Quantum Interferometry

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One of the primary driving forces behind the development of nanotechnology is the demand for smaller computer chips. The primary method used for chip fabrication is optical lithography. This method runs into a physical limit at the nanoscale because of a barrier known as the far-field diffraction limit. However, this limit was placed on light by physicists in classical times, before the development of quantum mechanics. The quantum mechanical model of light says that when two photons are entangled, they effectively have half of the wavelength that they have when they are not entangled. If three or more photons are entangled the effective wavelength is even smaller. Physicists are finding new ways to entangle photons (and other objects), for instance by passing them through special crystals. Quantum interferometric lithography exploits this property to focus light beyond half of its wavelength for patterning surfaces such as a silicon chip [1]. This may be good news for chip manufacturers who might be able to add entanglement crystals to their lithography machinery and continue to make a lot of money by selling nanochips.

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Reference:

[1] A. N. Boto, P. Kok, D. S. Abrams, S. L. Braunstein, C. P. Williams, J. P. Dowling, "Quantum Interferometric Optical Lithography: Exploiting Entanglement to Beat the Diffraction Limit," (02 October **2000**) *Physical Review Letters* 85. Abstract