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Optical Lattice Microscopy ERIC BETZIG, New Millennium Research, LLC — New classes of two- and three-dimensional optical lattices are described that yield excitation maxima of controllable polarization and periodicity relative to the excitation wavelength, confined to near the diffraction limit in all directions. Methods for their generation are proposed, as are methods for the simultaneous, independent detection of luminescence from numerous maxima across multiple lattice planes when such lattices are applied to dynamic live cell imaging or massively parallel single molecule spectroscopy. Performance metrics are also introduced that favorably compare lattice microscopy to widefield, confocal, and 4pi microscopy in terms of speed, resolution, photobleaching, and molecular sensitivity. Finally, the possible adaptation of lattice microscopy to superresolution methods such as total internal reflection microscopy and stimulated emission depletion microscopy is discussed.

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