



Research Methods in Science in Engineering

3D Graphics

Slide 1

1

Outline

- Perspective Vs. Orthographic Projection
- Volume Vs. Surface Shading
- Miscellaneous Tips

Slide 2

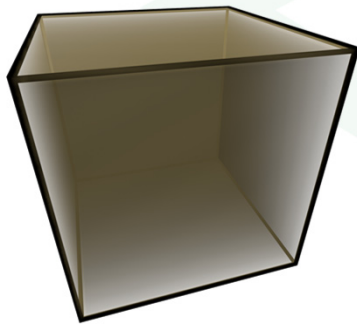
2

Perspective Vs. Orthographic Projection

3

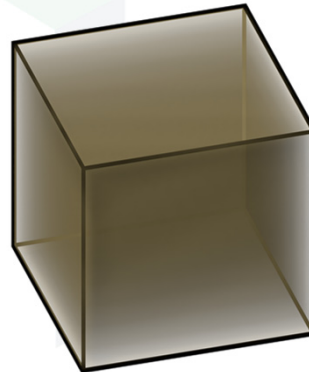
Projection Style

Perspective



Gives a better illusion of depth by showing farther objects as smaller.

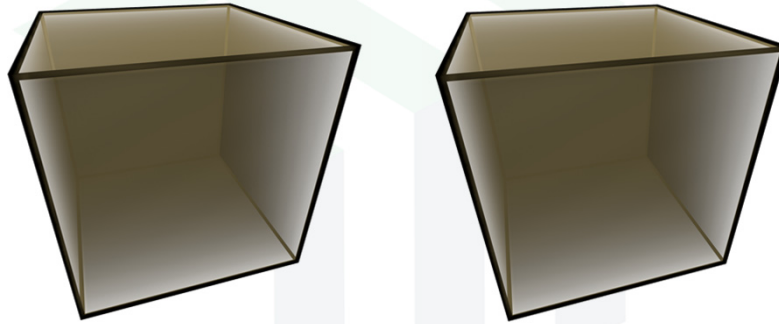
Orthographic



Maintains size regardless of depth.

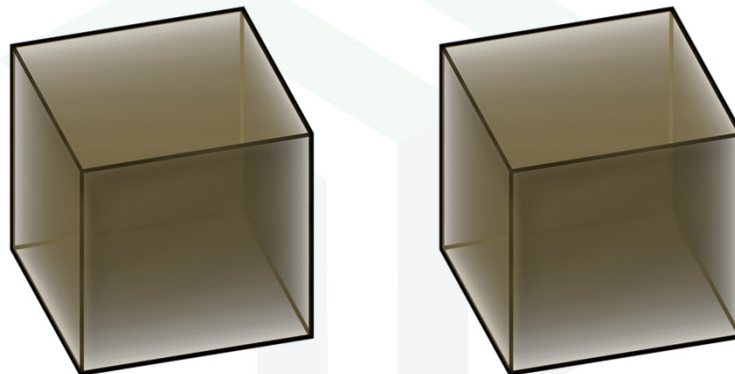
4

A Problem With Perspective



Placing two *perspective* objects together that were rendered separately looks awkward. Avoid doing this!

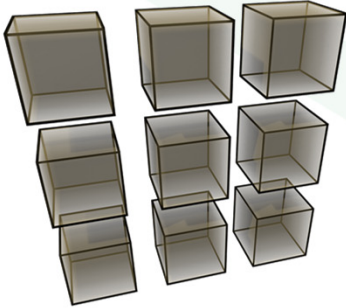
Better with Orthographic



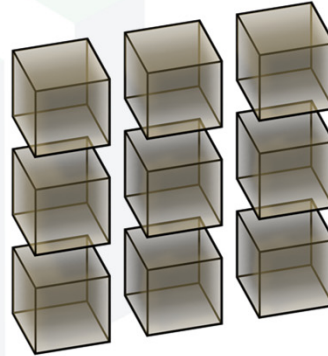
When rendering separately, orthographic projection works better when placed side-by-side.

Which is Best?

Perspective



Orthographic



When arraying objects rendered with perspective projection, it is best to produce the image in a single render.

Volume Vs. Surface Shading

What is a Shader?

A *shader* is the computer program that tells a rendering engine what the surface of an object looks like, not its shape.

Coarse Mesh



Simplest Shader

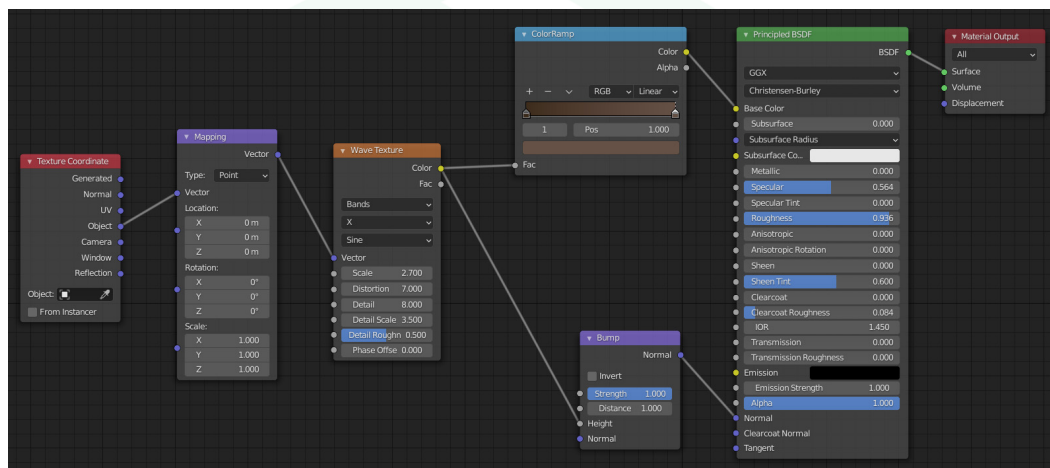


Bark Shader



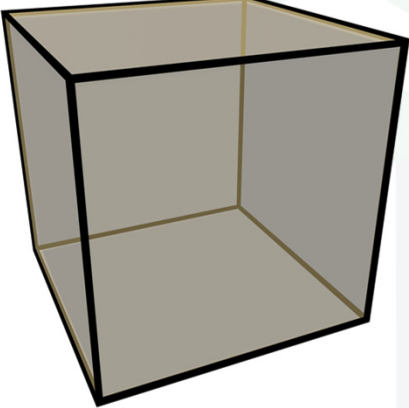
Imagine the complexity in the mesh and how computationally intensive it would be to render a mesh of tree bark. Shading allows for much simpler meshes to be used.

What Does a Shader Look Like?

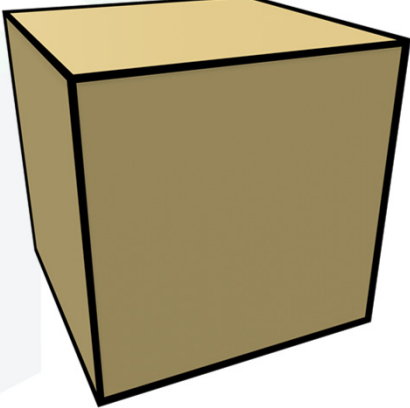


Surface Shading


Transparent



Opaque



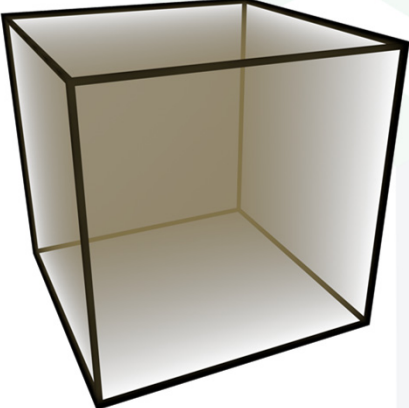
Surface shading is the easiest and fastest way to render an object. Transparency does not give a realistic look for a translucent object.

 Slide 11

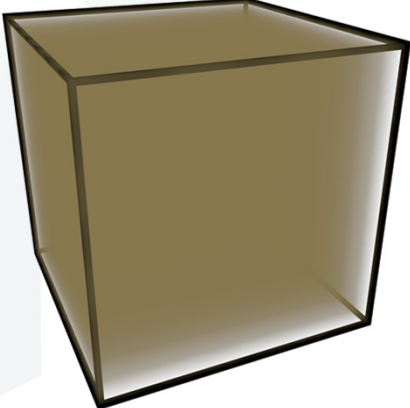
11

Volume Shading


Sparse



Dense



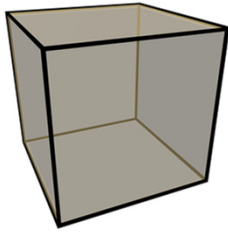
Volume shading looks like fog or smoke and is more computationally intensive. It still does not give a realistic look for a translucent object.

 Slide 12

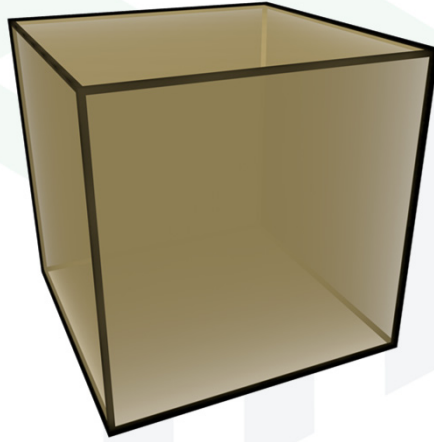
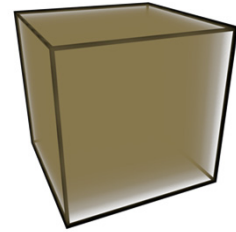
12

Both Surface & Volume Shading

Surface Shading Only



Volume Shading Only

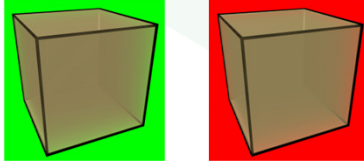


Using both surface and volume shading gives the most realistic representation of a translucent object.

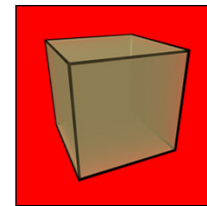
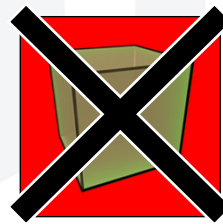
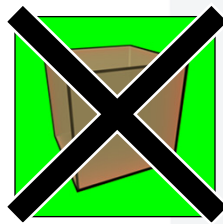
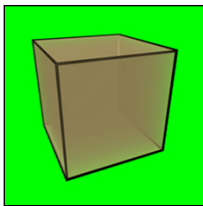
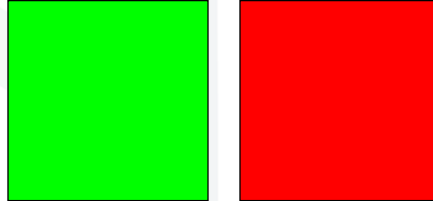
Miscellaneous Tips

Match Your Background Color

Same cube rendered with two different background colors.



Two different color backgrounds to paste images onto.



Give Reflective Surfaces Something to Reflect

No World

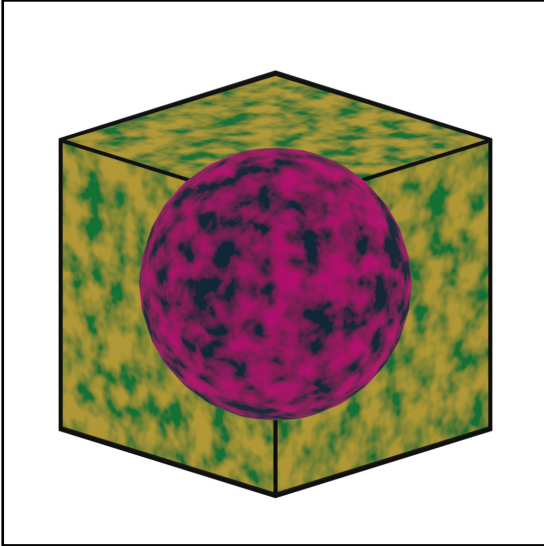


With World



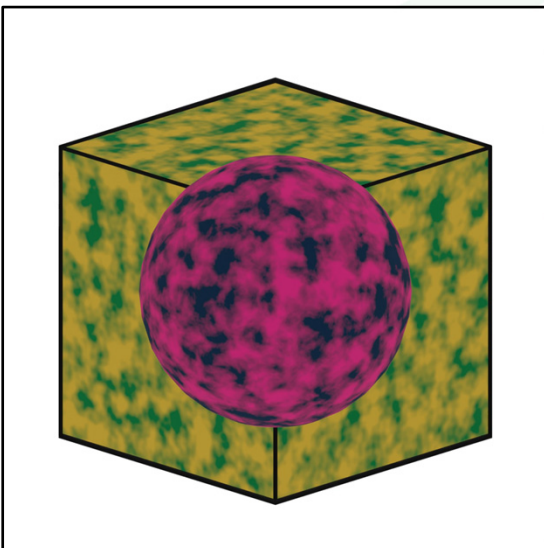
Other than the world, these are the exact same renders!

Conveying Three-Dimensional Geometries



What is the best way to illustrate the full shape and form of this cube?

Conveying Three-Dimensional Geometries

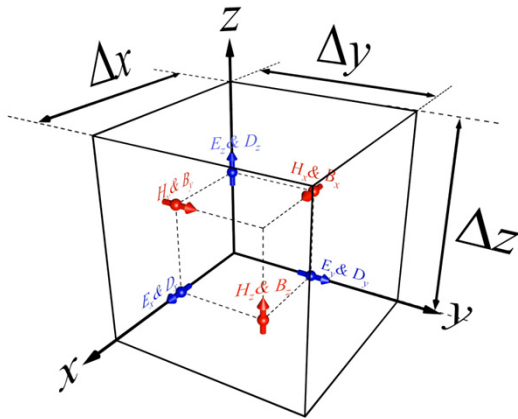


What is the best way to illustrate the full shape and form of this cube?

Show the object rotating in a slow and classy manner.

By doing this, it becomes obvious the green/yellow object is not even a cube!

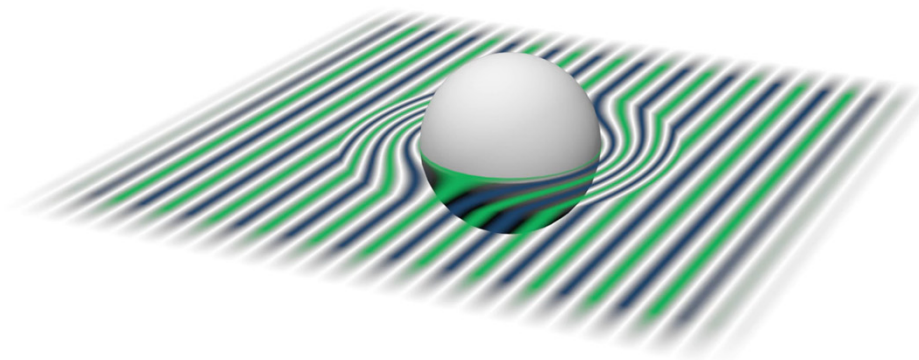
Conveying Three-Dimensional Geometries



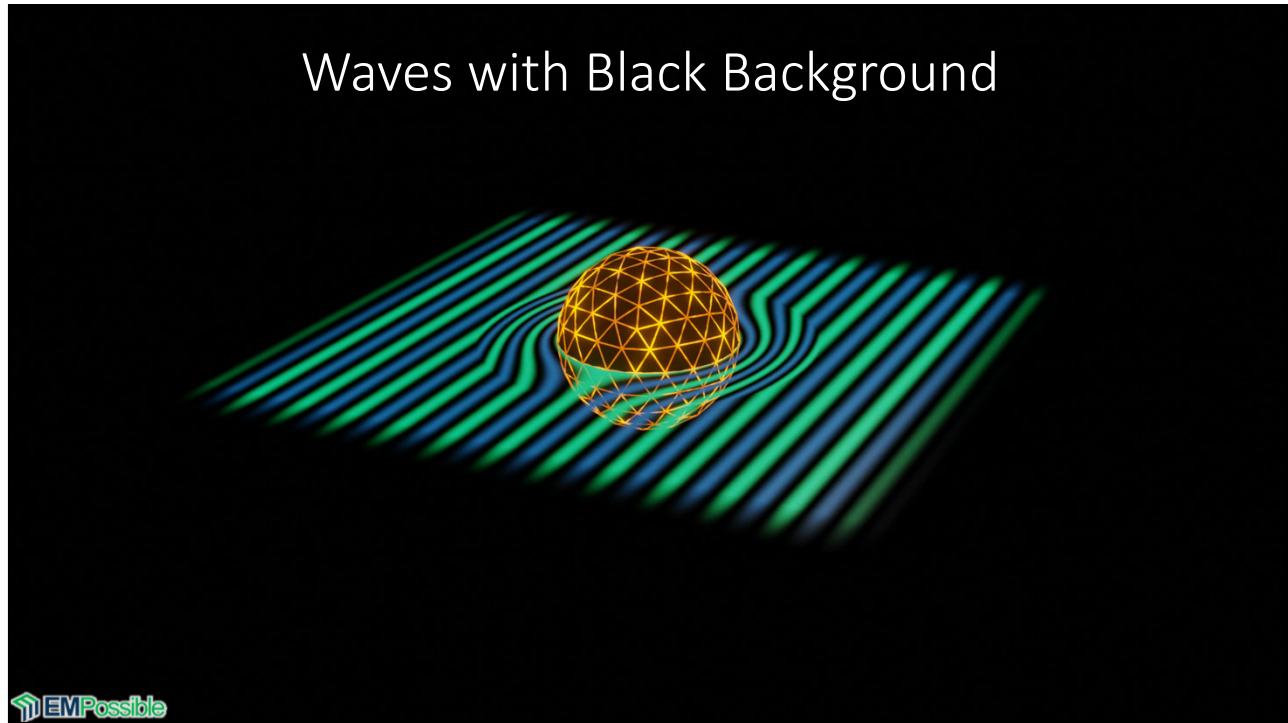
This is a three-dimensional Yee grid cell used in the finite-difference time-domain (FDTD) method for simulating electromagnetic waves.

The rotation activates the 3D computer in a person's brain to more quickly and intuitively understand the geometry of the object.

Waves with White Background

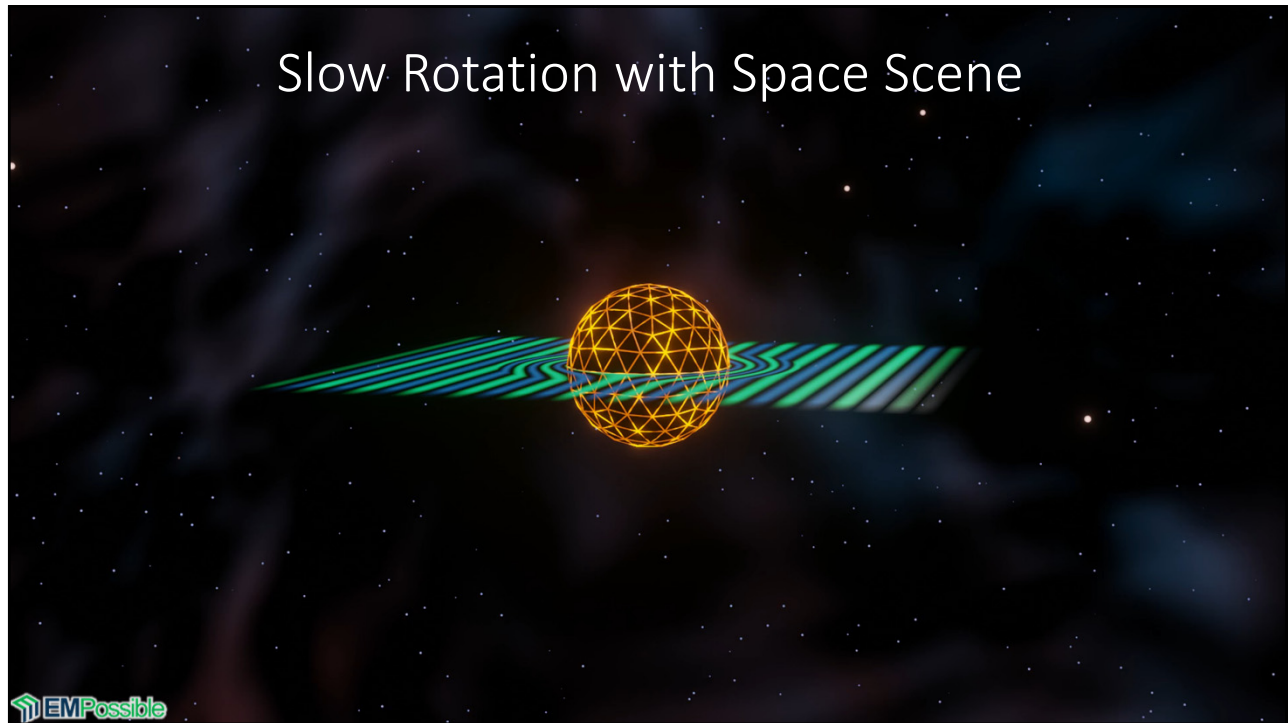


Waves with Black Background

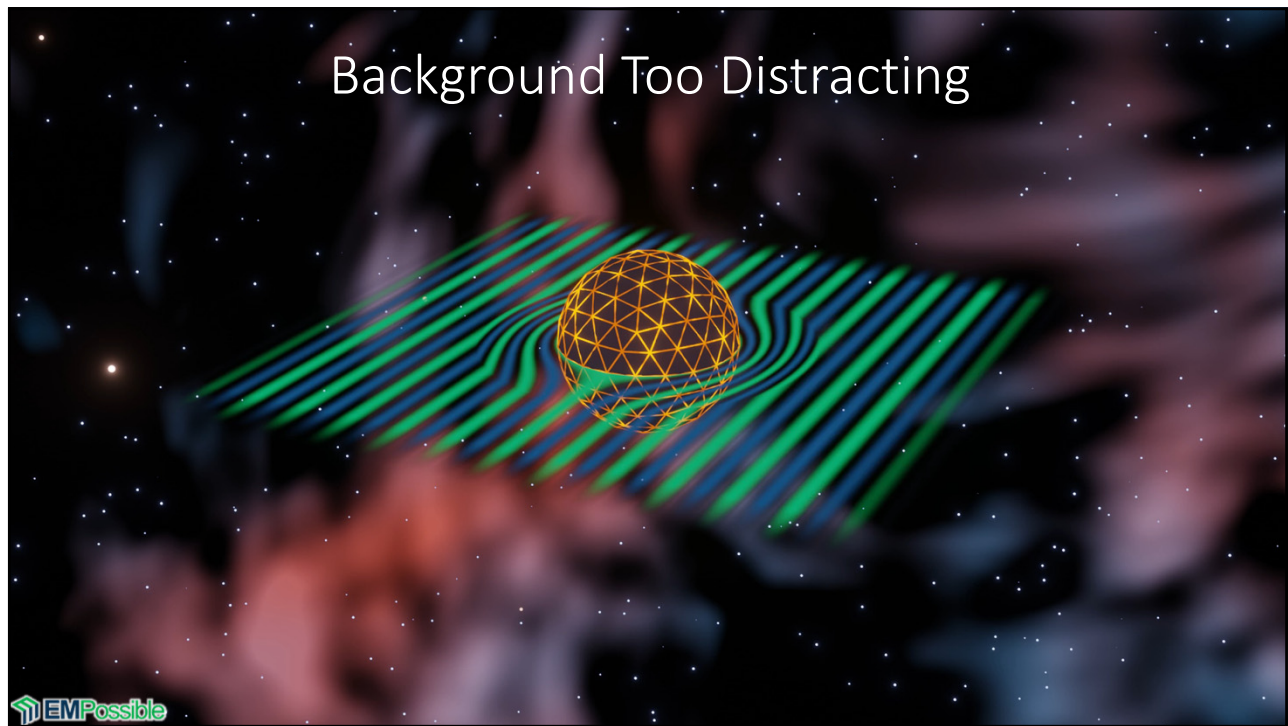


21

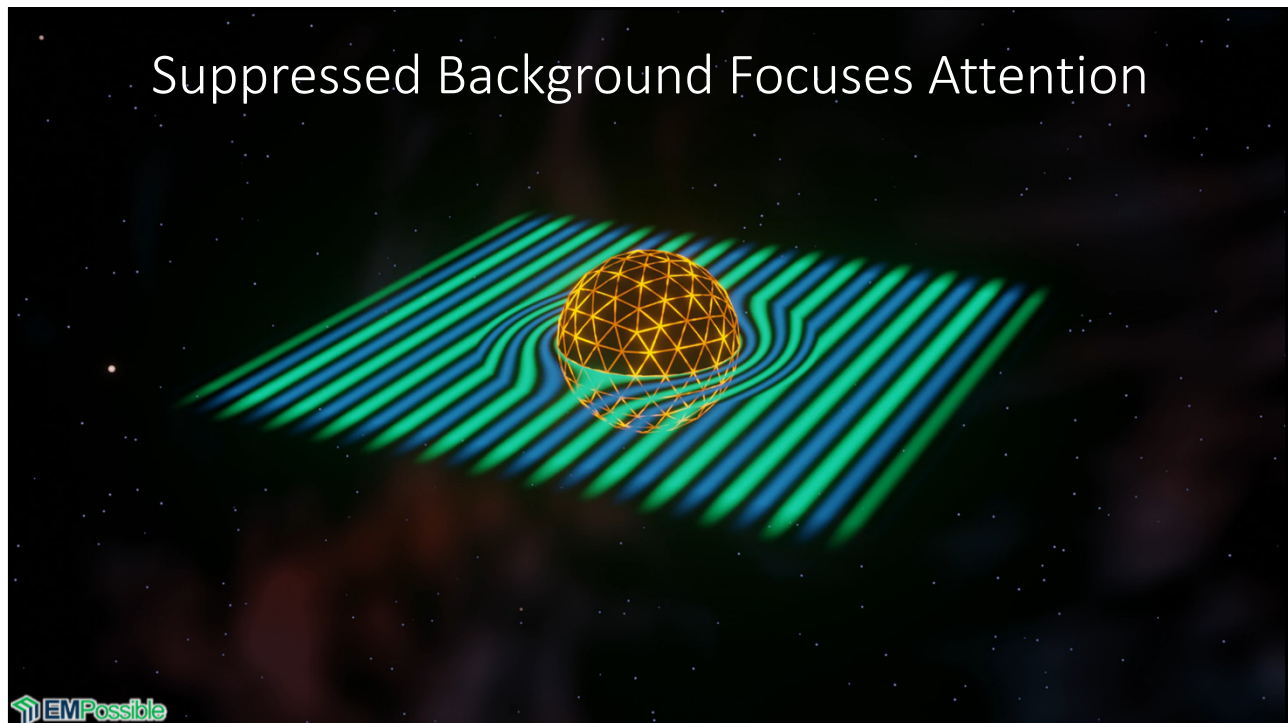
Slow Rotation with Space Scene



22



23



24