

# NUCLEAR SEMINAR SERIES

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**Prof. Areg Danagoulian**

**Massachusetts Institute of Technology**

**Monday, February 18**

**4:00 pm - Rm 184 NSH**

## ***Nuclear Disarmament Verification via Resonant Phenomena***

Nuclear disarmament treaties are not sufficient in and of themselves to neutralize the existential threat of the nuclear weapons. Technologies are necessary for verifying the authenticity of the nuclear warheads undergoing dismantlement before counting them towards a treaty partner's obligation. We have developed two novel concepts which leverage isotope-specific nuclear resonance phenomena to authenticate a warhead's fissile components by comparing them to a previously authenticated template. Most actinides such as uranium and plutonium exhibit unique sets of resonances when interacting with MeV photons and eV neutrons. When measured, these resonances produce isotope-specific features in the spectral data, thus creating an isotopic "fingerprint" of an object. All information in these measurement has to be and is encrypted in the physical domain in a manner that amounts to a physical zero-knowledge proof system. Using Monte Carlo simulations and experimental proof-of-concept measurements these techniques are shown to reveal no isotopic or geometric information about the weapon, while readily detecting hoaxing attempts. These new methodologies can dramatically increase the reach and trustworthiness of future nuclear disarmament treaties. The talk will discuss the concepts and recent results, and will give a general overview of nuclear security research pursued at MIT.



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