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Upper bounds on photonic bandgaps in two and three dimensions
MIKAEL RECHTSMAN, Courant Institute, NYU, SALVATORE TORQUATO, Princeton University — A 20-year search has been on to find photonic crystals (periodic dielectric structures) with the largest possible full photonic bandgaps. A large, robust bandgap is key to the many applications of these materials, which include near-lossless waveguiding, optical filtering, optical computing, and others. A number of three-dimensional structures with large gaps have been proposed (e.g., a diamond lattice of spheres [1], the "Woodpile" structure [2]), and in two dimensions, structural optimizations to find the largest-bandgap structure have been performed, (e.g., [3], [4]). So far, however, there has been no work on finding rigorous limits on how high the bandgap may be. In this talk, I present upper bounds on the bandgaps of two- and three-dimensional photonic crystals.
[1] Phys. Rev. Lett. **65**, 3152 (1990)
[2] J. Mod. Opt. **41**, 231 (1994)
[3] Appl. Phys. B. **81**, 235 (2005)
[4] Phys. Rev. Lett. **101**, 073902 (2008)

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