of its construction. In 1921, Orlov asked in a letter to the General Meeting of the AS UkrSSR *"to provide a land of one square mile near the grave of Taras Shevchenko and to appoint a special academic commission for a final selection of the observatory site near Kaniv city"* (Fig. 2). At that time he was not able to come often to Kyiv because of great difficulties of transportation between Kyiv and Odesa as well as of a family situation (six children) and a lack of appropriate apartment in Kyiv.

When Orlov was out of Kyiv, the decision about closing the Astronomical Computing Bureau was accepted, that was in fact a cessation of observatory's construction. Orlov took it as a personal outrage and distrust. He refused the status of a member of the Academy and other honorary positions in Kyiv in protest on such a decision. Orlov wrote in his official letter (Fig. 3): *"... Because the institutions entrusted to me can be destroyed by the Ukrainian Academy itself and because the reasons, for which it have been already happened as to the Astronomical Computing Bureau, did not tally with my high view on an authority of the Ukrainian Academy of Sciences, I has to decline the honor to be Ukrainian academician and ask to exclude me from the list of members"*. But the idea of establishing the Central Astronomical Observatory with the academic status did not leave him and was realized in 1944.

So, in the 1920-ties Orlov concentrated his activity in Odesa. These years have been very heavy both for the Odesa Observatory and the Orlov's family. Nevertheless, in a short period of time, there were realized scientific programs and projects aimed to support an economic development in Ukraine. Among them were a restoration of the triangulation network from the Dniester river to the Dniper river; preparation of the Marine astronomical calendar; leveling the Odesa coast for determining the movement of soil; development of an Ukrainian gravimetric network for mineral's search (see, in details, Tsesevich, 1980; Karetnikov, 1996, 2012; Volyanska et al., 2005).

To provide the Odesa Observatory with gravimetric instrumentations Orlov decided to undertake in 1923-1924 a perilous trip from Odesa to Tomsk. As Orlov noted: *"These trips were faced with difficulties. It was exceptional. Now I wondered how I could cope with all these things. And I managed not only all that was planning, but has done something more"*. Everybody who was acquanted with the Orlov's life and work has been also surprised by this undertaking. So, after overcoming all difficulties, Orlov delivered gravimetric devices to Odesa. Moreover, being in Irkutsk he persuaded V.K.Abolt, professor of the Irkutsk University, to organize the latitude observations in Irkutsk.

In 1924-1926, Orlov headed a large-scale program on the gravimetric survey of the areas of Ukraine. In 1926, with this aim and on the Orlov's proposal, the Poltava Gravimetric Observatory was established in the AS UkrSSR structure. At the same year Orlov was charged by the Academy of Sciences of the USSR (AS USSR) to travel to Nizhny Novgorod for choosing the site for a new gravity station (later the Gorky Latitude Station was organized).

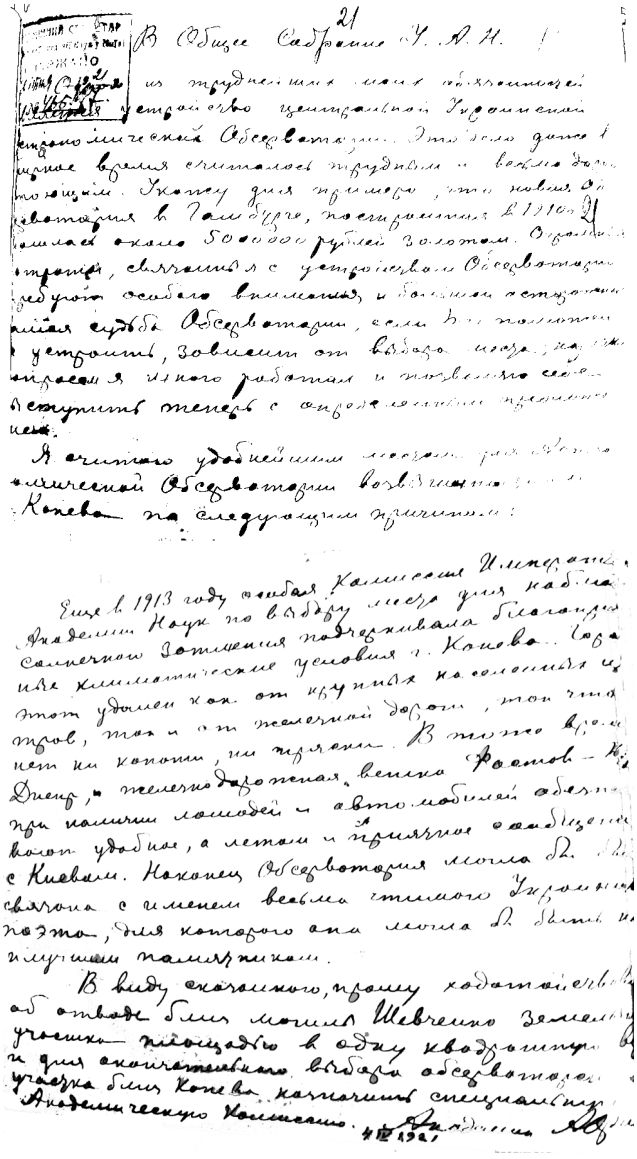

Figure 2: Letter by A.Ya. Orlov on April 4, 1921 with argumentation on a selection of the Kaniv site for an academic Central Astronomical Observatory in Ukraine (Archive of the NAS of Ukraine. A.Ya. Orlov, F. 251, op. 293, Personal Dossier No. 4, p. 21-22).

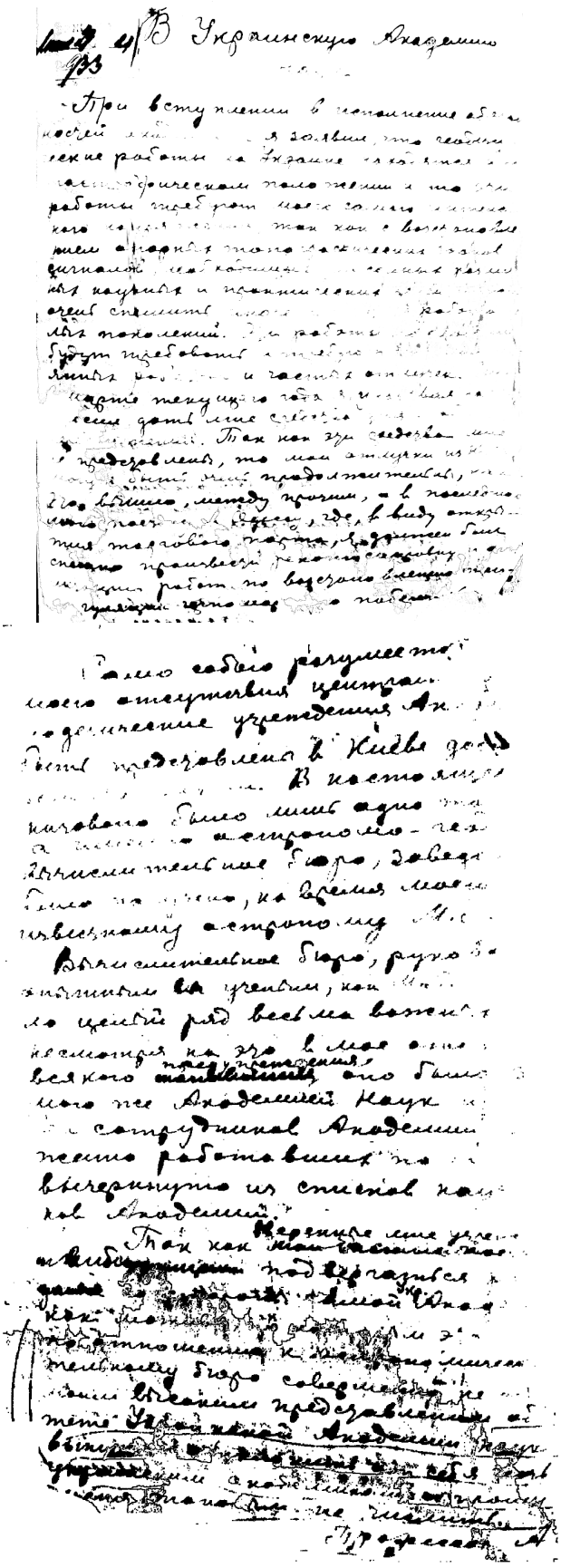

Figure 3: Letter by A.Ya. Orlov on July 29, 1921, in which he refused his status of a member of the AS UkrSSR in protest on the decision not to build an academic Central Astronomical Observatory in Ukraine (Archive of the NAS of Ukraine. A.Ya. Orlov, F. 251, op. 293, Personal Dossier No. 4, p. 40-41).

In 1927 A.Ya.Orlov was elected a corresponding member of the AS USSR, and in 1928 an honorary member of the Society of Natural History in Moscow.

4. Orlov's actvivity in 1934-1954

In 1934, Orlov started his activity as a professor of the Sternberg State Astronomical Institute (the reasons, why he moved to Moscow, are not still cleared up). In 1937, he was appointed as an astronomer at the Institute of Geodesy and Cartography. Working in Moscow, he proposed a plan to organize the Soviet Latitude Service based on observations in Poltava, Ust'-Kamnogorsk, and Khabarovsk as well as took part in some projects concerned with the Moscow metro construction.

In 1938, he returned to the duties of a director of the Poltava Gravimetric Observatory. That year Orlov applied unsuccessfully to a membership in the AS USSR. But in 1939 Orlov was elected once again (the first time in 1919-1922) as a full member of the AS UkrSSR. At the end of 1939, being appointed as a part-time director of the Carpathian Highaltitude Observatory, Orlov undertook a trip to the Pip Ivan mount for decission making whether the operation of this observatory could be possible (Korsun' et al., 1998). This observatory was constructed by the Polish government, but in 1939 its status was changed due to the Second World War realities. In 1940, the Carpatian Observatory began to work, but soon its activity was stopped by the war (today this observatory is under reconstruction in frame of a joint Ukrainian-Polish project). That year Orlov made also a trip to the Far East of the USSR for the choosing the site for constructing new latitude station.

On September 1941, Orlov organized the evaquation of the Poltava Observatory to Irkutsk. Here he erranged astronomical and geophysical observations under rigorous Siberian conditions. On October 1943, the staff of observatory removed to Poltava.

At the end of 1943, Orlov was appointed unexpectively for him as a part-time director of the Pulkovo Observatory, but very soon he left the director's position. There are several explanations for this decision. First of all, this is a private motivation, which is evidenced from the Orlov's letter appeal to the Presidium of the AS USSR: *"On January 20, 1944, I received an extract from the minutes of the administrative meeting of the Presidium on December 23, 1943 as concerns with my appointment as a director of the Main Astronomical Observatory in Pulkovo with subsequent approval by the General Meeting of the Academy of Sciences of the USSR. Of course, no one of astronomers should abandon the reconstruction of the Pulkovo Observatory. However, each of us must take in this affair a proper job. In view of the exceptional importance and difficulty of reneval of the Pulkovo Observatory, for which former glory and importance have to be returned, the chairperson of this observatory has to have the full confidence and high powers. Such a person can only be a member of the Academy of Sciences of the USSR, what I am not. Therefore I can not be a director of the Pulkovo Observatory. I have written repeatedly about this situation to the Presudium, to the Department of Physics and Mathematics, and to the Astronomical Council of the Academy of Sciences of the USSR. I ask kindly again to put the question about the election of a director of the Main Astronomical Observatory among the members of the Academy at the forthcoming General Meeting. I ask kindly not to consider my candidature for this appointment... Member of the AS UkrSSR, A.Ya.Orlov, January 28, 1944"* (Archive of the RAS. A.Ya.Orlov, Personal Dossier, F. 411, op. 4-A, No. 97). By the way, the Orlov's candidature was proposed for the full membership in the AS USSR, but he was not elected again. It might be related to his own principal position mentioned in this letter.

The second reason is concerned with that, in the same year, Orlov raised once again an issue on the construction of the Central Astronomical Observatory in Ukraine. The decision was accepted by the AS UkrSSR and supported by the Government of the Ukrainian SSR. In 1944, Orlov was appointed as a director of the Main Astronomical Observatory of the AS UkrSSR and was obligated to start to a very crucial work on its establishment in the after war economic realities. In other words, Orlov had to realize his own idea proposed yet in 1921.

Alexander Ya.Orlov served as a director of the Main Astronomical Observatory of the AS UkrSSR in years of 1944-1948 and 1951-1952. He conducted a lot of work for its construction and spent the most of his energy. At the same time, in the last years of life, Orlov did not stop his scientific activity and put forward many ideas, first of all, altogether with collaborators from the Poltava Gravimetric Observatory in the work of the Soviet Latitude Service in frame of the International Latitude Service (see, Aksent'eva, 1961; Dychko et al., 1980; Matveev, 1980; Fedorov, 1980; for overview of the Orlov's activity in this observatory) as well as for standing the perspective research fields at the Main Astronomical Observatory of the AS UkrSSR altogether with its new staff. On January 14, 1951 Orlov wrote to the Presidium of the AS UkrSSR: *"I bring to the attention of that thanks to the hard work of the staff of the Main Astronomical Observatory of the AS UkSSR in 1951, its two main instruments, vertical circle and a large astrograph-400mm, long after their inaction are finally in a state that they can now start a regularly scheduled work. In addition, last year the instrument of great importance is purchased, and microphotometer is established, as well as a plan to build the Observatory is approved. Writing this, I'm with a sense of duty once again ask the Bureau to relieve me of the administrative work for the post of director of the Main Observatory, as it is to me no more in force, nor on health. After retiring on a pension, I'm done I started some work, bring more benefit, and will not be*

Figure 4: Astronomical Observatories headed by A.Ya.Orlov. From left to right: Astronomical Observatory, I.I.Mechnikov Odesa National University (1912-34); Poltava Gravimetrical Observatory, Institute of Geophysics, NAS of Ukraine (1926-34, 1938-51). Carpatian Observatory (1939-41); Pulkovo Observatory, RAS (1943-44). Main Astronomical Observatory, NAS of Ukraine (1945-48, 1951-52) (photo is taken by P.Korsun).

dependent. There are no shortage of candidates in my place. The Department of Physics-Mathematics and Chem. Sciences appoints of them worthed. That would facilitate and improve the selection, it is necessary to eliminate discrimination of a director of the Main Observatory, when for large and responsible work is assigned him to pay 25 % less than the directors of other academic institutes". (Archiv of the NAS of Ukraine. A.Ya.Orlov, F. 251, op. 293, Personal Dossier No. 4, p.152). In 1948-1950, Prof. V.P.Tsesevich headed (part-time) the Main Astronomical Observatory of the AS UkrSSR being at the same time the director of the Astronomical Observatory of the Odesa University. In 1952, A.Ya.Orlov handed over the directorship of this observatory to Prof. A.A.Yakovkin.

5. The Orlov's Scientific School

A.Ya.Orlov has formulated his principal scientific ideas during the Odesa's period of his life. He studied a tidal deformation of the Earth and its polar motion using the gravity and latitude observations. He has proposed new defenitions of a mean pole and a mean latitude, as wel as a new method for determing the pole coordinates. To the end of 1940-ties, A.Ya.Orlov was recognised as a world wide expert in this field of research, which is now called as Astrogeodynamics or Space Geodynamics (Yatskiv, 1998). Among the representatives of the Orlov's scientific school are about 20 Doctors of Sciences and more than 40 Candidates of Sciences, including the members of Academy of Sciences of Ukraine and other countries. Some of them conducted their thesises

in Odesa, Poltava, and Kyiv under the Orlov's supervision: J.Witkowski (Poland), N.Stoyko-Radilenko (France), V.Zhardetsky (Yugoslavia-Austria-USA), D.Pyaskovsky, Z.Aksent'eva, E.Lavrentieva, N.Popov, E.Fedorov and A.Korol in Ukraine (Yatskiv et al., 2005; Rikun, 2005; Yatskiv & Vavilova, 2011). The deserved followers of the Orlov's scientific ideas were also his sons, A.A.Orlov and B.A.Orlov (Neizvestnyj, 2001). N.Stoyko wrote: *The last time I met Orlov at the International Astronomical Congress in Zurich in 1948. Despite heavy administrative duties, his studies of the motion of the pole of the Earth were in full swing. However, his ideas about a Latitude Service and a mean pole of epoch did not attract enough attention to be too innovative. Only in 1958, after the Orlov's death, his ideas have been universally recognized the International Astronomical Congress in Moscow... Orlov could not even dream that his methods, ten years after his death, will be used to determine the coordinates of the instantaneous pole of the Earth using the results of 31 astronomical stations. He himself could calculate the coordinates of the instantaneous pole of the Earth, using a maximum of 9 astronomical stations"* (Stoyko-Radilenko, 1969).

A wider continuation of the Orlov's research in field of geodynamics and nutation, i.e. the motion of Earth pole in space, is related to the works by E.Fedorov with colleagues from Poltava and Kyiv (the second generation of the Orlov's scientific school) (see, Korsun', 1989). Since the 1970-ties, astronomical and space observation techniques (laser ranging of the Moon and satellites, GNSS observations, VLBI, etc.) was put for studying the Earth rotation as related to the polar rotation motion, precession-nutation motion, and other geodynamical phenomea (Yatskiv, 1998, 2003; Paton et al., 2001; Pavlenko et al., 2006).

This transformation from classical to new techniques for studying the Earth rotation was initiated in Ukraine by Ya.Yatskiv with colleagues from the Main Astronomical Observatory in a tight international cooperation (the third generation of the Orlov's scientific school).

6. Instead of conclusion

A.Ya.Orlov was the outstanding scientist and organizer of astronomical research being principal in persistance of own opinions. He has played a decisive role in the development of astronomy in Ukraine in the XX century. The best evidences are both his astrogeodynamics scientific school and directorship at the five observatories, for two of those (in Poltava and Kyiv) he was a founder (Fig. 4).

Evgen P.Fedorov (1909-1986), member of the AS UkrSSR, has successfully followed the Orlov's study of the Earth rotation and put it in a theory and practice at the new higher level (Korsun' et al., 1989; Korsun', 2000, 2005). He became a well-known expert in the nutation theory, positional astronomy, and astronomical data analysis (President of the IAU Commission 19 in 1955-1061, Head of the Commission on the Earth rotation of the Astronomical Council of the AS USSR in 1962-1966). In 1980, E.P.Fedorov noted in his paper "Alexander Yakovlevich Orlov: Life, Activity, and Scientific Heritage" about foresight that Alexander Ya.Orlov has written just before the death in 1954: "'Through 15 or 20 years the study of the latitude variations and polar motion will be improved and will cover another research fields than it is now". It was happened.

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