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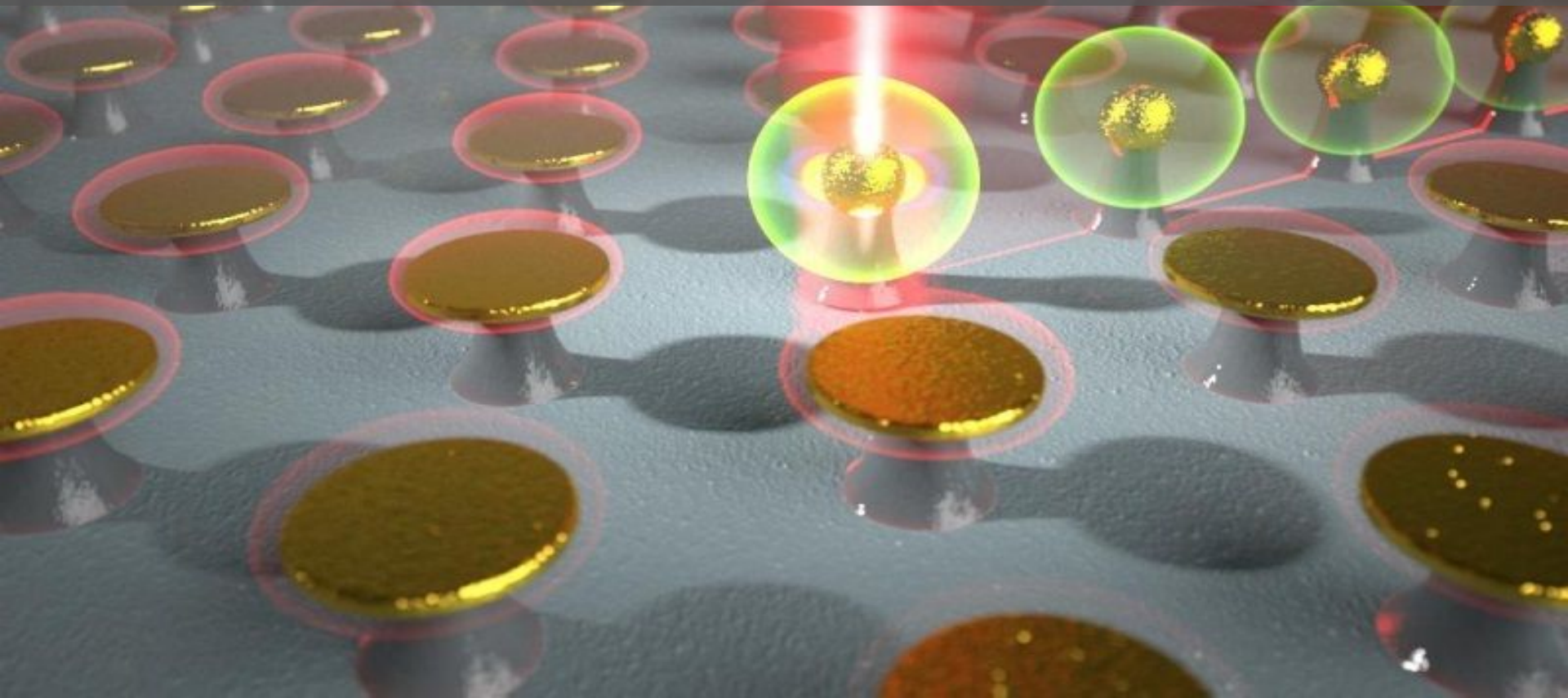
Nanofotónica y Metamateriales (Teoría)

José A. Sánchez Gil & Vincenzo Giannini



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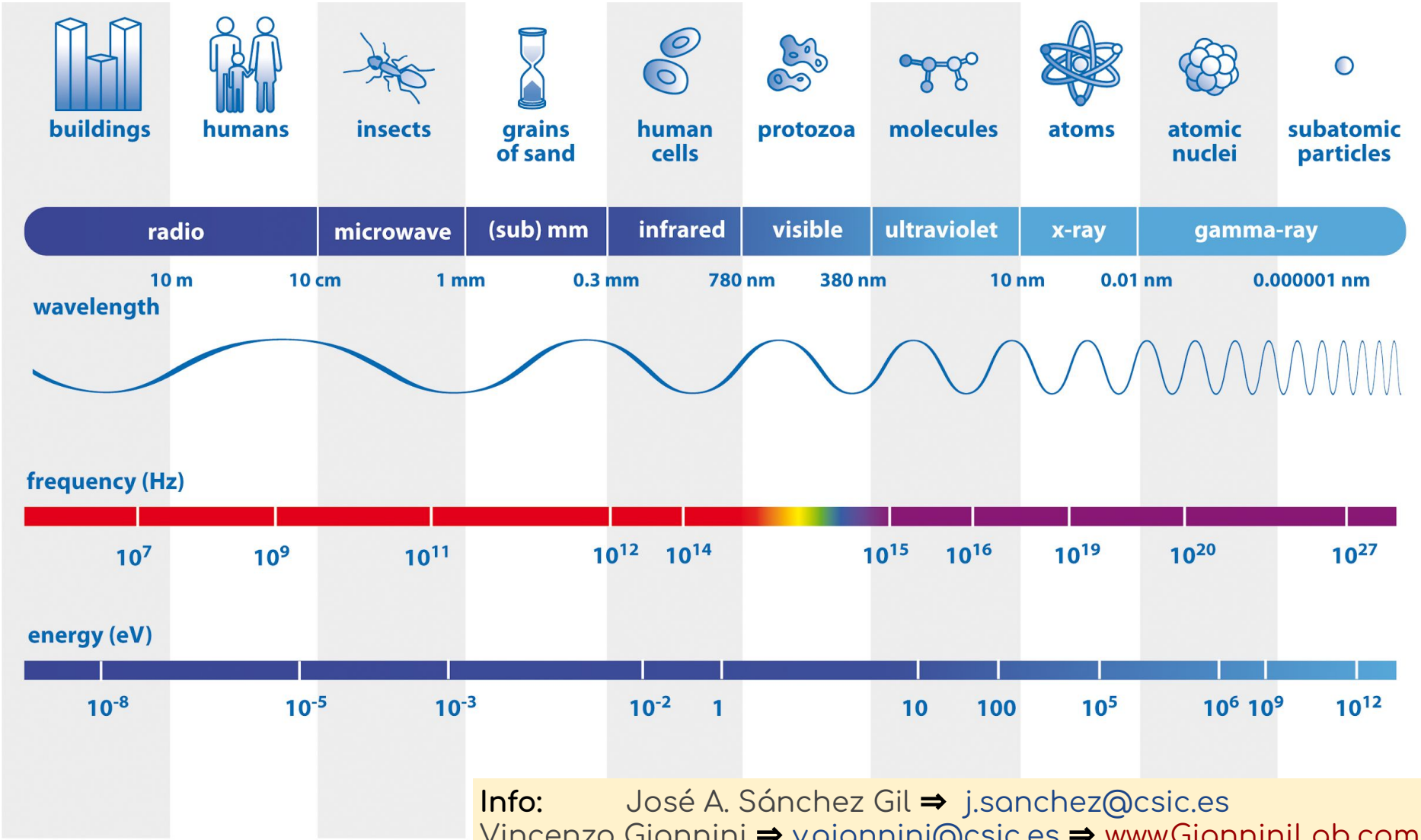
Dpto. Espectroscopía Nuclear, Vibracional y de Medios Desordenados

Espectroscopías de Superficie y Fotónica de Plasmones Superficiales

Jose A. Sánchez Gil
Álvaro Buendía

Info: José A. Sánchez Gil ⇒ j.sanchez@csic.es
Vincenzo Giannini ⇒ v.giannini@csic.es ⇒ www.GianniniLab.com

¿Qué es la nanofotónica?



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¿Qué es la nanofotónica?

ELECTROMAGNETISMO + MATERIA CONDENSADA

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \cdot \mathbf{D} = \rho$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

- Medio contínuo
- Propiedades Macroscópicas
- Ecs. Constitutivas para ***D*** y ***B***

$$\frac{\hbar^2}{2m}\nabla^2\Psi + V\Psi = \frac{i\hbar\partial}{\partial t}\Psi$$

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METALES EN EL VISIBLE

Teoría de Drude para metales: el modelo de electrones libres

$$\mathbf{D}(\mathbf{r},\omega) = \epsilon(\omega)\mathbf{E}(\mathbf{r},\omega), \epsilon(\omega) = 1 - \frac{\omega_p^2}{\omega(\omega + i\gamma)}$$

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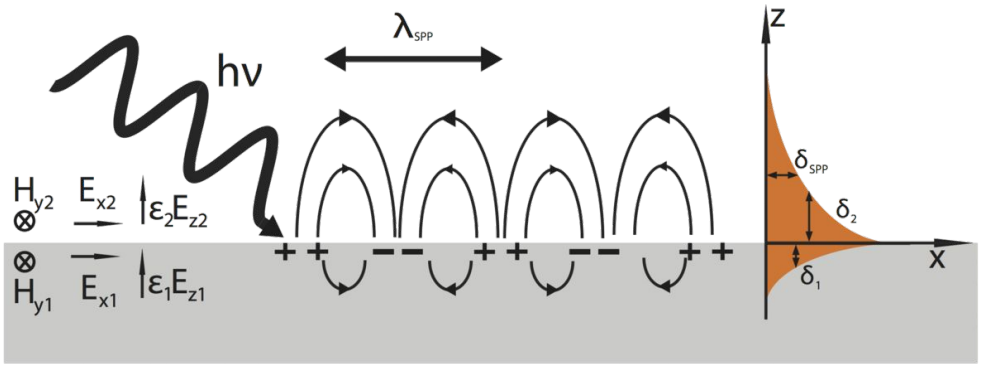
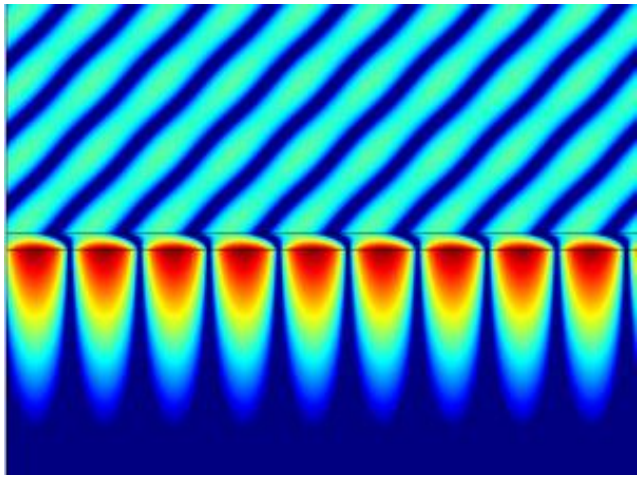
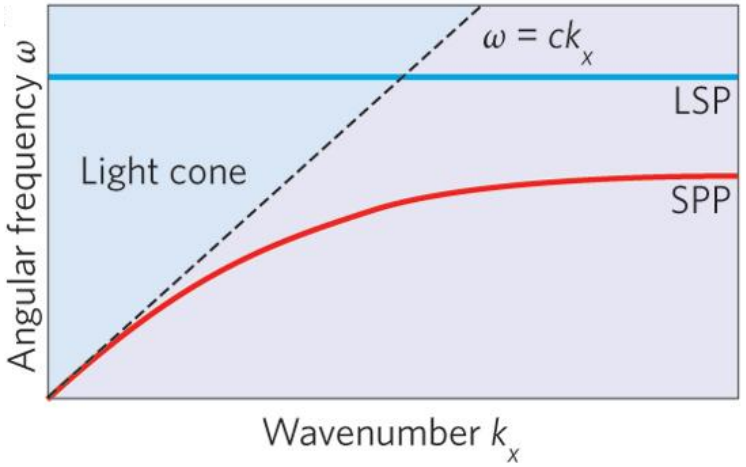
PLASMONES SUPERFICIALES

¡SOLUCIONES CONFINADAS EN LA FRONTERA METAL-DIELÉCTRICO!







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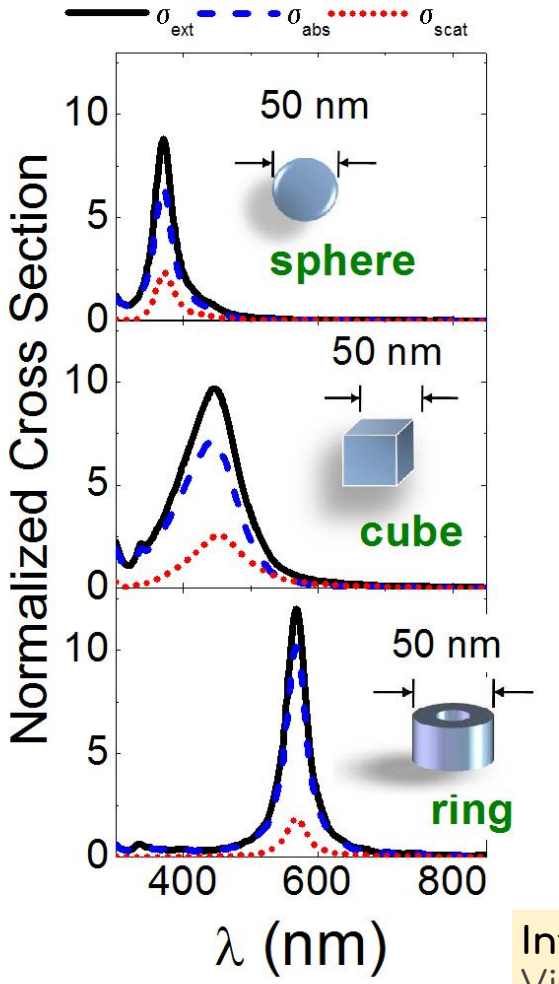
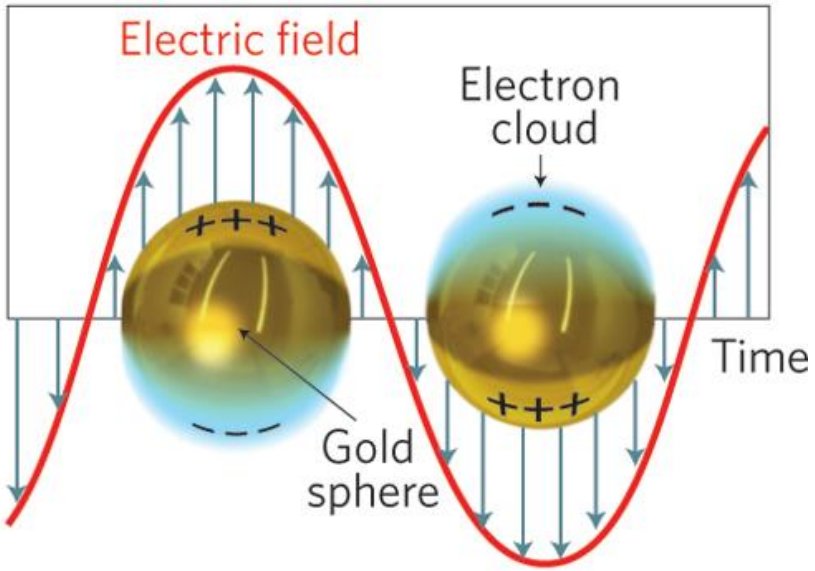
PLASMONES SUPERFICIALES LOCALIZADOS (LOCALIZED SURFACE PLASMON RESONANCES)





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Intereses en Nanofotónica

- Plasmones Superficiales Localizados
- Metamateriales y refracción negativa
- Luz Magnética
- Nanohilos semiconductores
- Aislantes topológicos fotónicos
- Plasmónica en Grafeno
- Plasmónica Cuántica

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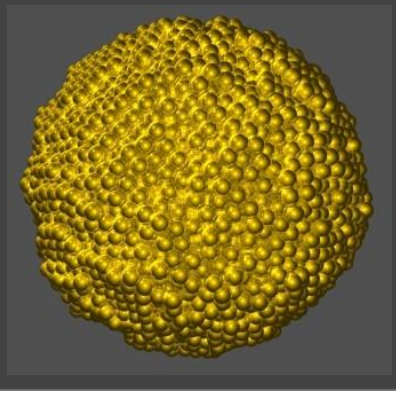
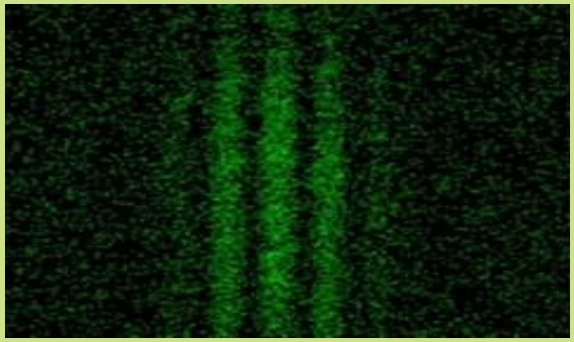
PLASMÓNICA CUÁNTICA

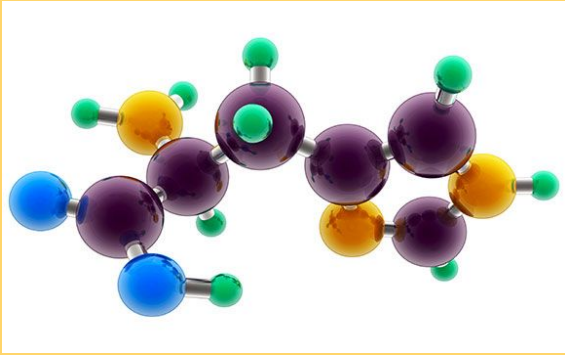
Átomos



Fotones



Moléculas



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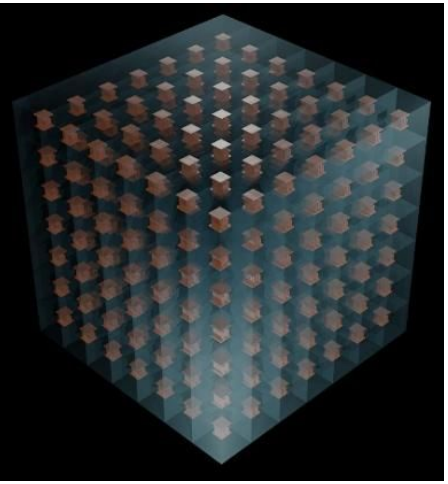
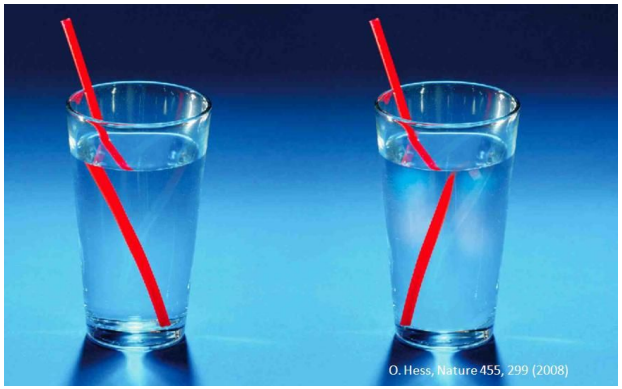
¿Qué son los metamateriales?

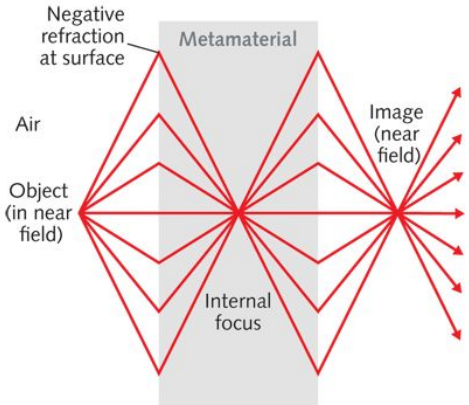


ϵ_m, μ_m

$L << \lambda$

$$\langle \boldsymbol{D}(\boldsymbol{r}) \rangle = \epsilon_0 \epsilon_{eff}(\omega) \langle \boldsymbol{E}(\boldsymbol{r}) \rangle,$$
$$\langle \boldsymbol{B}(\boldsymbol{r}) \rangle = \mu_0 \mu_{eff}(\omega) \langle \boldsymbol{H}(\boldsymbol{r}) \rangle$$





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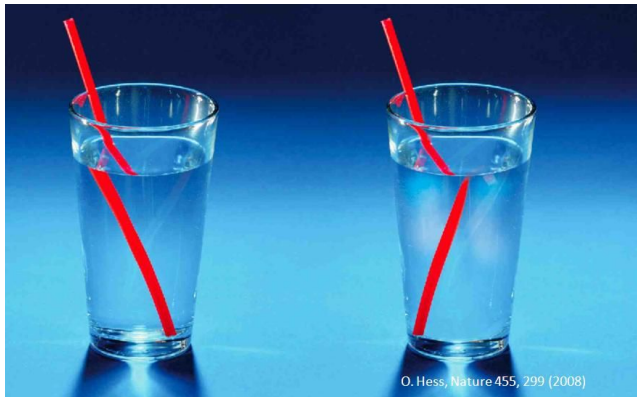
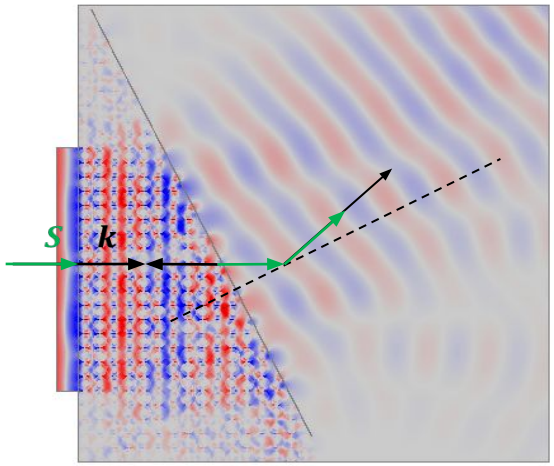
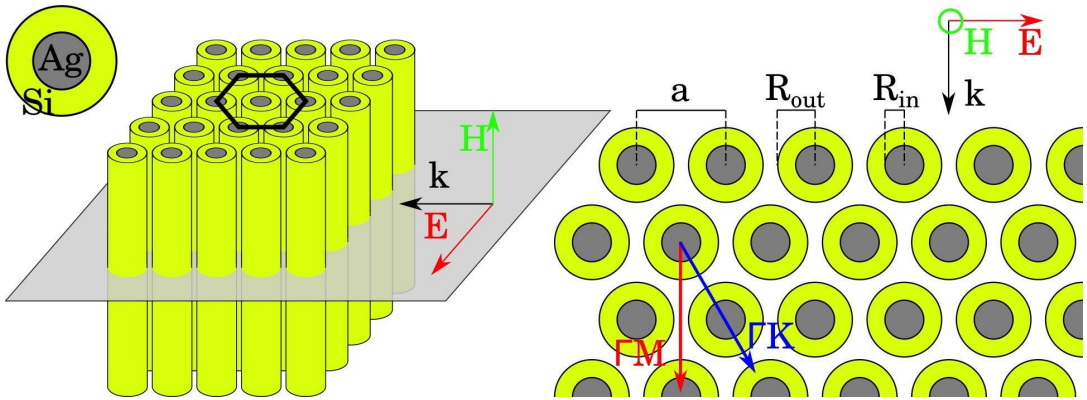
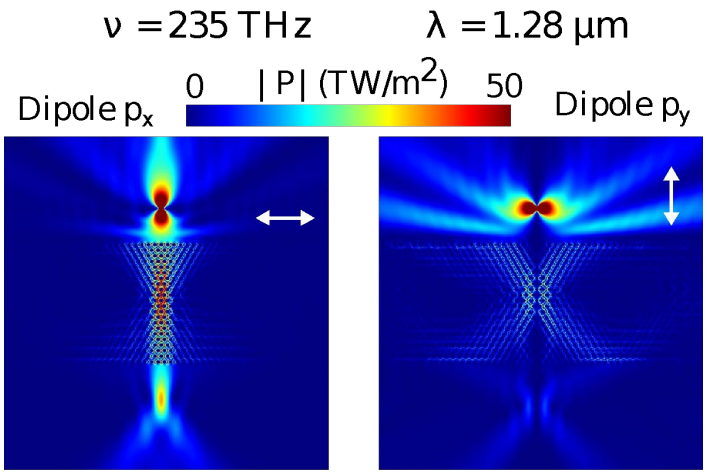
Negative Refraction









Flat lensing

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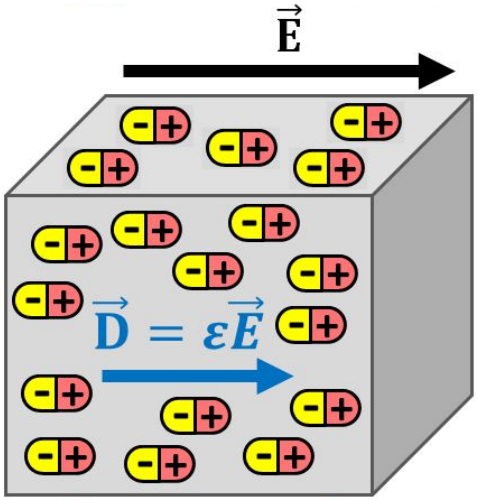

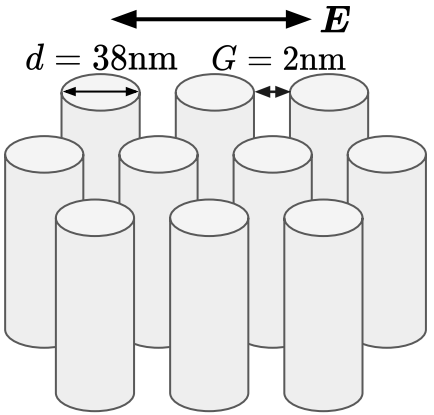

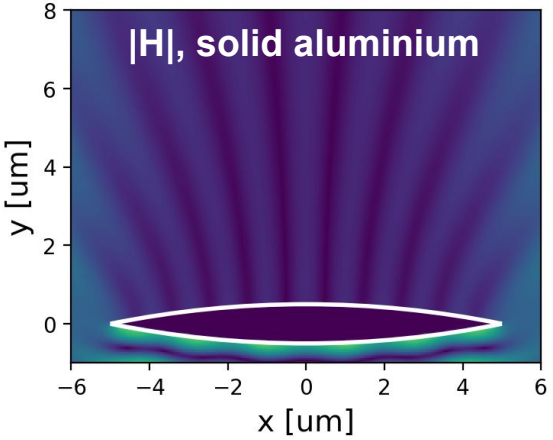

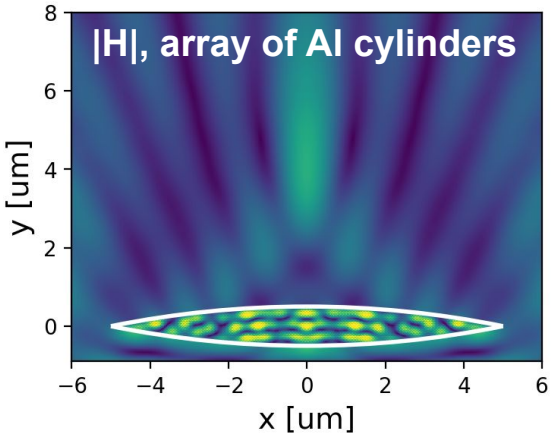

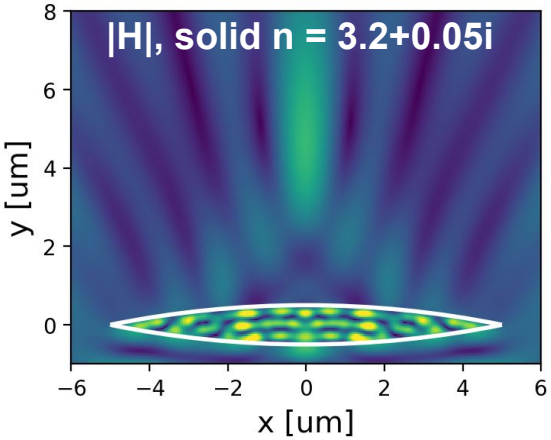

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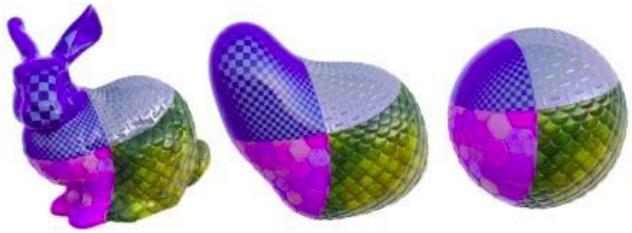

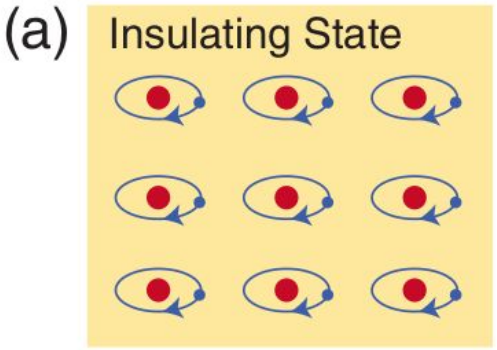

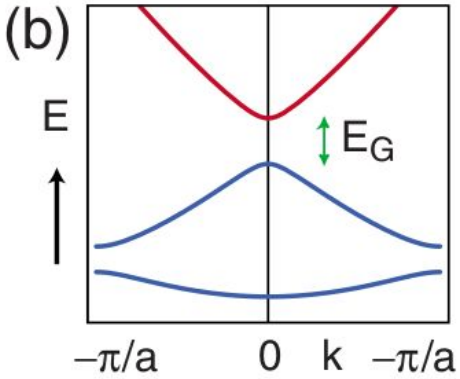

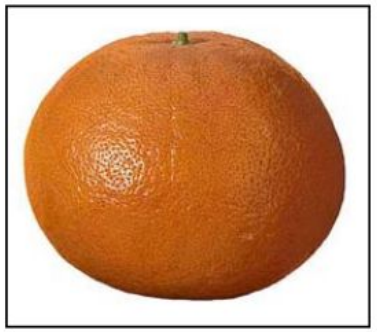

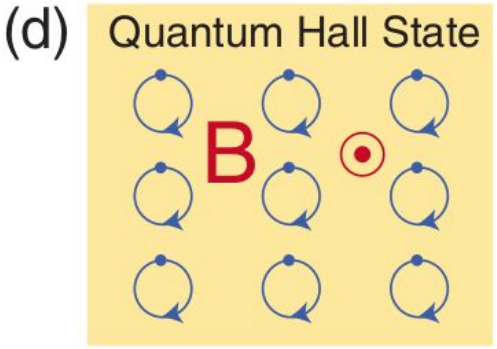

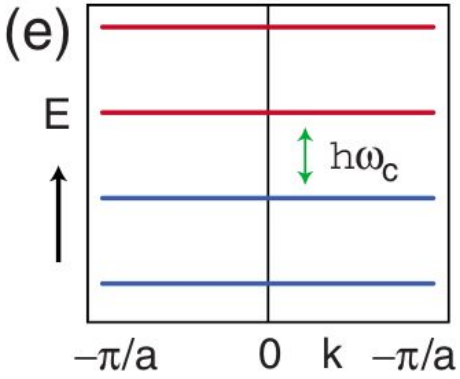

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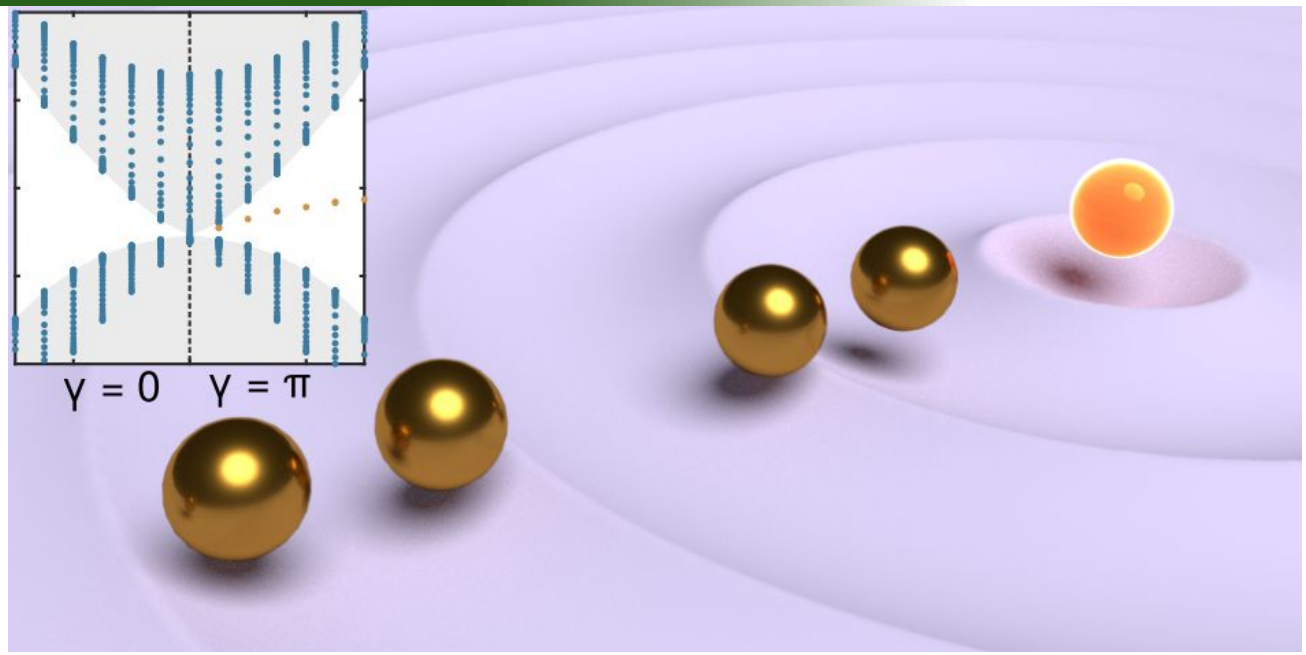

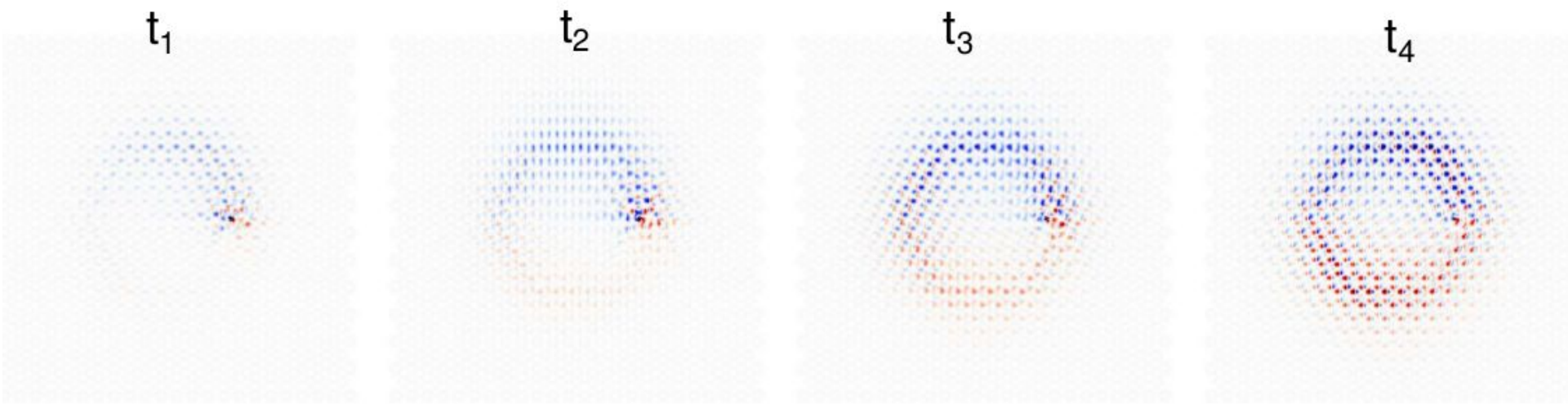

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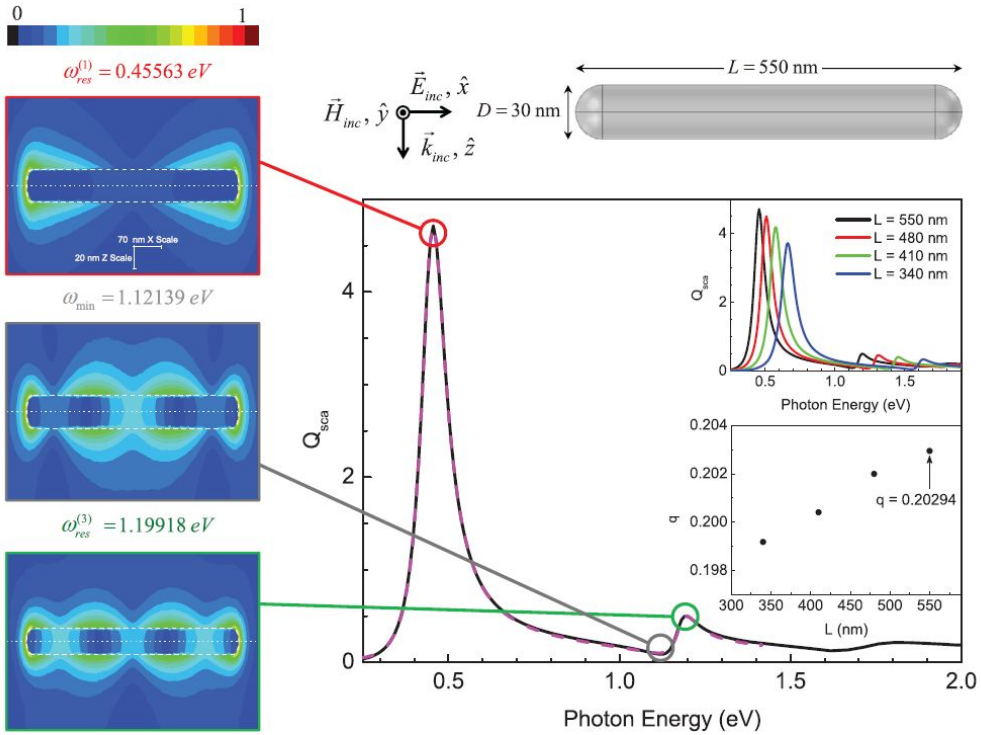
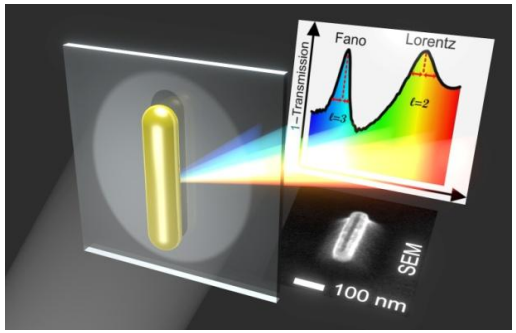
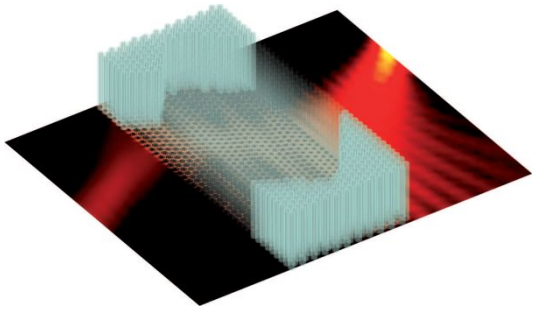
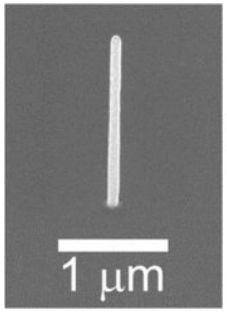
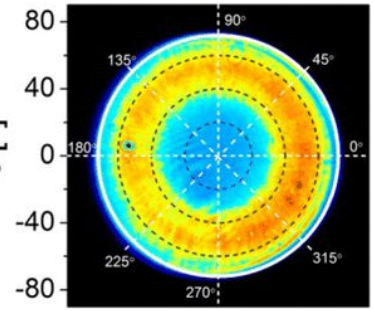
DE LO TEÓRICO... ...A LO APLICADO











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