

Nonproliferation and the Budapest Memorandum



While I found Bill Sweet's article "France's Oppenheimer" (Physics Today, March 2025, page 46) informative and entertaining, I also find it necessary to correct a serious omission in the final paragraph. South Africa is not the only nuclear-armed state to have given up its arsenal. Belarus, Kazakhstan, and Ukraine gave up the nuclear weapons left in their lands following the breakup of the Soviet Union.

Indeed, when the Soviet Union col-

AN UNIDENTIFIED MISSILE-LAUNCH SITE IN UKRAINE IN MAY 1995. This photo was taken during an inspection team's visit as part of the Ukrainian nuclear dismantlement project. (Photo from the Defense Threat Reduction Agency, Department of Defense/National Archives photo no. 7286446.)

lapsed, Ukraine held the world's third-largest arsenal of nuclear weapons. It denuclearized voluntarily and joined the Treaty on the Non-Proliferation of Nuclear Weapons in 1994. In return, the US, the UK, and the Russian Federation signed the Budapest Memorandum, in

which they committed to, among other things, "respect the independence and sovereignty and the existing borders of Ukraine," "refrain from the threat or use of force against the territorial integrity or political independence of Ukraine," and "refrain from economic coercion

designed to subordinate to their own interest the exercise by Ukraine of the rights inherent in its sovereignty.”¹

Russia’s forced annexation of Crimea in 2014, followed shortly by its promotion of separatist activities in the Donetsk and Luhansk territories, and later its full-scale invasion of Ukraine starting in 2022 violated the Budapest Memorandum. And now doubts among US allies as to the reliability of US security commitments threaten to cause other nations to become nuclear states.^{2,3}

References

1. Ukraine, Russian Federation, United Kingdom of Great Britain and Northern Ireland, United States of America, *Memorandum on Security Assurances in Connection With Ukraine’s Accession to the Treaty on the Non-Proliferation of Nuclear Weapons*, 5 December 1994, no. 52241.
2. G. Chafetz, Z. S. Davis, “The end of nonproliferation?” *Defense One* (16 March 2025).
3. G. Rose, “Get ready for the next nuclear age: How Trump might drive proliferation,” *Foreign Affairs* (8 March 2025).

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► **Sweet replies:** I take Stephen Schiff’s point. I should have said that South Africa was the one country to have developed nuclear weapons and then voluntarily agreed to give them up.

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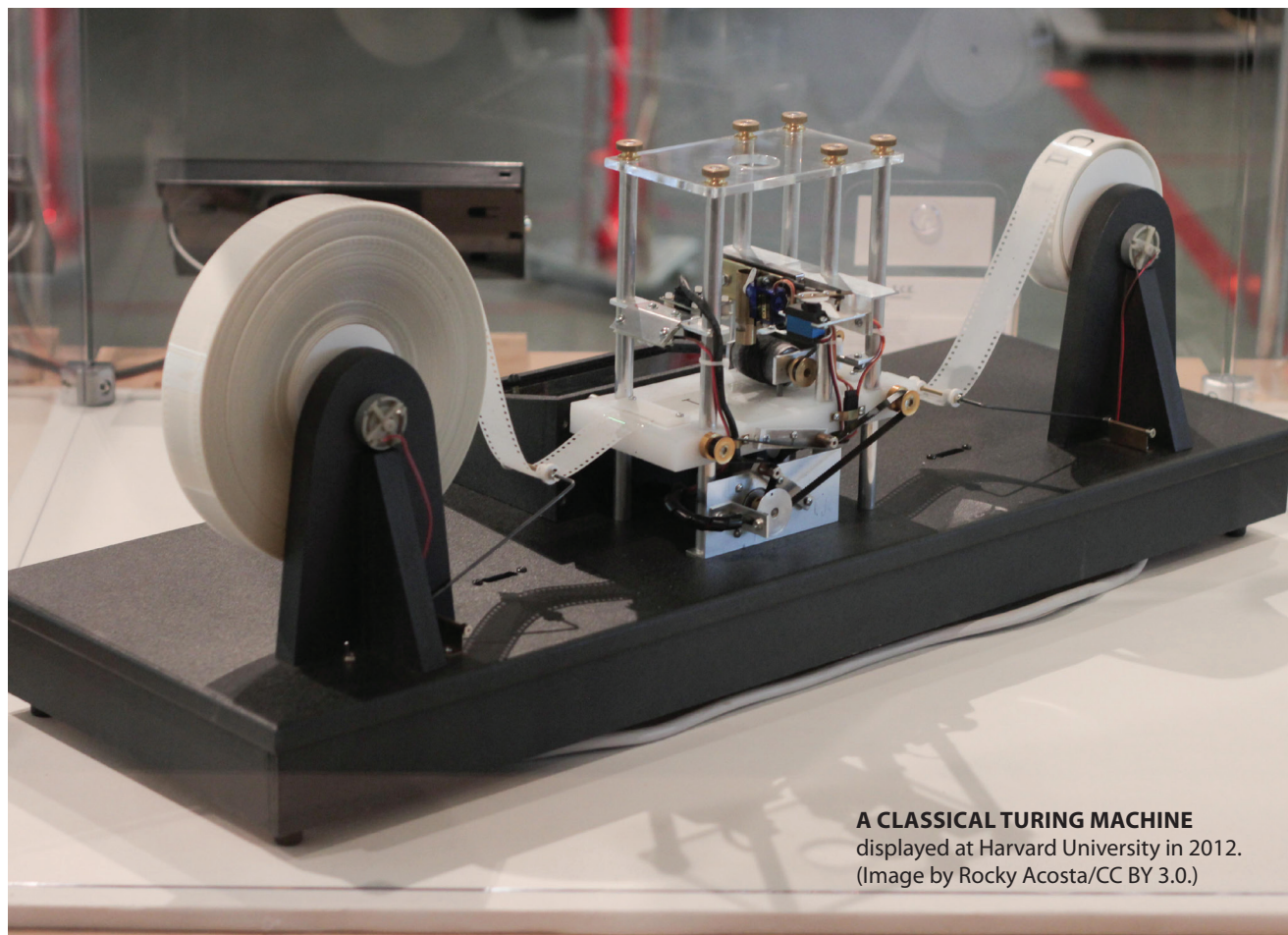
A question pertaining to Shor’s discovery

The recently published interview “Peter Shor on the genesis of Shor’s algorithm” (*PHYSICS TODAY*, April 2025, page 34), conducted by David Zierler and adapted and annotated by Ryan Dahn, was fascinating. I was interested in Shor’s discovery that there is a polynomial-time quantum computer

factoring algorithm that violates the Church–Turing thesis, which in Shor’s words, says “basically, anything any computer can do in polynomial time, a Turing machine can do in polynomial time.” The presentation of the social aspects around this discovery provides an excellent view into the topic’s history. Of course, the now well-known implications are also discussed, but in so doing, the article also highlights, by omission, something missing in the field of theoretical computing.

Since the Turing machine is classical, I am left with an obvious but unaddressed question: Is it possible that there is also a quantum Turing machine? I wonder if someone is studying this, but perhaps it is too much to expect that they would make themselves available to discuss it with Dahn for publication in *PHYSICS TODAY*. That would only bring unwanted attention and competition to the issue.

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A CLASSICAL TURING MACHINE
displayed at Harvard University in 2012.
(Image by Rocky Acosta/CC BY 3.0.)