The next generation of metrology - NIST Quantum SI

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Abstract: With the new definition of the SI currently scheduled to be internationally accepted in 2018, the new SI definition will replace the classical SI [artifact based SI traceability (e.g., kilogram)] with the quantum SI based on quantum phenomena and fundamental and atomic constants. NIST is positioning itself to develop quantum-based standards and sensors to disseminate the quantum SI. These new devices will potentially enable zero-chain SI traceability by enabling NIST to deliver dual standards and sensors to the factory floor. The NIST vision is that these quantum-based innovations will improve the SI dissemination through dual standards and sensors to the point where routine exchange of artifacts for measurement quality assurance is no longer needed. Quantum and photonic based rugged small-scale devices open new horizons in measurement science and represent a disruptive technological shift in how metrology is done. These quantum SI devices draw upon a range of technologies not previously exploited for these applications, such as nanofabrication, photonics, and atomic physics. The NIST next-generation, quantum-metrology programs will be discussed in terms of the larger programmatic view of how quantum-based, chip scale technologies will disrupt the dissemination of the SI through the NIST quantum SI.