instituto de telecomunicações

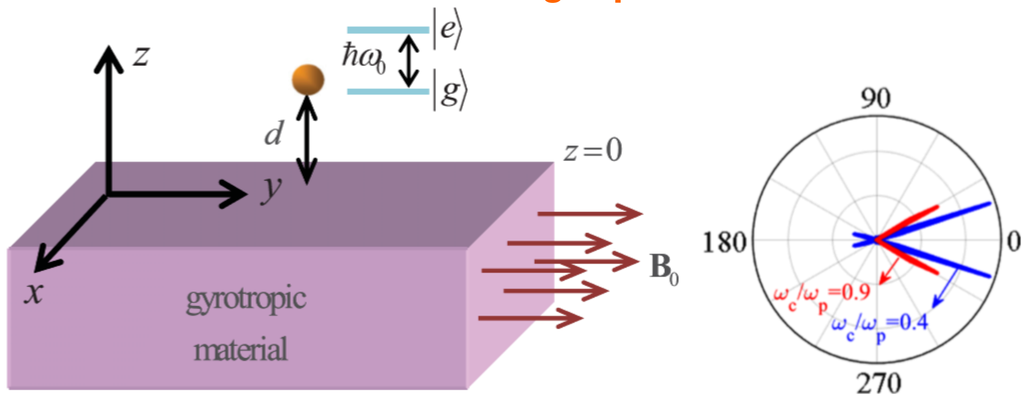
IT-Lisboa

Lateral optical forces on linearly-polarized emitters near a reciprocal substrate

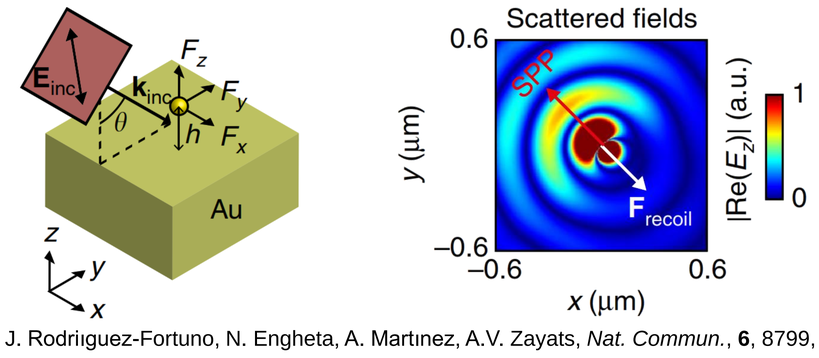
Antennas and Propagation

Background and challenges

Lateral forces on subwavelength particles:

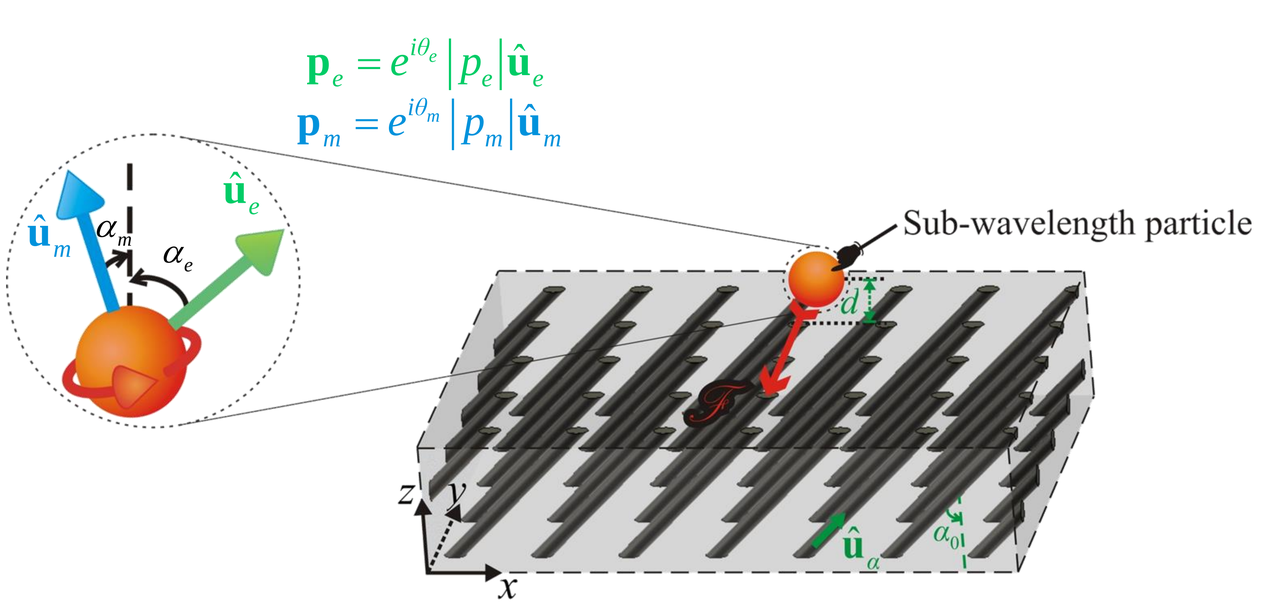


M. G. Silveirinha, S. A. Gangaraj, G. W. Hanson, and M. Antezza, *Phys. Rev. A*, **97**, 022509, 2018.



F. J. Rodrıguez-Fortuno, N. Engheta, A. Martınez, A.V. Zayats, *Nat. Commun.*, **6**, 8799, 2015.

Relaxation of an excited particle/atom near a smooth surface:



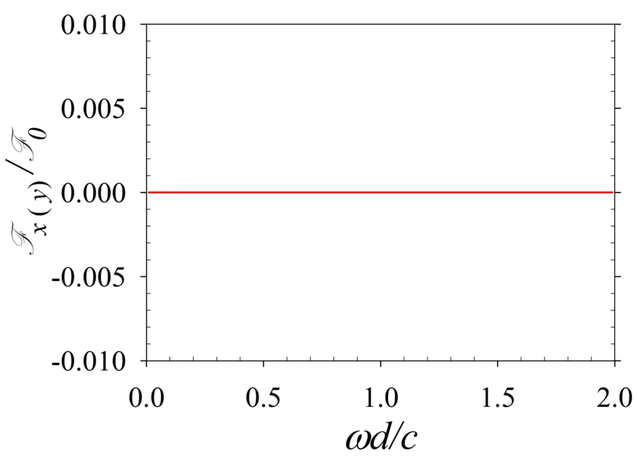
Can we take advantage of the anisotropy or bi-anisotropy of a reciprocal substrate to have analogous lateral forces on linearly-polarized particles?

Description and main innovation

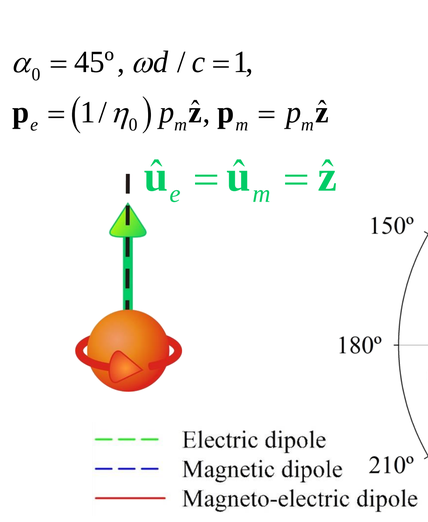
- **We prove that for a linearly-polarized particle with a purely electric response, the lateral force vanishes for any reciprocal translation-invariant substrate, independent of the orientation of the optical axes or of the bianisotropy (chirality) of the involved materials.**
- **We propose a new mechanism to have non-trivial lateral forces with linearly-polarized emitters with nontrivial electric and magnetic responses.**

Achievements

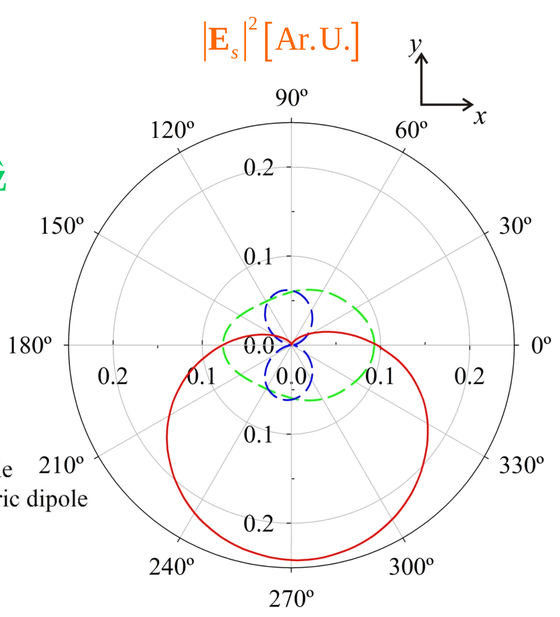
Single electric/magnetic dipole particle

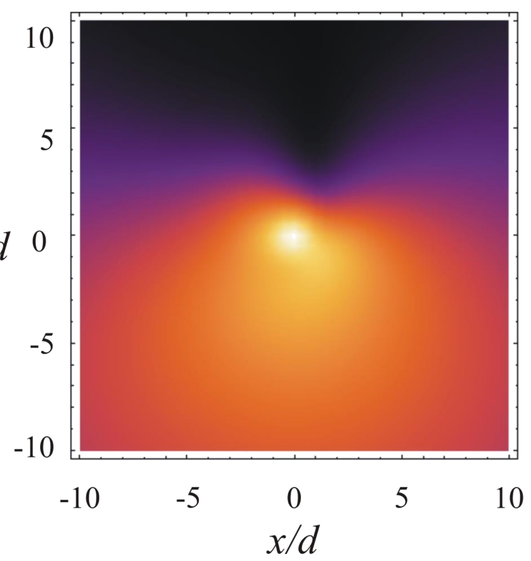


Magneto-electric dipolar particle

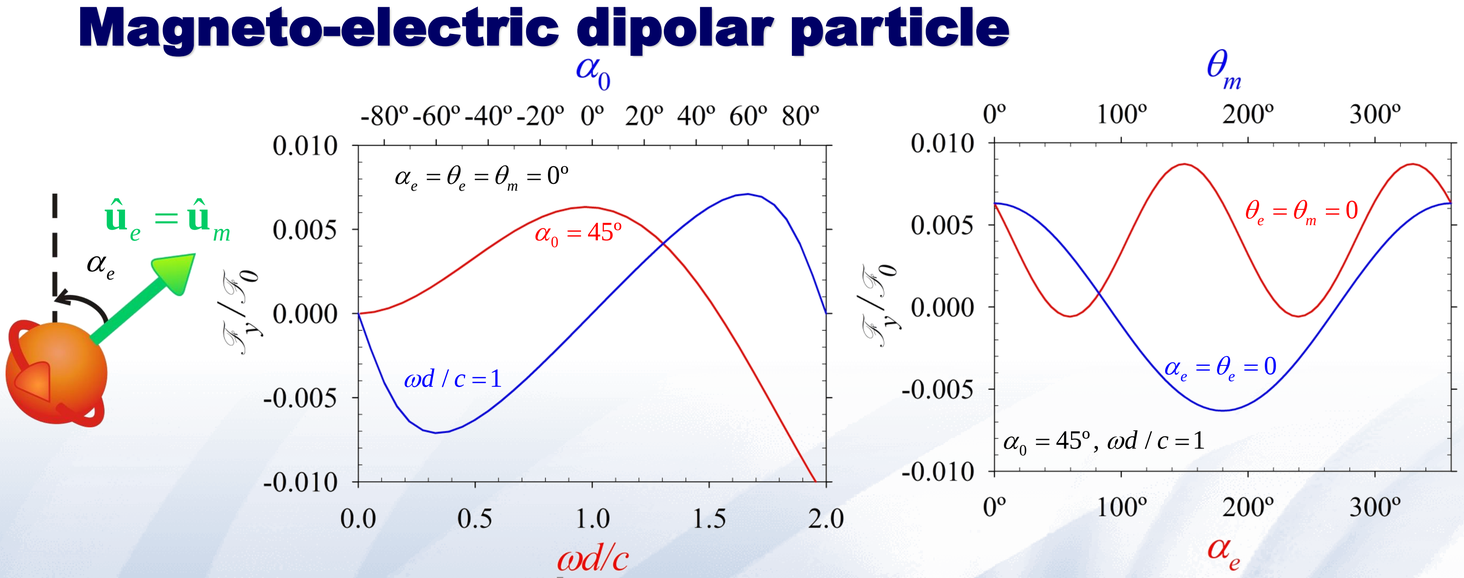


At a plane parallel to the surface substrate ($z = d$)

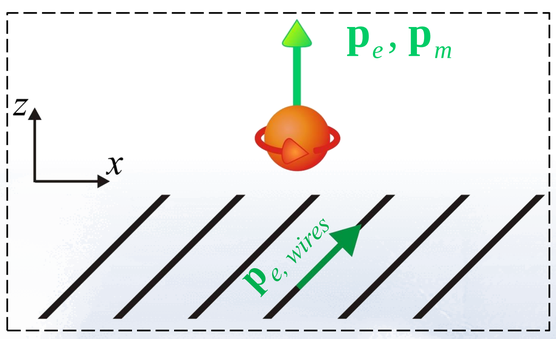




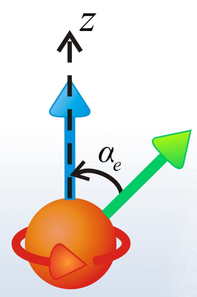
Magneto-electric dipolar particle



Why is the force along *y*?



"Effective" Huygens radiator:



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