Genealogical tree of Russian schools on Nonlinear Dynamics

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Abstract

One of the most prominent feature of research in Russia and the former Soviet Union is so-called scientific schools. It is a collaboration of researchers with a common scientific background working, as a rule, together in a specific city or even at an institution. The genealogical tree of scientific schools on nonlinear dynamics in Russia and the former Soviet Union is grown. We use these terminology in a broad sense including theory of dynamical systems and chaos and its applications in nonlinear physics. In most cases we connect two persons if one was an advisor of the Doctoral thesis of another one. It is an analogue of the Candidate of Science thesis in Russia. If the person had no official advisor or we don't know exactly who was an advisor, we fix that person who was known to be an informal teacher and has influenced on him/her very much.

1. Introduction

The intent of our project is to grow a genealogical tree of nonlinear dynamics in Russia and the former Soviet Union. We use these terminology in a broad sense including theory of dynamical systems and chaos and its applications in nonlinear physics.

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One of the most prominent feature of research in Russia and the former Soviet Union is so-called scientific schools. It is a collaboration of researchers with a common scientific background working, as a rule, together in a specific city or even at an institution. Mandelstamm's, Landau's, Kolmogorov's, Tamm's, Andronov's are famous examples. We tried to specify a few schools including the Moscow mathematical school on dynamical system theory and the Nizhny Novgorod (former Gorky), Novosibirsk, Saratov and Vladivostok schools on nonlinear dynamics.

For better viewing the material is structured as follows. In Fig. 1 we present a general image of the Russian tree on nonlinear dynamics. It is a huge tree with the roots which we were able to trace down to the thirteen century. The picture can be zoomed using common Adobe Reader tools. Then we split the tree into two parts and show them separately. The first part in Fig. 2, which we call the Petrarch–Ockham branch, shows the roots which go down to medieval European naturalists and philosophers. The second part in Fig. 3 show British, German and Italian roots of the Nizhny Novgorod, Novosibirsk, Saratov and Vladivostok schools which go down to medieval Italian physicists and mathematicians. Each Russian scientific school is presented in detail in a separate section and is shown on a graph.

2. Moscow mathematical school on dynamical system theory

The fruitful Kolmogorov's mathematical school at the Lomonosov State University in Moscow is widely known for great achievements in dynamical system theory and mechanics by A. Kolmogorov (1903–1987) and his former students, V. Arnold (1937–2010), Ya. Sinai, I. Gel'fand (1913–2009), V. Alekseev (1932–1980), A. Yaglom (1921–2007), A. Obukhov (1918–1989), A. Monin (1921–2007) and many others. N. Luzin (1883–1950) was the Kolmogorov's doctoral advisor. The branches from N. Luzin go via the Russian mathematicians D. Egorov (1869–1931) and N. Bugaev (1837–1903) to the French mathematicians, J. Liouville (1809–1882), S. Poisson (1781–1840), P.-S. Laplace (1749–1827), J. Lagrange (1736–1813), J. d'Alembert (1717–1783) and to the German ones, K. Weierstrass (1815–1897), E. Kummer (1810–1893), F. Bessel (1784–1846), C. Gauss (1777–1855) and L. Euler (1707–1783). The other branch from N. Bugaev goes down to the German professor A. Kaestner (1719–1800). One of his branches goes upward to the mathematicians R. Lipschitz (1832–1903) and F. Klein (1849–1925) and then to the German physicist A. Sommerfeld (1868–1951) and his famous school on quantum physics. On another Kaest-
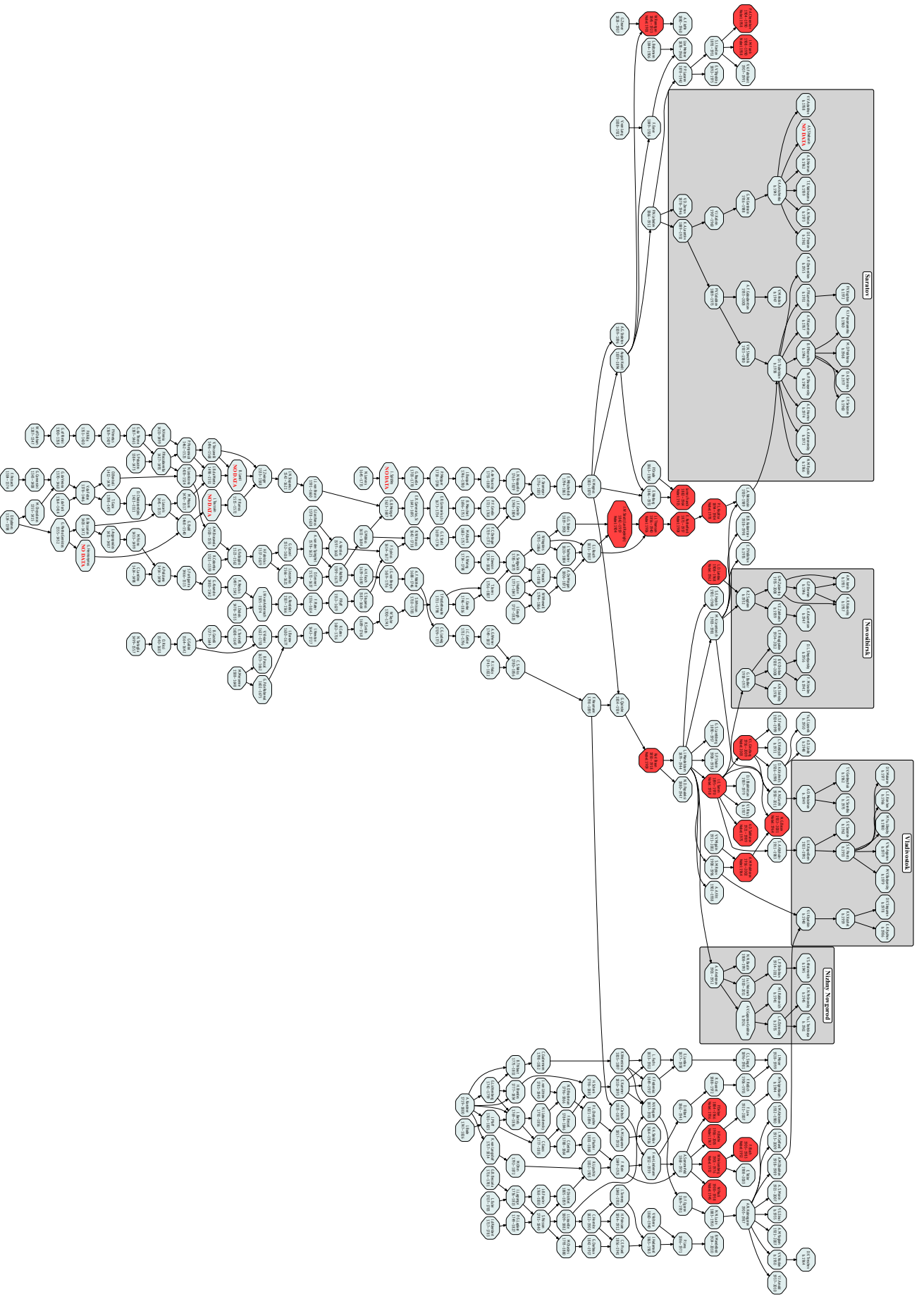
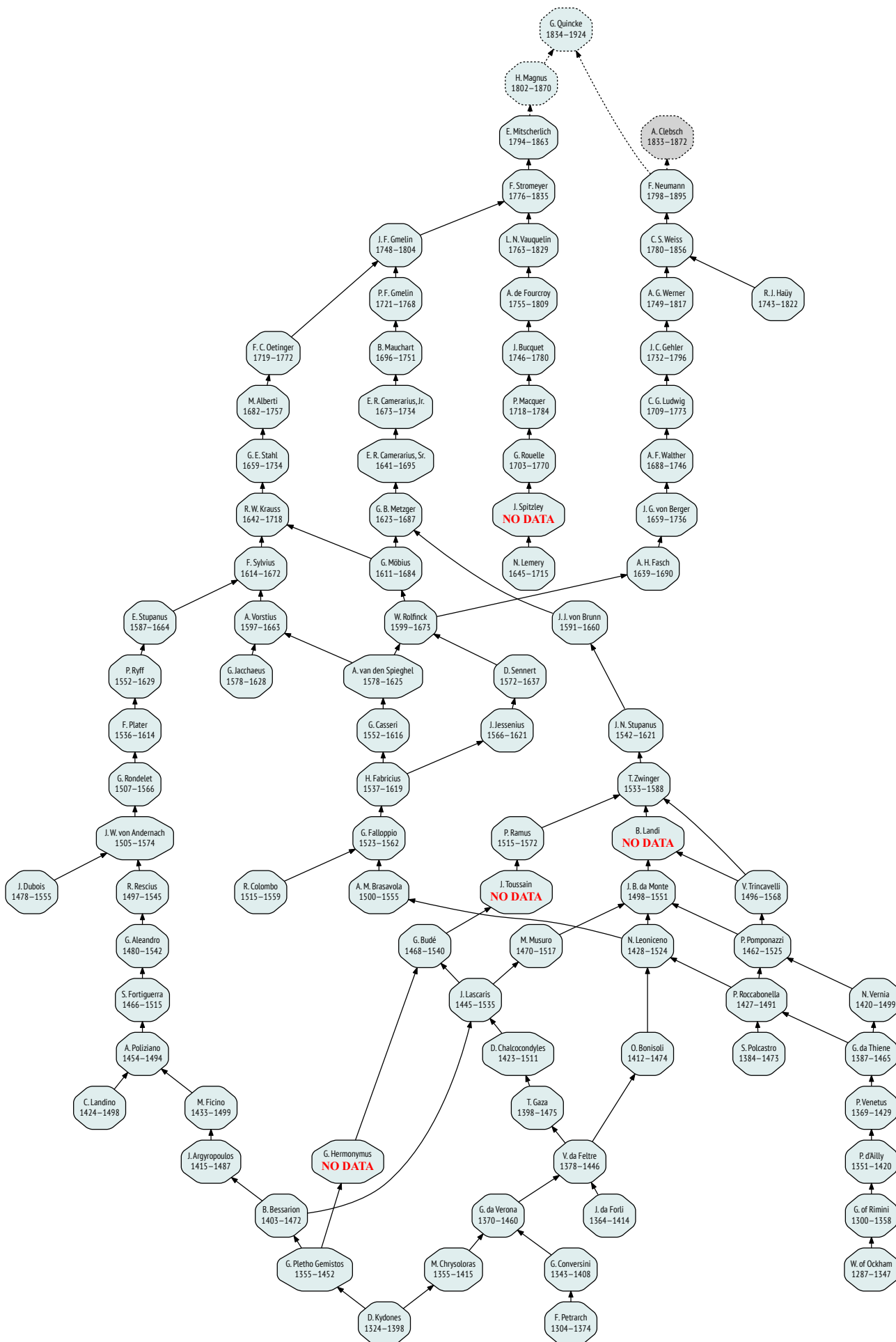Figure 1: The Russian tree on Nonlinear Dynamics.

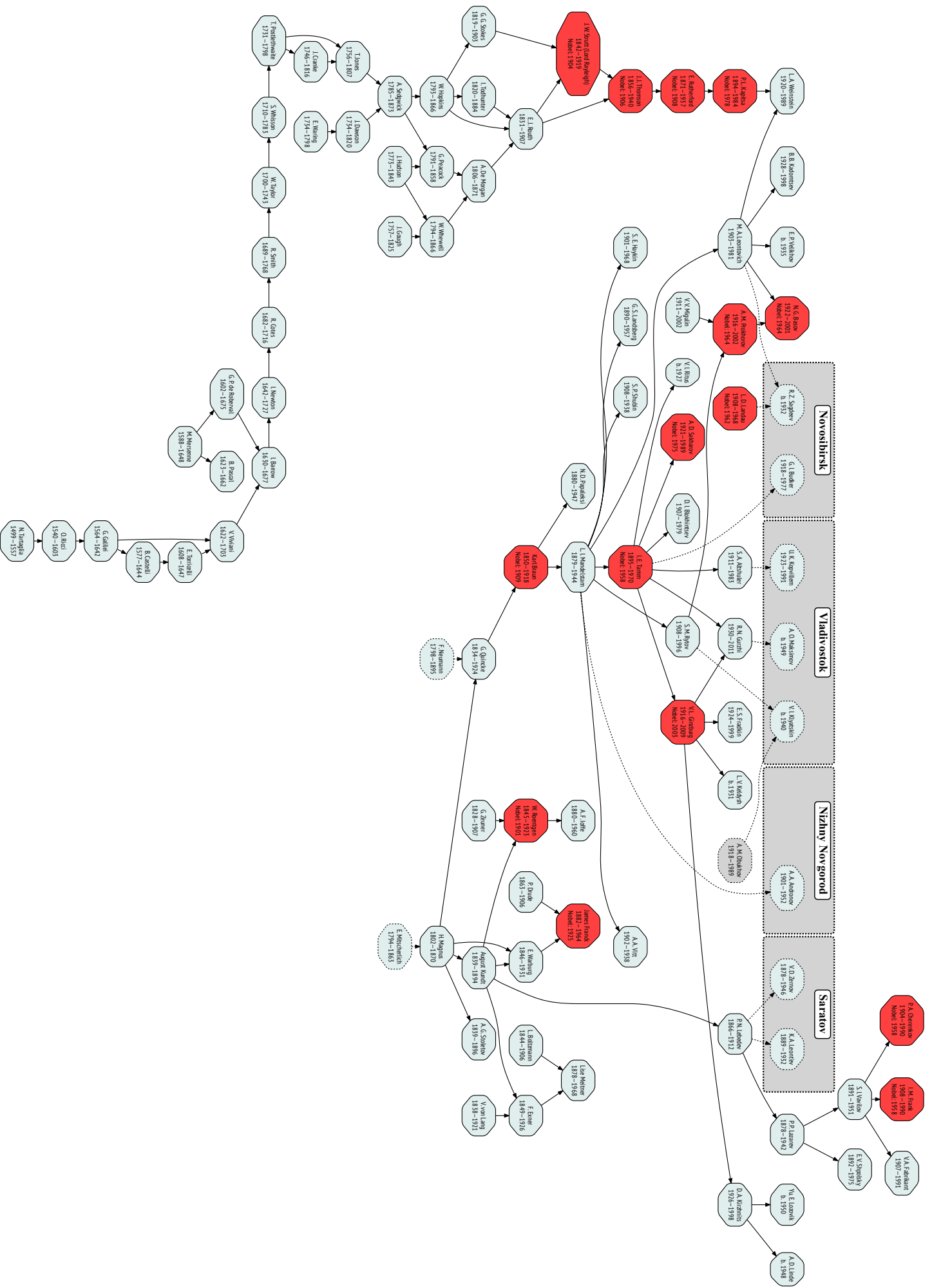Figure 2: The British–German–Italian branch. 🔽
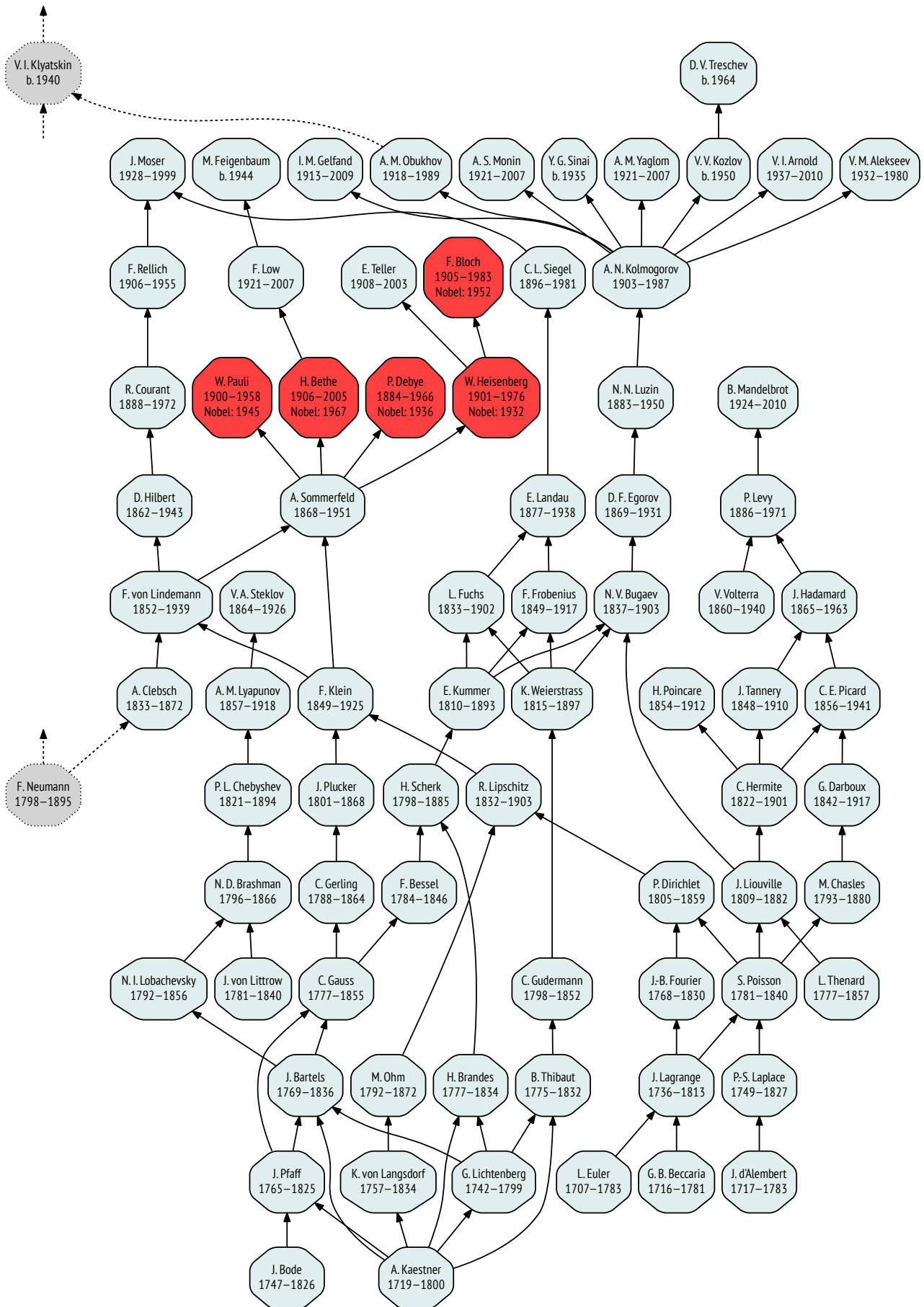
Figure 3: The Petrarch–Ockham branch.

Figure 4: The Moscow mathematical school on dynamical system theory. ⬇

ner's branch we meet the Russian mathematicians N. I. Lobachevsky (1792–1856), P. L. Chebyshev (1821–1894) and A. M. Lyapunov (1857–1918).

3. Nizhny Novgorod (former Gorky) school on nonlinear oscillations and dynamical system theory

The Nizhny Novgorod (former Gorky) school on nonlinear oscillations and dynamical system theory was founded by A. Andronov (1901–1952) who was a student of L. Mandelstam (1879–1944). K. Braun (1850–1918), a German inventor and Nobel laureate in physics, was Mandelstam's doctoral advisor. That branch via the German scientists G. Quincke (1834–1924), H. Magnus (1802–1870) and F. Neumann (1798–1895) goes, on one hand, to the German physicists and mathematicians, A. Clebsch (1833–1872), D. Hilbert (1862–1943), A. Sommerfeld and others. The mathematical branch from D. Hilbert goes upward via R. Courant (1888–1972) and F. Rellich (1906–1955) to J. Moser (1928–1999). The other branch to J. Moser is connected to A. Kolmogorov via K. Weierstrass and E. Kummer (1810–1893) and N. Bugaev. Thus, all the authors of the famous Kolmogorov–Arnold–Moser theorem turn out to be scientific relatives. A. Sommerfeld was a doctoral advisor for a few Nobel laureates in physics, P. Debye (1884–1966), W. Pauli (1900–1958), W. Heisenberg (1901–1976), F. Bloch (1905–1983) and H. Bethe (1906–2005).

On the other hand, the branch from G. Quincke and F. Neumann goes down to medieval naturalists and to the great Italien poet F. Petrarch (1304–1374). The branch from G. Quincke and H. Magnus goes down to medieval naturalists and to the English Franciscan friar and philosopher W. of Ockham (1287–1347). Italien mathematician and engineer N. Tartaglia (1499–1557) from Republic of Venice has been found to be connected via G. Galilei (1564–1642), V. Viviani (1622–1703) and I. Barrow (1630–1677) to I. Newton (1642–1727). The Newton's branch goes upward to the British physicists including G. G. Stokes (1819–1903) and Nobel laureates in physics J. W. Strutt (Lord Rayleigh) (1842–1919), J. J. Thomson (1856–1940) and E. Rutherford (1871–1937) who was an advisor of the Nobel laureate in physics P. Kapitza (1894–1984).

4. Saratov school on nonlinear oscillations and chaos

One branch of the Saratov school on nonlinear oscillations and chaos goes from P. Kapitza to L. A. Weinstein (1920–1989) and then to D. I. Trubetskov who was a Doctoral advisor of many modern physicists and mathematicians in Saratov. The second branch of the Saratov school via K. A. Leont'ev (1889–1932) goes to the Russian physicist P. N. Lebedev (1866–1912), the first person who measurered the light pressure. He was a student of August Kundt (1839–1894) whose scientific roots are hidden in Middle Ages and could be traced to
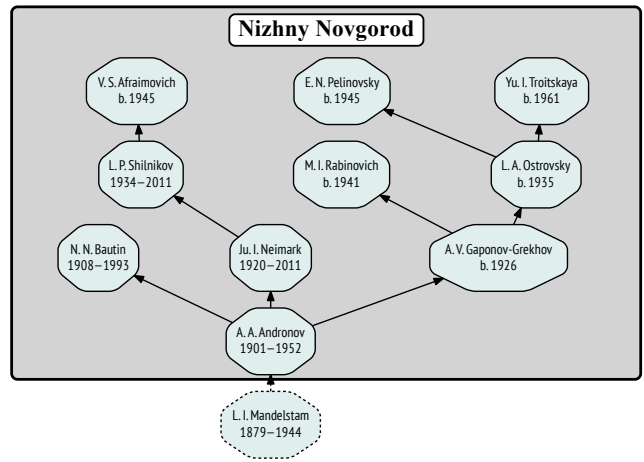

Figure 5: The Nizhny Novgorod (former Gorky) school on nonlinear oscillations and dynamical system theory.

W. of Ockham and F. Petrarch. It is interesting that the Saratov school via L. A. Weinstein and M. A. Leontovich (1903–1981) is connected again with L. I. Mandelstam.

5. Novosibirsk school on nonlinear physics and chaos

L. I. Mandelstam was also one of the founders of the Novosibirsk school on nonlinear physics and chaos. One Mandelstam's branch goes to M. A. Leontovich, then to R. Z. Sagdeev and his school on nonlinear physics including G. M. Zaslavsky (1935–2008) and V. E. Zakharov each of which has his one school in Siberia, Moscow and the USA. The other Mandelstam's branch goes to the Nobel laureate in physics I. E. Tamm (1895–1970) and then to G. I. Budker (1918–1977), a founder of the Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Sciences in Novosibirsk. B. V. Chirikov (1928–2008), known as one of the key persons in theory of Hamiltonian chaos, worked at that institute. We show only a small part of the Novosibirsk school which is much more extensive.

6. Vladivostok school on nonlinear oceanography and chaos

In fact, L. I. Mandelstam was a founder of all the Russian schools on nonlinear dynamics and nonlinear physics including the most remote and young one in Vladivostok. One Mandelstam's branch via I. E. Tamm, S. A. Altshuler (1911–1983) and U. Kh. Kopvillem (1923–1991) forms the modern Vladivostok school on nonlinear oceanography and dynamical system theory approch to study the ocean and atmosphere. The other one via the Nobel laureates in physics I. E. Tamm and V. L. Ginzburg (1916–2009) and R. N. Gurzhi (1930–2011) forms now the Vladivostok school on nonlinear oscillations and acoustics. The third Mandelstam's branch via S. M. Rytov (1908–1996) and V. I. Klyatskin forms the modern Vladivostok school on hydrodynamical chaos and statistical physics. This
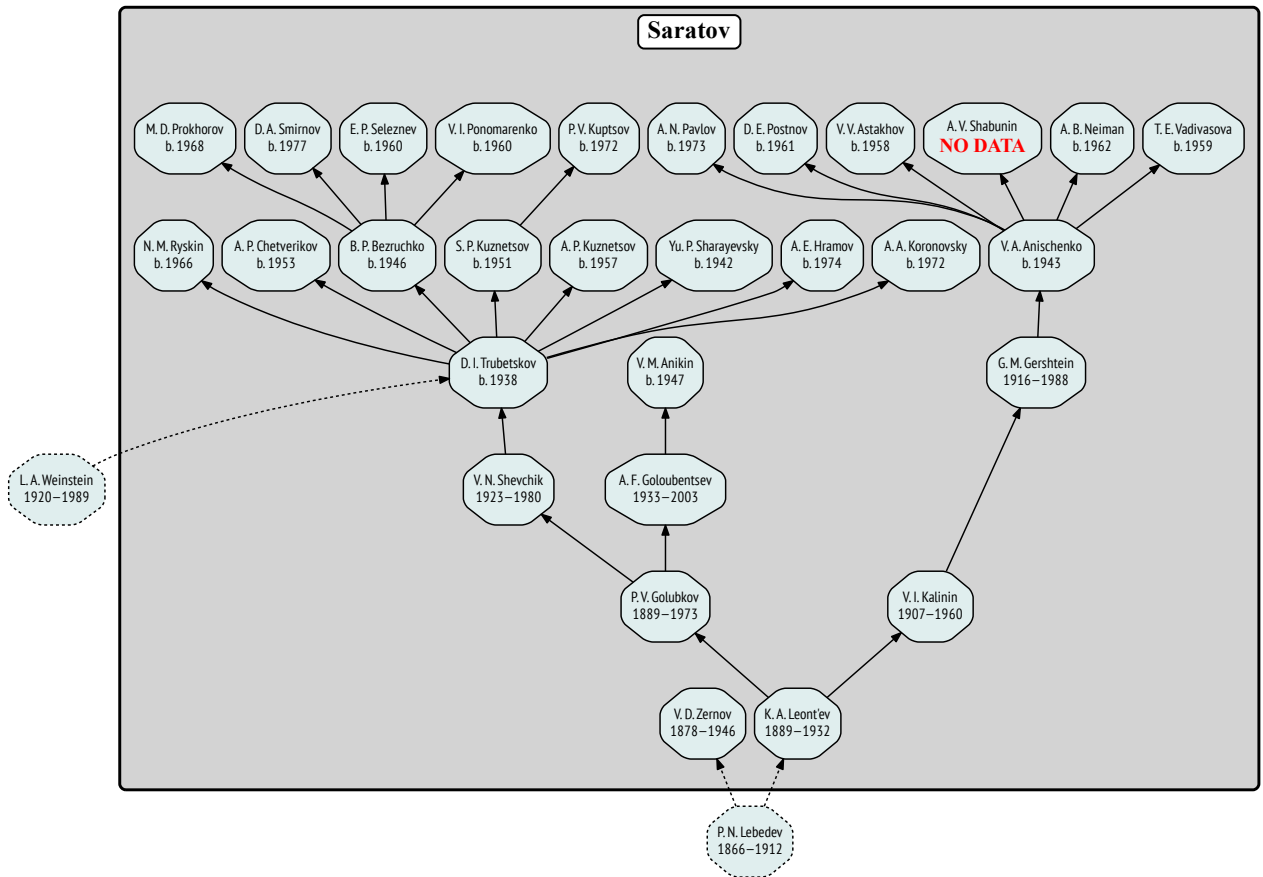
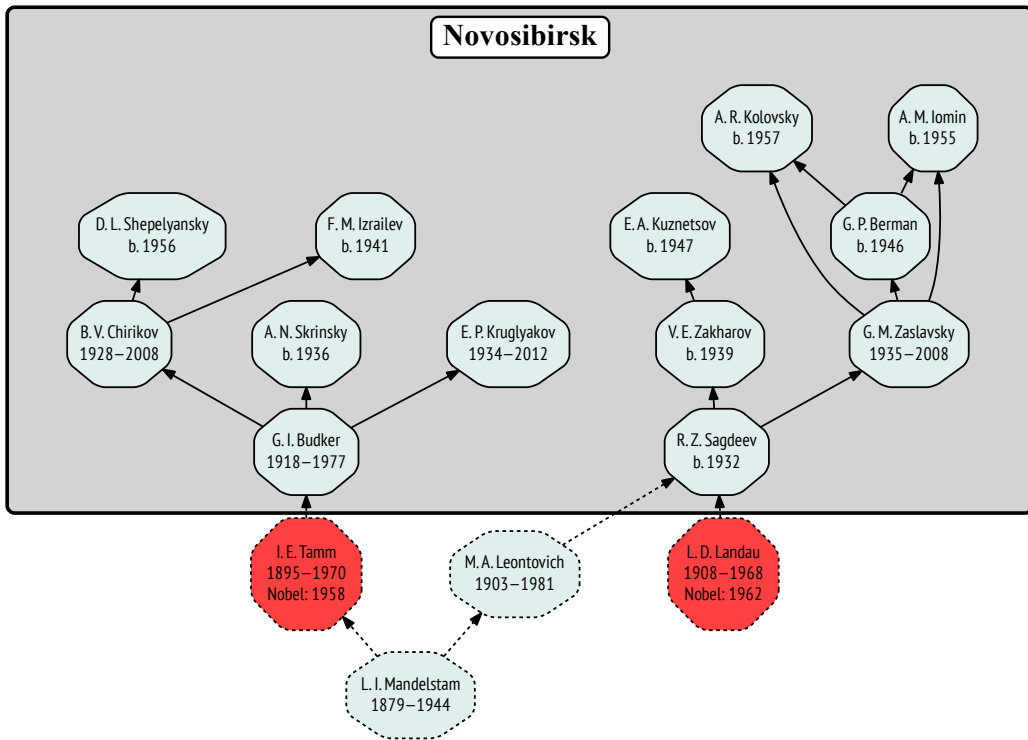Figure 6: The Saratov school on nonlinear oscillations and chaos. ⬇

Figure 7: The Novosibirsk school on nonlinear physics and chaos. ⬇
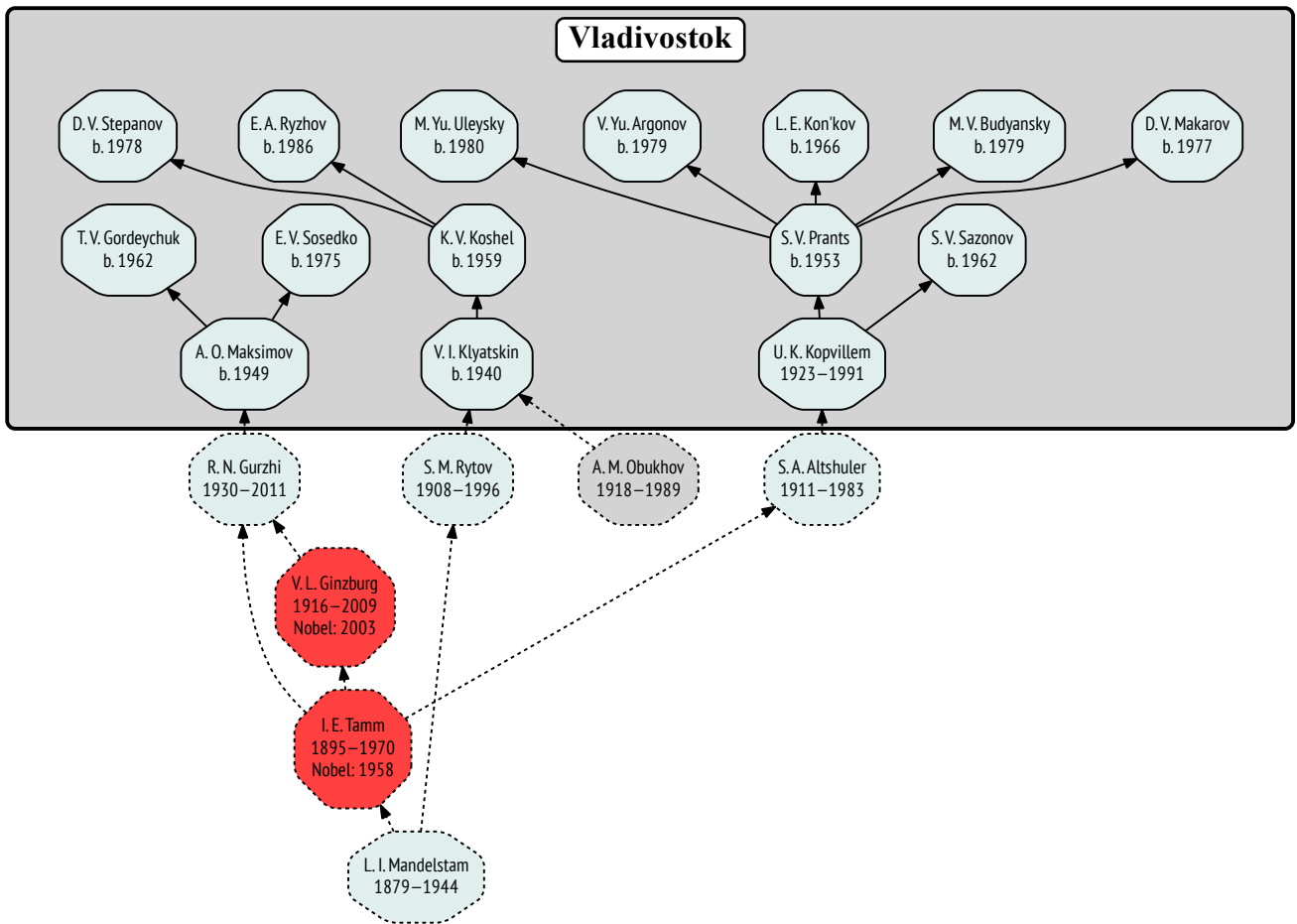
Figure 8: The Vladivostok school on nonlinear oceanography and chaos.

branch via A. M. Obukhov (1918–1989) is connected also to A. N. Kolmogorov's Moscow mathematical school on dynamical system theory and mechanics and to many French and German mathematicians.

Everybody is welcome to complete the tree and we would appreciate any corrections, comments and additions. The graphs were created by a **dot** program from the Graphviz package (http://www.graphviz.org/). The source files for each tree can be found by clicking on the arrow ⬇ after the corresponding figure caption.

The following sources have been used:

- Mathematics Genealogy Project (https://www.genealogy.ams.org).

- The Academic Family Tree (http://academictree.org/).

- Russian (https://ru.wikipedia.org/wiki) and English (https://en.wikipedia.org/wiki) Wikipedia.

- Private communications. We thank V. Afraimovich (San Luis Potosi, Mexico), F. Izrailev (Puebla, Mexico), V. Klyatskin (Moscow, Russia), E. Kuznetsov (Moscow, Russia), S. Kuznetsov (Saratov, Russia), A. Maksimov (Vladivostok, Russia), L. Ostrovsky (Boulder, USA), D. Shepelyansky (Toulouse, France), V. Sokolov (Novosibirsk, Russia).

- Biographical and autobiographical texts.