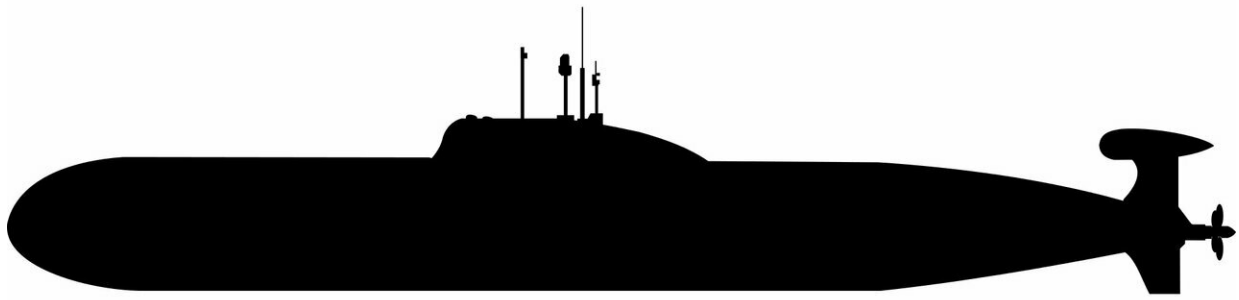
Using an antineutrino reactor-off method between submarine patrols to by-pass need for onboard access inspections

July 25 2022, by Bob Yirka



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A pair of researchers at Virginia Tech is suggesting that it should be possible to use a low-energy antineutrino reactor-off method set between submarine patrols to by-pass the need for onboard access by inspectors. In their paper published in the journal *Physical Review Letters*, Bernadette Cogswell and Patrick Huber describe a means for safeguarding nuclear fuel used for naval propulsion systems on vessels

around the world.

Over the past several decades, several countries have begun to use nuclear reactors to power ocean-going military vessels, most particularly submarines and aircraft carriers. Over roughly the same period of time, officials around the world have been working to prevent the spread of nuclear arms to new countries, particularly those believed to harbor terrorist organizations. One conspicuous hurdle to such efforts is the use of fissile material aboard ocean going vessels for use as a fuel that could just as easily be used to create nuclear weapons. This difficulty became more apparent last year when the U.S. and the U.K., both nuclear armed countries, agreed to transfer nuclear powered submarines to Australia—an ally and non-nuclear armed country.

Currently, the only way to verify whether an ocean-going vessel has weapons-grade uranium aboard is for inspectors to board the vessel with equipment that is able to detect its presence and use it in a reactor compartment—something most countries, will not permit. In this new effort, the researchers suggest an alternative means of detecting such material—one that does not require boarding the vessel at all. They suggest that rather than attempting to measure weapons-grade uranium using neutrino detectors that must be placed near a source, inspectors could instead install antineutrino detectors on undersea vessels. Doing so would allow inspectors to determine if weapons-grade uranium is aboard a targeted vessel by simply moving the detection vessel near to the targeted vessel. They also note that all of the technology for building such a system currently exists. They acknowledge that their solution, while much better than those now in use, would still face political challengers from entities who prefer to not have their ships scanned for such purposes. There would also still remain the problem of locating submarines used to transport material created for power plants to entities wishing to use it to create weapons.

More information: Bernadette K. Cogswell et al, Cerium Ruthenium Low-Energy Antineutrino Measurements for Safeguarding Military Naval Reactors, *Physical Review Letters* (2022). DOI: 10.1103/PhysRevLett.128.241803

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