Laser uranium enrichment technology may create new proliferation risks

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A new laser-based uranium enrichment technology may provide a hard-to-detect pathway to nuclear weapons production, according to a forthcoming paper in the journal *Science & Global Security* by Ryan Snyder, a physicist with Princeton University's Program on Science and Global Security.

One example of this new third-generation laser enrichment technique may be the separation of isotopes by laser excitation (SILEX) process which was originally developed in Australia and licensed in 2012 for commercial-scale deployment in the United States to the Global Laser Enrichment consortium led by General Electric-Hitachi. Research on the relevant laser systems is also currently ongoing in Russia, India and China.

The paper explains the basic physics of the new uranium separation concept, which relies on the selective laser excitation and condensation repression of uranium-235 in a gas. It also estimates the key laser performance requirements and possible operating parameters for a single enrichment unit and how a cascade of such units could be arranged into an enrichment plant able to produce weapon-grade highly enriched uranium.

Using plausible assumptions, the paper shows how a covert laser enrichment plant sized to make one bomb's worth of weapon-grade material a year could use less space and energy than a similar scale plant based on almost all current centrifuge designs, the most efficient enrichment technology in use today. The results suggest a direct impact on detection methods that use size or energy use as plant footprints.

Acquiring the key laser systems appears to be the main technological hurdle to states mastering this new enrichment process. The paper details some of the different lasers that, in principle, could be used for uranium enrichment. Technology export controls on possible laser systems may be hard to implement since some of the lasers have multiple applications in areas such as medicine, telecommunications, and defense. One consequence of this is that commonplace laser research and development activities could allow more countries a latent nuclear weapons capability.

Snyder observes that an unexpected window of opportunity to think more carefully about the proliferation potential of the new laser technology has opened up with the April 2016 decision by General Electric-Hitachi to withdraw from the Global Laser Enrichment consortium which has stalled the commercialization effort.

"We have a second chance to think about the risks of deploying new laser-based uranium enrichment technologies on a laboratory or industrial scale," said Snyder. "Previously developed technologies that provided pathways to nuclear weapons such as gaseous diffusion and gas centrifuges have spread to other countries, and the same should be expected with laser enrichment if commercial deployment of this new technology is successfully demonstrated."

The paper concludes with the suggestion that attention should be focused on regulating laser systems capable of enriching uranium to weapon-grade levels, otherwise such lasers may come to pose proliferation concerns comparable to if not greater than gas centrifuge development or plutonium reprocessing today.

The paper, "A Proliferation Assessment of Third Generation Laser

Enrichment Technology," will be published in *Science & Global Security*.

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