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of Quantum Technologies for the Enhancement of the CTBTO Verification Activities

Currently, the world is undergoing the second quantum revolution. While the first revolution resulted in a wide range of transformative technologies, including nuclear weapons, developments emerging from the second revolution, including a range of promising quantum technologies, seem to be enhancing the monitoring capabilities of the CTBTO. This study explores the potential of quantum sensing, computation, and cryptography to enhance the IMS, addressing critical issues of nuclear test detection.

Quantum sensors promise unprecedented sensitivity in detecting seismic, hydroacoustic, and infrasonic anomalies. These capabilities can significantly improve the resolution and accuracy of monitoring subterranean nuclear tests. Similarly, quantum gravimetry and magnetometry enable precise identification of underground voids or disturbances caused by nuclear activities, even in complex geological environments. Moreover, quantum cryptographic methods can ensure the security of sensitive monitoring data transmissions, reducing risks of interception or manipulation. Although quantum technologies remain in their developmental stages, they represent a highly promising scientific and technological area. Their integration with other innovations, such as AI, drones, etc., has the potential to provide the CTBTO with highly effective monitoring tools, both for non-proliferation and nuclear control and natural disaster warning systems and risk reduction.

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