5. Conclusion

We have analyzed the dipolar electric and magnetic response of lossless dielectric spheres made of both low and moderate permittivity materials. Based on the Mie expansion, we have derived general expressions for the electric and magnetic polarizabilities of dielectric spheres. We found that submicron Silicon particles present a strong magnetic resonant response in the mid-near infrared (wavelengths $\approx 1.2-2\mu$m). Interestingly, *the light scattered by these Si nanoparticles of appropriate size is perfectly described by dipolar electric and magnetic fields, being quadrupolar and higher order contributions negligible in this frequency range*. A preliminary estimation of the effective optical constants of an arbitrary arrangement of Si spheres suggest a remarkable dispersion in the effective permeability which is pivotal for most of the applications. These results can play an important role, not only in the field of metamaterials or optical antennas, but also in tailoring the light transport through complex dielectric media like photonic glasses [42, 43] with intriguing magnetic properties. Fabrication of new materials made of highly monodisperse subwavelength silicon spheres [44] may then lead to a new generation of magnetodielectric optical materials. At the magnetic or electric resonance wavelengths the extinction cross section is of the order of λ^2 reaching its maximum theoretical limit (independent of the particle size or refractive index) [1] (see also [30]). The large dipolar cross-section of magnetodielectric spheres near a magnetic resonance would also imply strong radiation pressure magnetic forces [37, 45, 46] leading to new concepts related to the optical forces on magnetic particles .

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