



Centre for Metamaterial
Research and Innovation

EPSRC Centre for
Doctoral Training
in Metamaterials

XM^2



Engineering and
Physical Sciences
Research Council

The first part of the paper discusses the importance of the research and the objectives of the study. It then presents a literature review of the existing research on the topic. The second part of the paper describes the methodology used in the study, including the data collection and analysis techniques. The third part of the paper presents the results of the study, and the fourth part discusses the implications of the findings.

The study was conducted using a quantitative research design. Data was collected from a sample of 100 participants. The data was then analyzed using statistical software. The results of the study show that there is a significant relationship between the variables being studied.

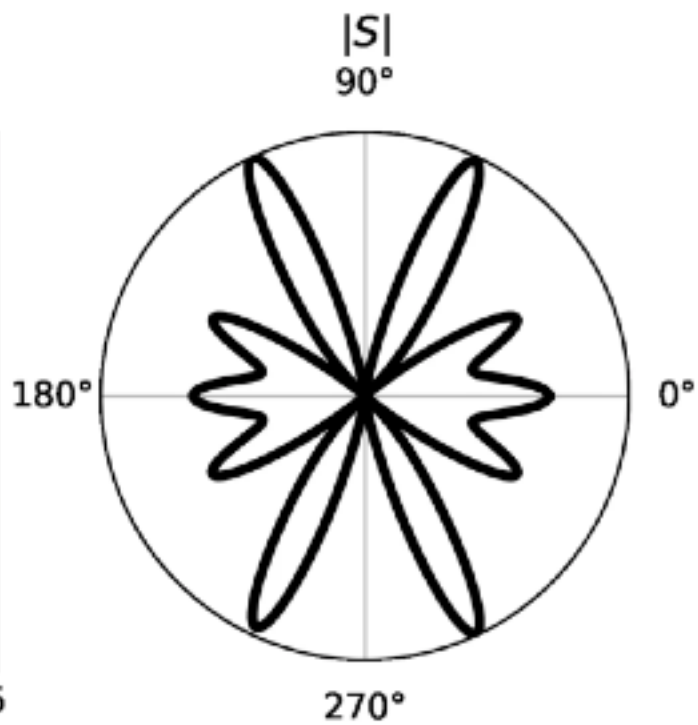
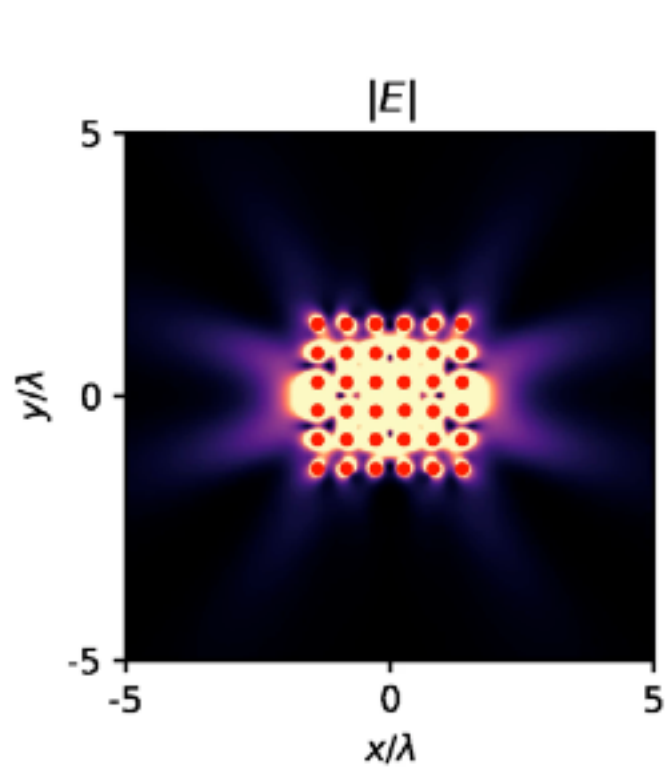
The findings of the study have several implications. First, they suggest that the variables being studied are related in a way that has not been fully explored in the literature. Second, they suggest that the research methodology used in the study is valid and reliable.

In conclusion, the study has provided valuable insights into the relationship between the variables being studied. The findings suggest that there is a need for further research in this area.

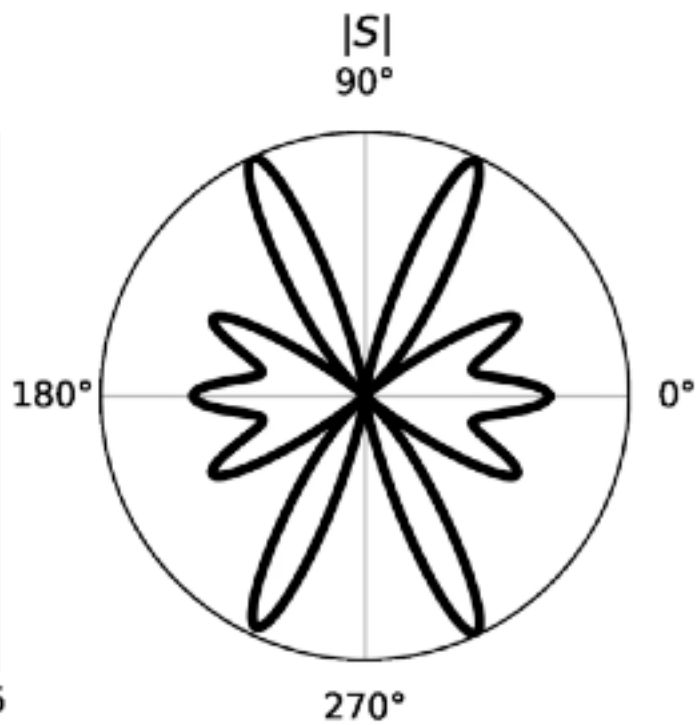
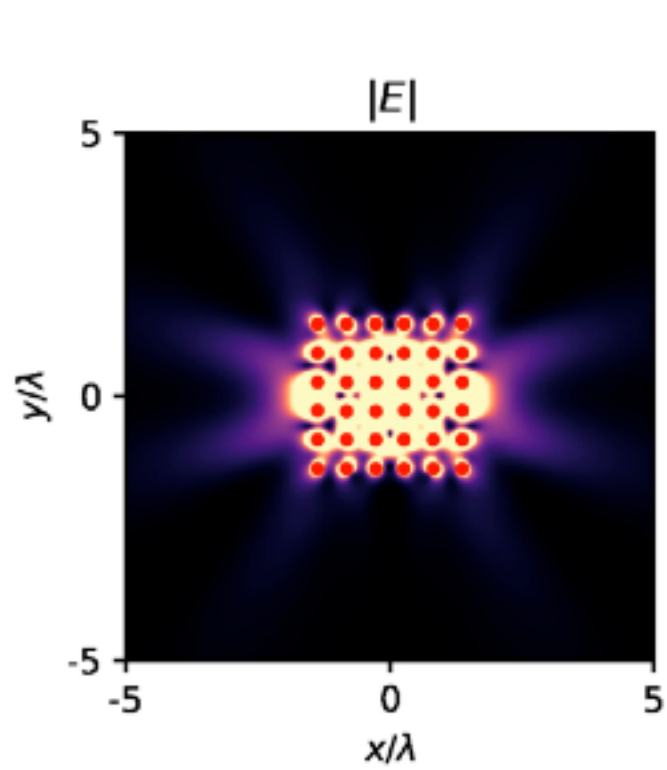
[www.nmetsmaterialscenter](http://www.nmetsmaterialscenter.com)

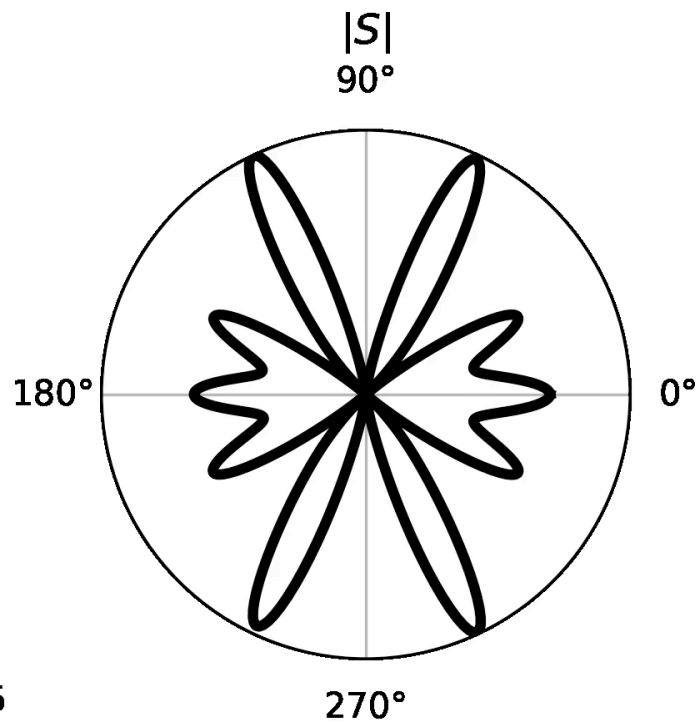
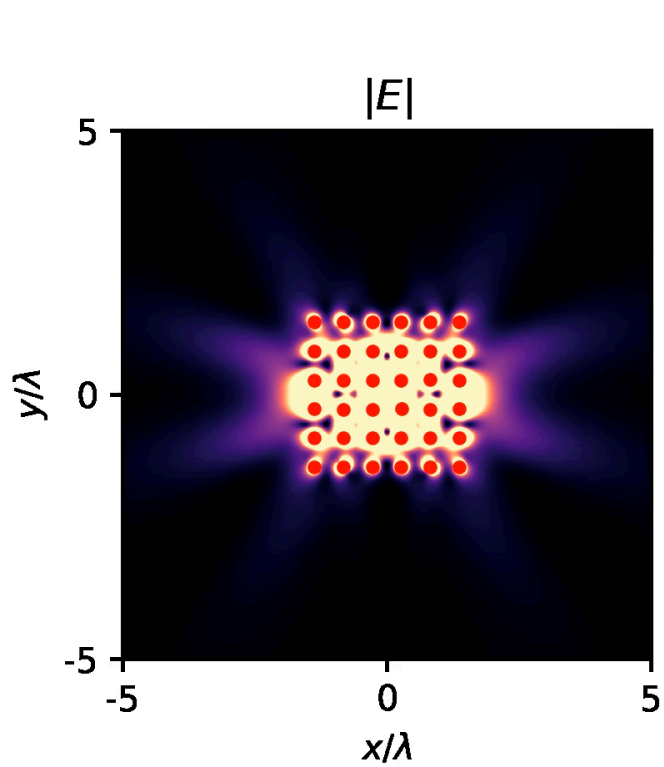
Directivity





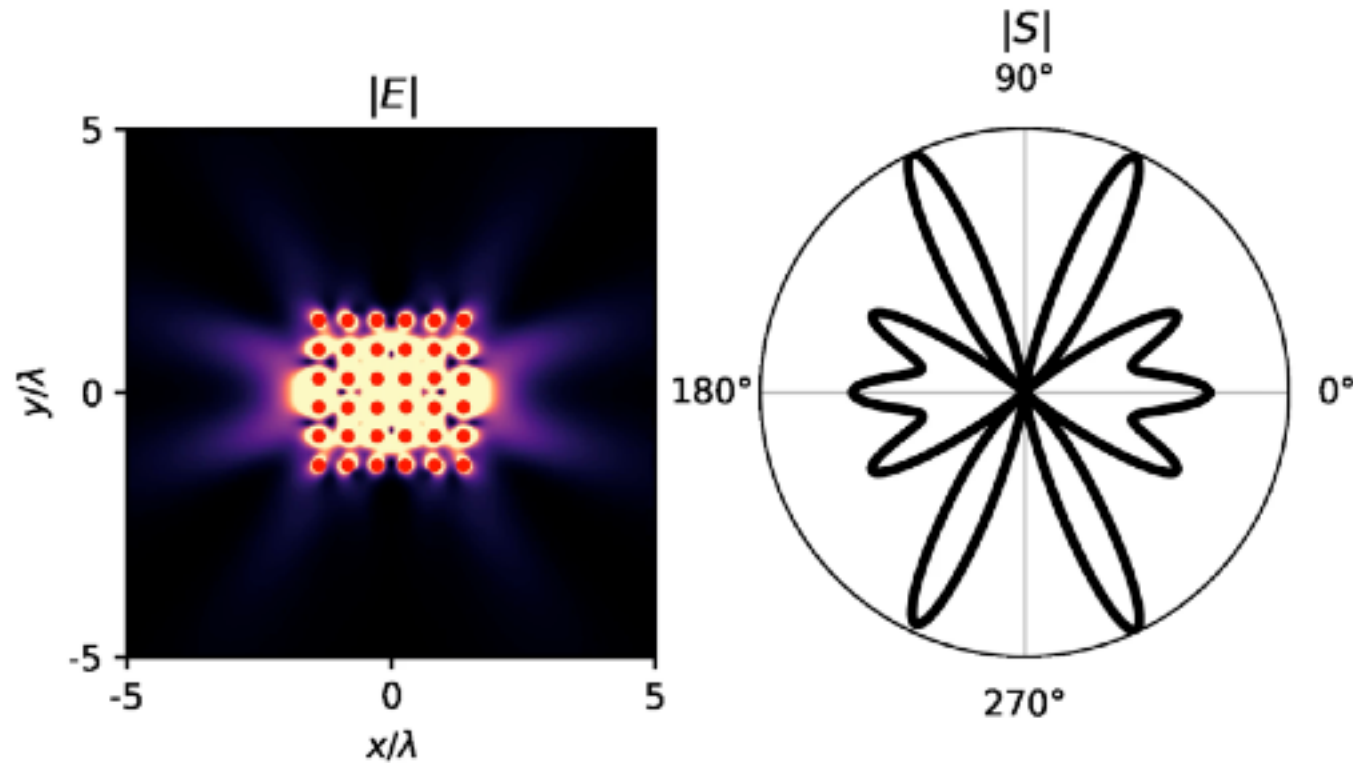
$$\delta P = \text{Im} \left\{ \mathbf{p}^* \cdot \left[\xi^2 \overset{\leftrightarrow}{\mathbf{G}}(\mathbf{r}_t, \mathbf{r}_n) \alpha_E \nabla \mathbf{E}(\mathbf{r}_n) + i \xi \nabla \times \overset{\leftrightarrow}{\mathbf{G}}(\mathbf{r}_t, \mathbf{r}_n) \alpha_H \nabla \mathbf{H}(\mathbf{r}_n) \right]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





Directivity

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



Far-field Shaping

$$F = \frac{1}{\sqrt{\int d\theta |S(\theta)|^2} \sqrt{\int d\theta \phi(\theta)^2}} \int d\theta |S(\theta)| \phi(\theta)$$

