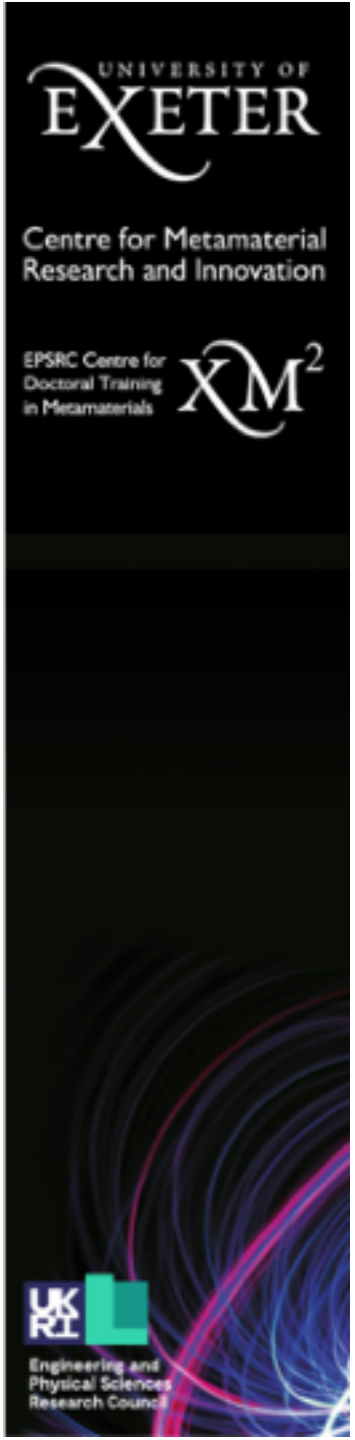
UNIVERSITY OF EXETER

Centre for Metamaterial Research and Innovation

EPSRC Centre for Doctoral Training in Metamaterials

XM²

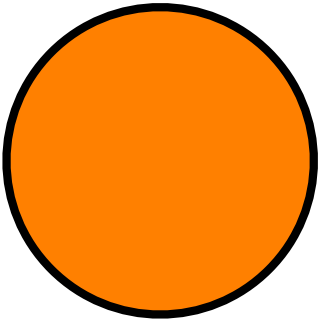


UKRI Engineering and Physical Sciences Research Council

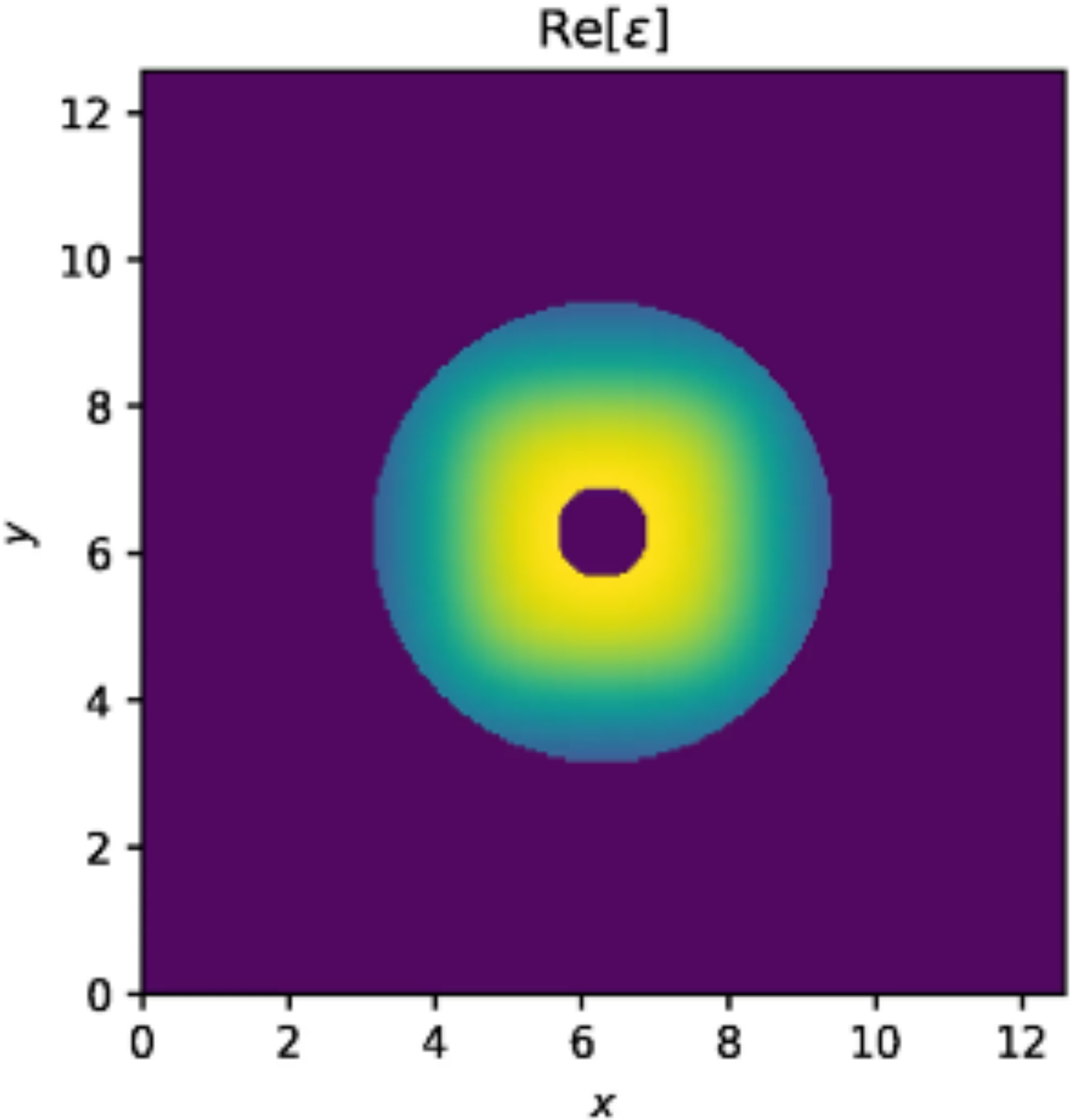
www.metamaterials.center

Continuous → Discrete

7



- Purcell, E. M. and Pennypacker, C. R., “Scattering and absorption of light by nonspherical dielectric grains” Astrophysical Journal 186 705 (1973)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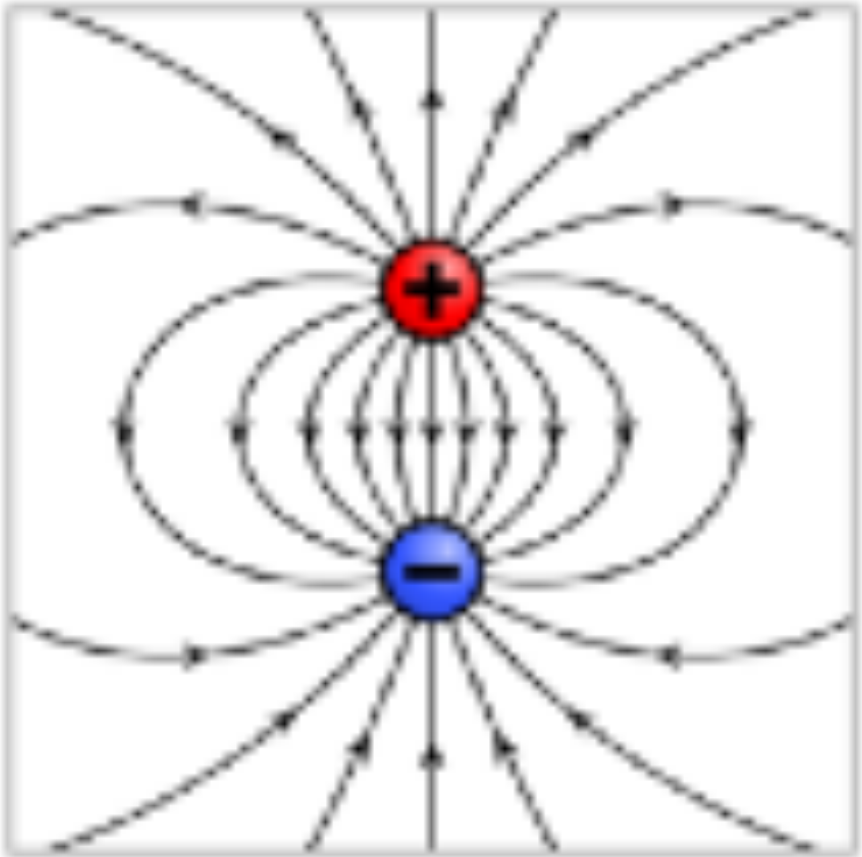
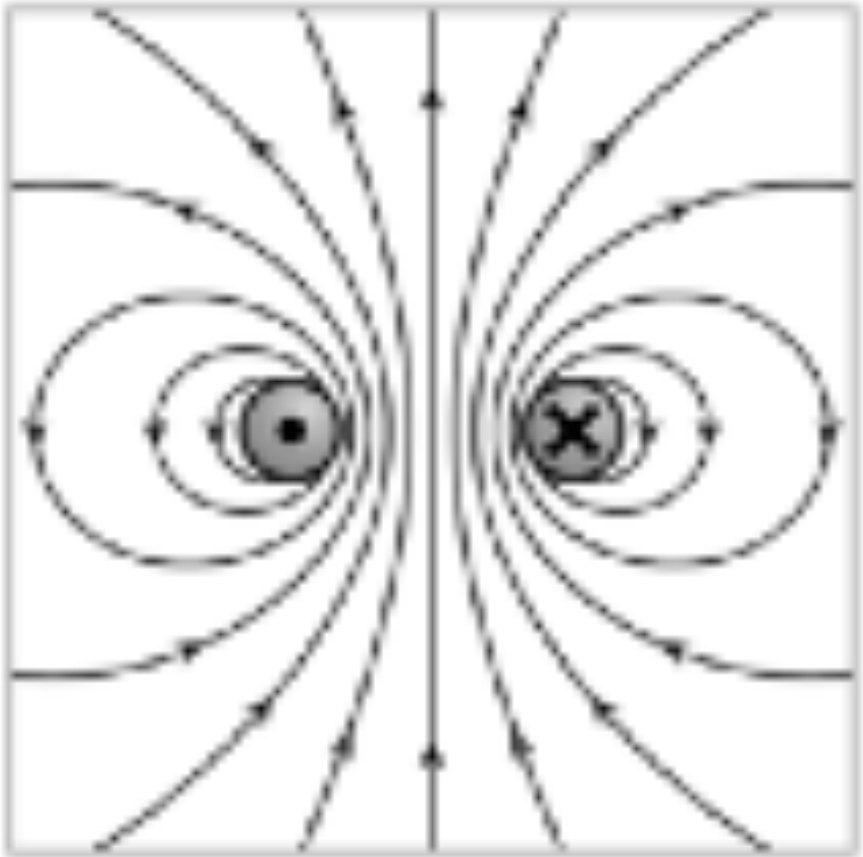




$$\delta \mathbf{E}(\mathbf{r}) = -\left[\xi^2 \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_E \nabla \mathbf{E}(\mathbf{r}_n) + i\xi \nabla \times \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_H \nabla \mathbf{H}(\mathbf{r}_n)\right] \delta \boldsymbol{r}_n$$

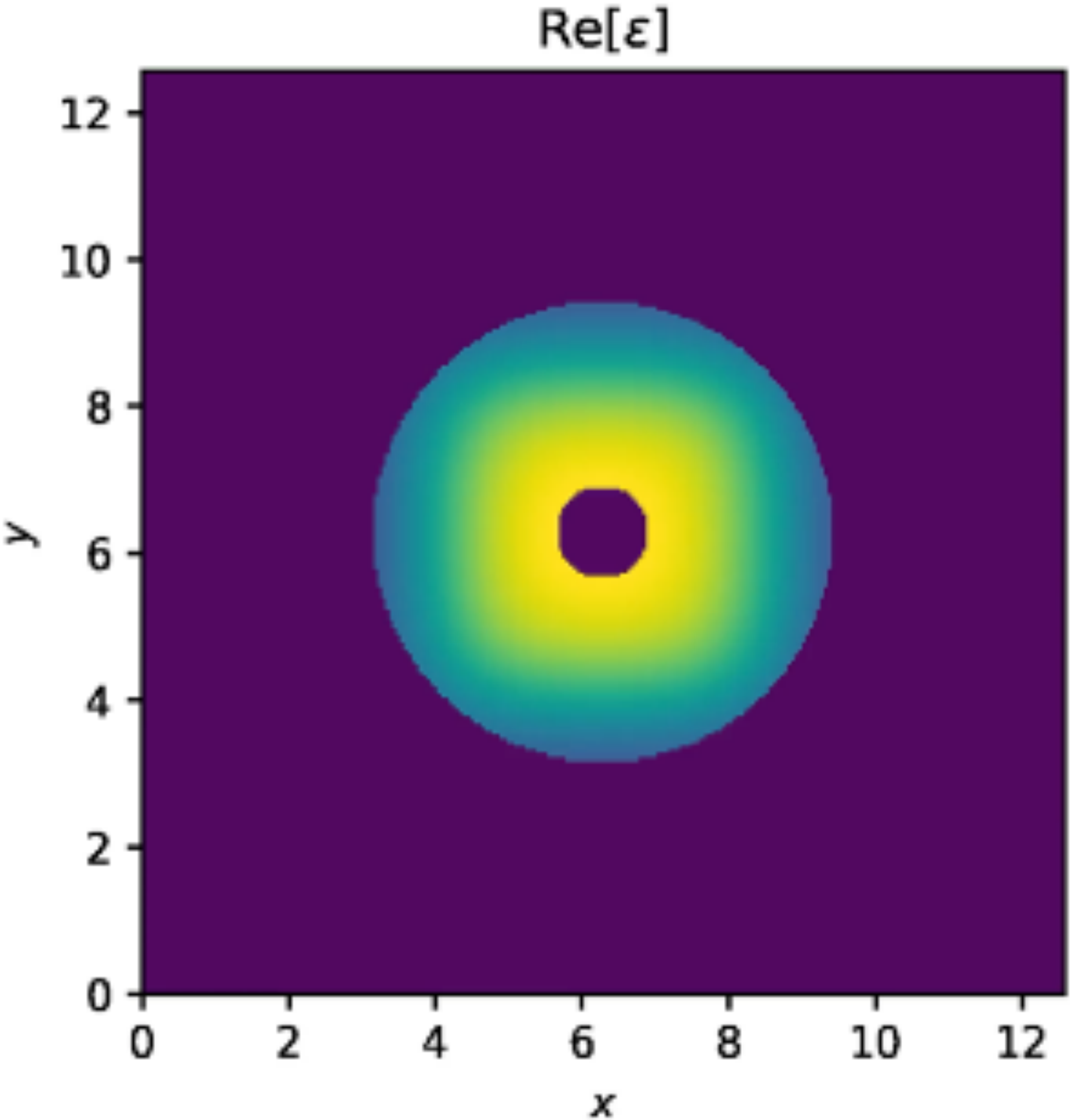
$$\begin{pmatrix} \boldsymbol{p} \\ \boldsymbol{m} \end{pmatrix} = \begin{pmatrix} \boldsymbol{\alpha}_E & 0 \\ 0 & \boldsymbol{\alpha}_H \end{pmatrix} \begin{pmatrix} \boldsymbol{E} \\ \boldsymbol{H} \end{pmatrix}$$

$$\begin{pmatrix} \boldsymbol{E}(\boldsymbol{r}) \\ \boldsymbol{H}(\boldsymbol{r}) \end{pmatrix} = \begin{pmatrix} \boldsymbol{E}_s(\boldsymbol{r}) \\ \boldsymbol{H}_s(\boldsymbol{r}) \end{pmatrix} + \sum_n \begin{pmatrix} \xi^2 \boldsymbol{G}(\boldsymbol{r}, \boldsymbol{r}_n)\boldsymbol{\alpha}_E & i\xi \nabla \times \boldsymbol{G}(\boldsymbol{r}, \boldsymbol{r}_n)\boldsymbol{\alpha}_H \\ -i\xi \nabla \times \boldsymbol{G}(\boldsymbol{r}, \boldsymbol{r}_n)\boldsymbol{\alpha}_E & \xi^2 \boldsymbol{G}(\boldsymbol{r}, \boldsymbol{r}_n)\boldsymbol{\alpha}_H \end{pmatrix} \begin{pmatrix} \boldsymbol{E}(\boldsymbol{r}_n) \\ \boldsymbol{H}(\boldsymbol{r}_n) \end{pmatrix}$$

Total =

Source +

Scattered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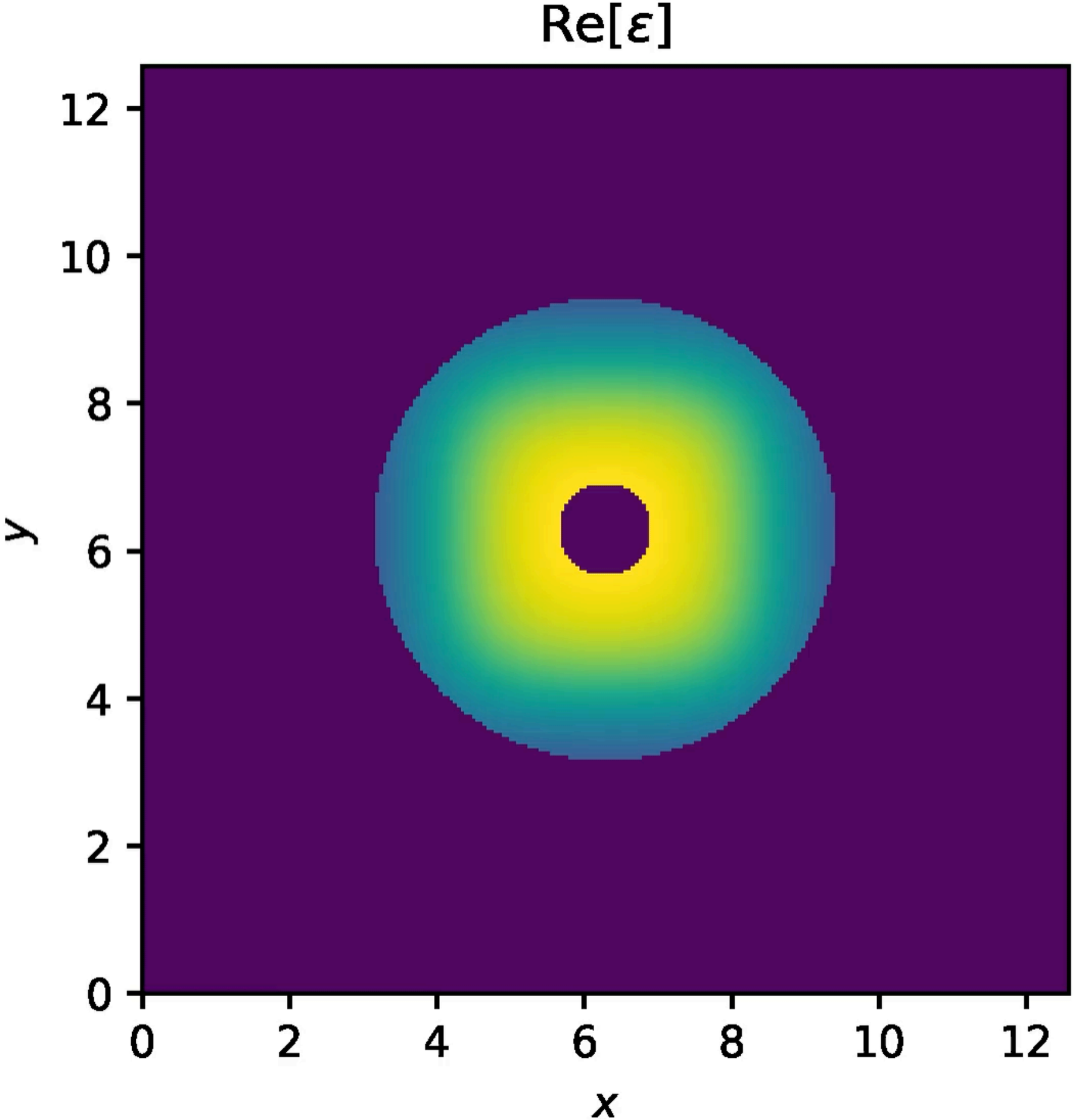
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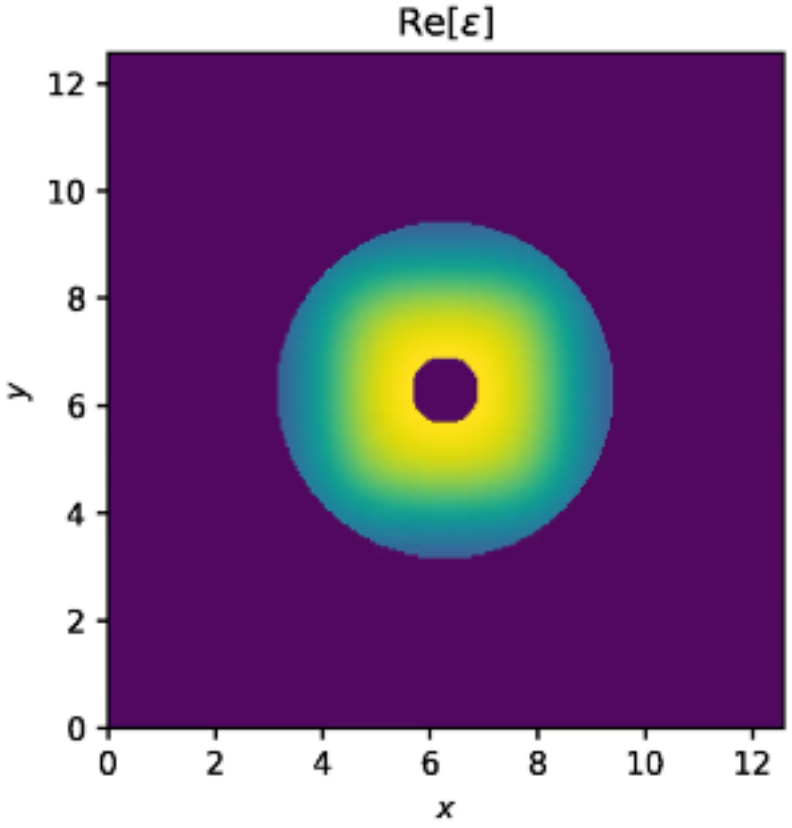
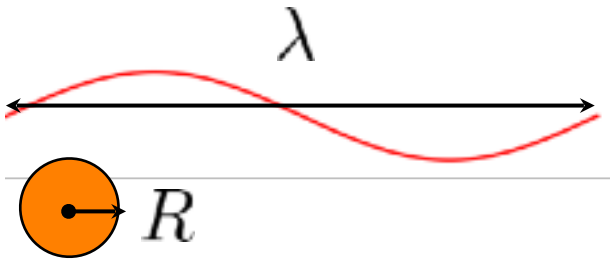
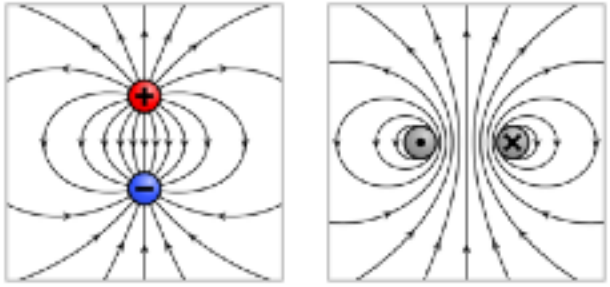
Continuous → Discrete





$$kR \leq 1$$



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Total = Source + Scattered

$$\delta\mathbf{E}(\mathbf{r}) = -\left[\xi^2 \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_E \nabla \mathbf{E}(\mathbf{r}_n) + i\xi\nabla \times \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_H \nabla \mathbf{H}(\mathbf{r}_n)\right] \delta \boldsymbol{r}_n$$

- Purcell, E. M. and Pennypacker, C. R., "Scattering and absorption of light by nonspherical dielectric grains" Astrophysical Journal 186 705 (1973)

Continuous → Discrete

$$\delta P = \mathrm{Im}\left[\mathbf{E}_*(\mathbf{r}) \cdot \mathbf{E}(\mathbf{r})\right] \delta\varepsilon$$

$$\delta P = \mathrm{Im}\left\{\mathbf{p}^* \cdot \left[\xi^2 \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_E \nabla \mathbf{E}(\mathbf{r}_n) + i\xi \nabla \times \mathbf{G}(\mathbf{r}, \mathbf{r}_n)\alpha_H \nabla \mathbf{H}(\mathbf{r}_n)\right]\right\} \delta \boldsymbol{r}_n$$