

GUEST ESSAY

I'm a Physicist Who Doesn't Want Russia to Leave the World of Science

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By Michael Riordan

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ORCAS ISLAND, Wash. — One of the many unfortunate consequences of Russia's invasion of Ukraine is the collateral damage to international scientific cooperation. The past two decades may have been the apex of this cooperation. Now it appears to be coming to at least a pause, if not an end.

In the years immediately after the Cold War ended in 1991, Russian scientists turned increasingly to Europe and the United States to remain involved in frontier research. Through the efforts of Presidents George H.W. Bush and Bill Clinton, Space Station Freedom became the International Space Station, which included major contributions from Canada, Japan, European nations and Russia as partners.

From 1993 to 1996, the Russian agency responsible for atomic energy signed agreements with the European Laboratory for Particle Physics, known as CERN, and contributed money, equipment and brainpower to the Large Hadron Collider project. That project led to the discovery in 2012 of the Higgs boson, a heavy subatomic particle that imbues other elementary particles with mass. Its existence was predicted a half-century earlier.

And during the 1990s, Russian scientists from Lomonosov Moscow State University joined the international LIGO Scientific Collaboration, which in 2016 announced striking evidence of mergers of ultramassive black holes. The discovery confirmed the prediction in Einstein's general theory of relativity that cataclysmic events like the merger of two black holes — in this case, about 1.3 billion light years away — create ripples in space-time known as gravitational waves.

But Russia recently decided to terminate its participation in the space station after 2024, and CERN will no longer allow Russian institutes to participate in collider experiments after its contracts with Russia expire that year. What's more, the European Space Agency has excluded Russia from its planned ExoMars rover project, despite the yearslong delays that will likely result. And notwithstanding Russia's efforts in support of the X-ray laser project known as European XFEL in Germany, which has opened opportunities for research in materials science, biology and physics, scientists and institutions based in Russia cannot (at least for now) perform new experiments at this facility.

Scientific research has advanced to such an extent since the end of the Cold War that such large, expensive international projects are the only way to push back the frontiers in many disciplines. Individual nations no longer have sufficient financial and intellectual resources to pursue the science unilaterally. The current retreat from Russian involvement in these big projects can in this way easily curtail scientific progress — as well as impair international relations more broadly.

CERN was established in a suburb of Geneva in the early 1950s to promote peaceful cooperation among European nations, which experienced two disastrous wars during the previous 40 years. Organizers viewed nuclear and high-energy physics as promising disciplines that invited cooperation. And it succeeded. With the discovery in the early 1980s of the W and Z bosons, which together are responsible for one of the four fundamental forces that govern the behavior of matter in the universe, CERN established itself as the world's premier laboratory for high-energy physics. To many European leaders, it had become the highest expression of continental unity — reason enough to approve its multibillion-euro L.H.C. project in the 1990s.

After the Soviet Union dissolved in 1991, the funding of many of its institutes for scientific research collapsed. CERN became the principal venue where Russian high-energy physicists could continue doing cutting-edge research. And CERN had begun to seek additional L.H.C. funding from well beyond its European member nations. Physicists from Russia's Joint Institute for Nuclear Research joined the gargantuan Compact Muon Solenoid experiment on this collider, contributing to its design and making sophisticated contributions. They could take due credit for their part in the breakthrough Higgs boson discovery — perhaps the pinnacle of international scientific achievement. Russia became an important player in a world laboratory knit together by the internet and Web, which now includes Canada, China, India, Japan, the United States and many other non-

European nations.

Part of the rationale for establishing CERN was to promote international understanding among researchers working toward common scientific goals. It has proved a wonderful polyglot place. Although English and French dominate conversations in labs, offices and the cafeteria, national differences seem to melt away amid vigorous technical exchanges and good food.

But this scientific camaraderie begins to dissolve when one of the participant nations savagely attacks another. During the first month of the Russian invasion of Ukraine, thousands of Russian scientists signed a petition opposing the attack, taking great risks to their careers and livelihoods. In contrast, Russian scientific institutes have toed the Kremlin line — dependent as they are on its continued support.

Collaborations on the basis of individual relationships may continue with some Russian scientists. This intellectual exchange is certainly valuable. But one can easily imagine that pullbacks and withdrawals will continue on other large scientific projects, if they haven't already, to the detriment of international relations generally. That would be an unfortunate aspect of a renewed bifurcation of the world order much like what happened during the Cold War. But I sincerely hope that the strong scientific bonds established during the past three decades will survive and help re-establish broader East-West relations.

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