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ABOUT THE COVER: OLGA ALEXANDROVNA LADYZHENSKAYA

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This issue of the *Bulletin of the American Mathematical Society* has a photograph of a remarkable woman of great charm and beauty on its cover. She is, of course, famous for her outstanding contributions to mathematics. Recently, I received an e-mail from a long-time member of the AMS and reader of the *Bulletin*, Sean Sather-Wagstaff. He observed that over the years there have been many more *Bulletin* covers that feature men than those featuring women. My response pointed out to him that the *Bulletin* covers are usually taken from some historical document, sometimes connected with a survey article in the issue. Historically, the mathematical community had many more notable men than women, so images with men were inevitably more prevalent than those with women. However his observation made me think about material for the cover of the upcoming issue in January 2019. One of the survey articles in this issue is by Isabelle Gallagher, entitled "From Newton to Navier–Stokes, or how to connect fluid mechanics equations from microscopic to macroscopic scales". The Navier–Stokes equations describing the motion of viscous fluids have challenged mathematicians for centuries. One of the most important breakthroughs in this area in the twentieth century was made by Olga Ladyzhenskaya.

Ladyzhenskaya died in 2004 and in that year the *Notices of the AMS* published a memorial article [1] containing brief surveys of some of her mathematical achievements in addition to "memories" of Olga Alexandrovna by distinguished mathematicians who knew her and her work for many years. I wrote a brief introduction to this memorial article and we reprint it here.

Olga Alexandrovna Ladyzhenskaya died in her sleep on January 12th, 2004, in St. Petersburg, Russia, at the age of eighty one. She left a wonderful legacy for mathematics in terms of her fundamental results connected with partial differential equations and her "school" of students, collaborators, and colleagues in Russia. In a life dedicated to mathematics, she overcame personal tragedy arising from the cataclysmic events of twentieth century Russia to become one of that country's

FIGURE 1. CLEAR COPY OF THE COVER: Olga Alexandrovna Ladyzhenskaya. This photograph is reprinted here with the kind permission of her family [2].

leading mathematicians. Denied a place as an undergraduate at university, she was an exceptionally gifted young girl, but one whose father disappeared in Stalin's gulag. She eventually became a leading member of the Steklov Institute (PDMI) and was elected to the Russian Academy of Science. Her mathematical achievements were honored in many countries. She was a foreign member of numerous academies, including the Leopoldina, the oldest German academy. Among other offices, she was president of the Mathematical Society of St. Petersburg and, as such, a successor of Euler.

Ladyzhenskaya made deep and important contributions to the whole spectrum of partial differential equations and worked on topics that ranged from uniqueness of solutions of PDEs to convergence of Fourier series and finite difference approximation of solutions. She used functional analytic techniques to treat nonlinear problems using Leray–Schauder degree theory and pioneered the theory of attractors for dissipative equations. Developing ideas of De Giorgi and Nash, Ladyzhenskaya and her coauthors gave the complete answer to Hilbert's nineteenth problem concerning the dependence of the regularity of the solution on the regularity of the data for a large class of second-order elliptic and parabolic PDEs. She published more than 250 articles and authored or coauthored seven monographs and textbooks. Her very influential book *The Mathematical Theory of Viscous Incompressible Flow*, which was published in 1961, has become a classic in the field. Her main mathematical "love" was the PDEs of fluid dynamics, particularly the Navier–Stokes equation. This equation has a long and glorious history but remains extremely challenging: for example, the issue of existence of physically reasonable solutions to the Navier–Stokes equations in three dimensions was chosen as one of the seven millennium "million dollar" prize problems of the Clay Mathematical

FIGURE 2. Ladyzhenskaya, age 79, in her St.Petersburg apartment. This photograph is reprinted here with the kind permission of her family.

Institute. (The CMI website gives a description by Fefferman of the prize problem.) The three-dimensional problem remains open to this day, although it was in the 1950s that Ladyzhenskaya obtained the key result of global unique solvability of the initial boundary problem for the two-dimensional Navier–Stokes equation. She continued to obtain influential results and to raise stimulating issues in fluid dynamics, even up to the days before her death.

References

[1] S. Friedlander, P. Lax, C. Morawetz, L. Nirenberg, G. Seregin, N. Ural'tseva, M. Vishik, *Olga Alexandrovna Ladyzhenskaya (1922–2004)*, Notices Amer. Math. Soc. **51** (2004), no. 11, 1320–1331. MR2105237

[2] Various sources, *Photo album of Olga Aleksandrovna Ladyzhenskaya*, `www.mathsoc.spb.ru/pantheon/ladyzhen/` (2018).

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