We're now finished with plane wave/planar slab problems. These are probably the simplest scattering problems, and provide ample opportunities for elucidating physical understanding and insight for many types of problems.

Nevertheless, solutions to more complex scattering problems is needed. Computational EM packages are needed to solve most EM scattering problems. In some instances, though, the problem has distinguishing physical characteristics that allow an accurate approximate solution.

For large, smooth, PEC scatterers, it is possible to obtain a rough measure of the EM scattering with surprisingly little computational effort. This technique is called the physical optics (PO) approximation.

Consider a PEC scatterer illuminated by a plane wave as shown:

![Diagram](image)
In any problem of this type, the quest is to determine the unknown electric surface current density \( \mathbf{J}_5 \) that has been induced on the surface of the PEC scatterer by the incident wave. It is then a relatively simple matter to compute the scattered fields from these induced currents. The difficult part is computing \( \mathbf{J}_5 \).

In the P.O. approximation, a known surface current density \( \mathbf{J}_5 \propto 2 \mathbf{\hat{n}} \times \mathbf{E}_i \) is assumed to reside on the illuminated surface as shown, while \( \mathbf{J}_5 = 0 \) on the shadow side.

It is important to notice that \( \mathbf{J}_5 \propto 2 \mathbf{\hat{n}} \times \mathbf{E}_i \), which is known.

This approximation can be partially justified by considering each elemental piece of the scatterer as an infinite PEC plane!
...in that case.

\[ \frac{T^i}{m^i} \quad \text{sources} \]

\[ \frac{T^i}{m^i} \]

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PEC

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...can be replaced with the equivalent problem:

\[ T^i \]

\[ \text{equivalent fields} \]

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\[ \Rightarrow T_s \]

\[ \text{null fields} \]

...where \( T_s = \ell^i \times H^i \) (from image theory).