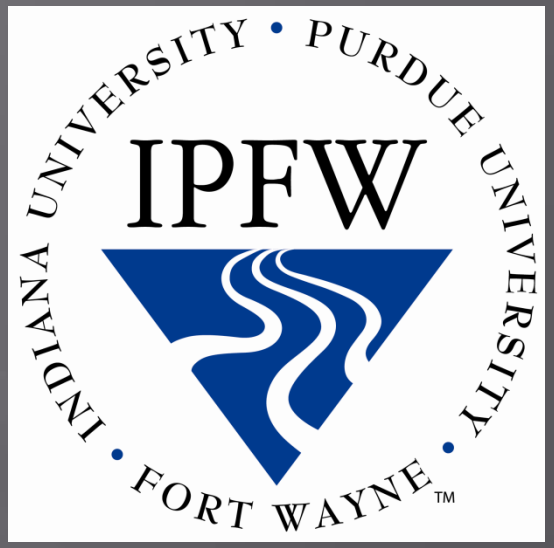
ACTIVE LEARNING USING TUTORIALS IN INTERMEDIATE OPTICS



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We want the students to conceptually understand optics, to be able to think through optics problems, and to be able to solve problems in optics.

Use interactive engagement, collaboration and tutorials in the classroom to help the students learn basic concepts and to work through complex optical problems.

Topics and concepts for Class

Geometric optics

- Point and Extended sources
- Ray tracing
- Optical systems
- Aberrations

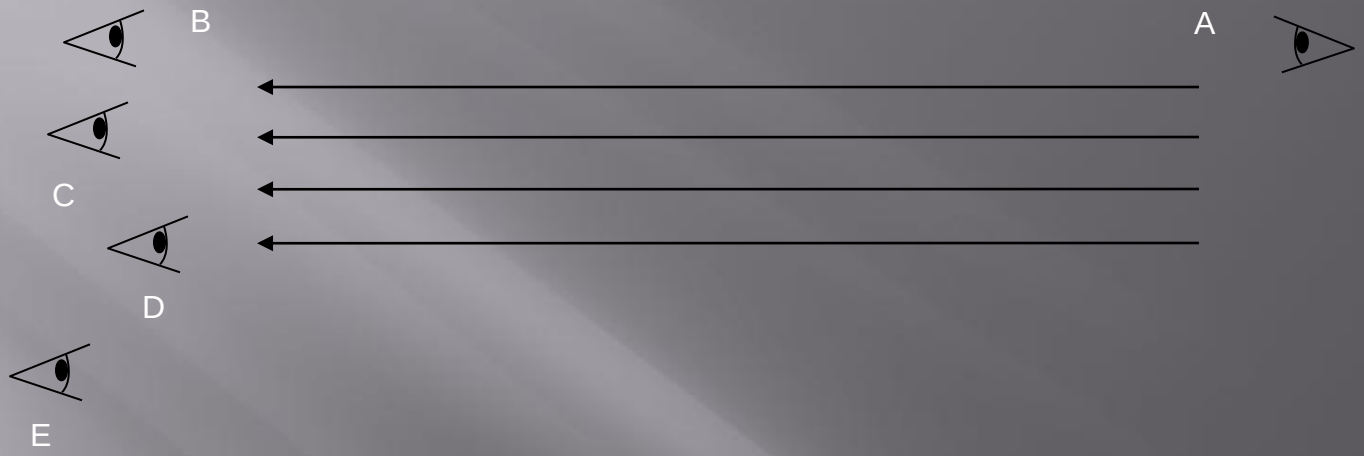
Physical Optics

- Wave nature of light
- Polarization: physical representation and how polarizers work
- Interferometry

Example 1 From Class work

Students have a difficult time interpreting wave diagrams often believing that the amplitude corresponds to spatial extent.

They have to be guided to develop the interpretation of the diagrams.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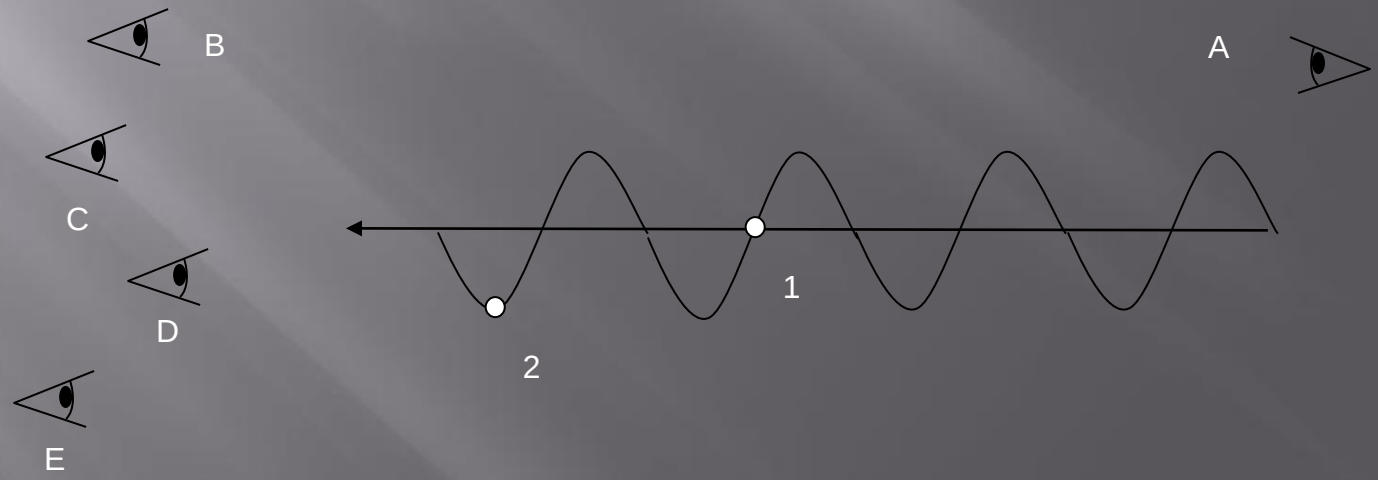
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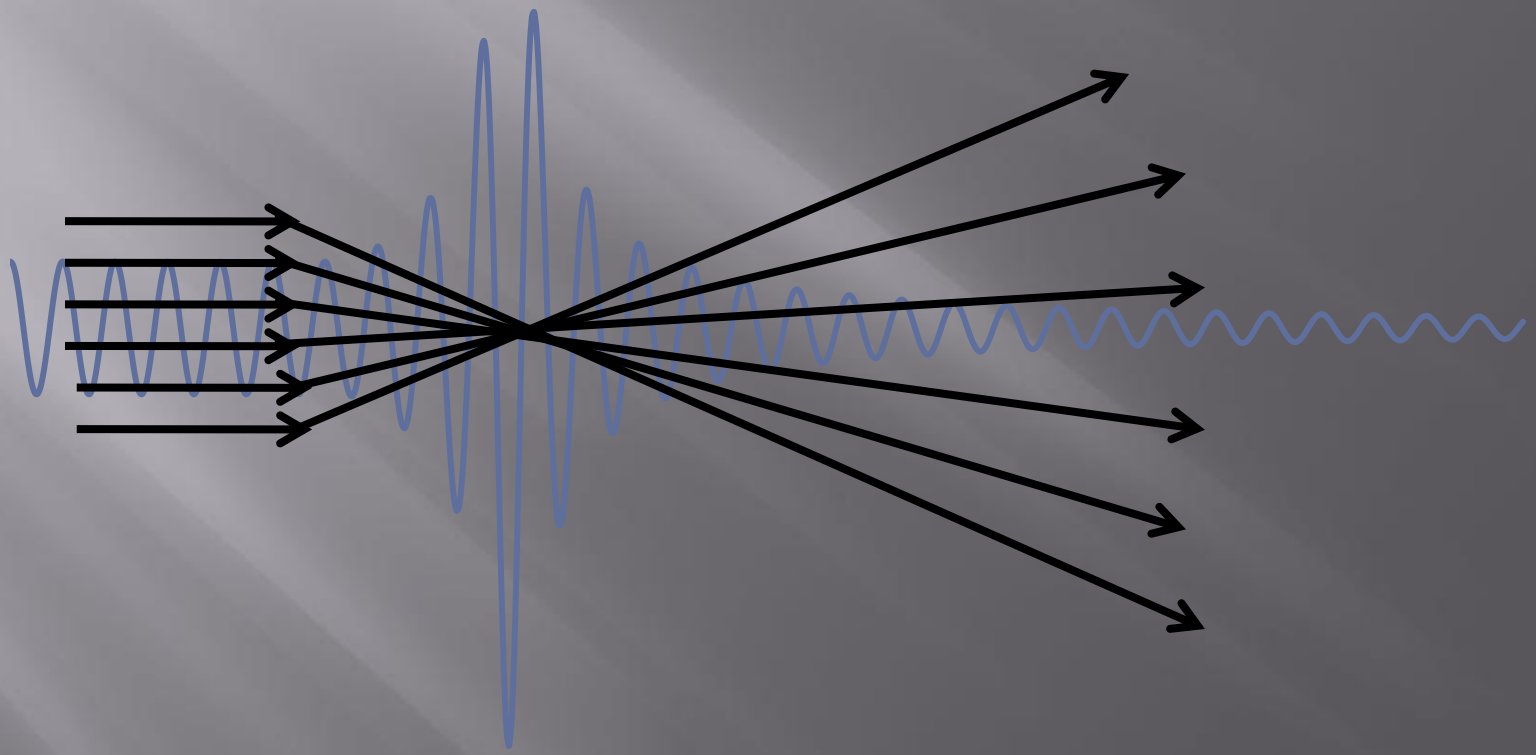
Example 2 from class work

Continuing with the relation of ray diagrams and waves, further questions can be asked to reinforce the concepts and start to relate waves and ray diagrams.

We develop quasi-quantitative ray diagrams to help understand the difference between irradiance and power

Example 3 from class



Example 4: Guided Derivation

Students must also learn and understand the mathematics of the physics.

Rather than lecture, tutorials are used to guide the students through derivations.

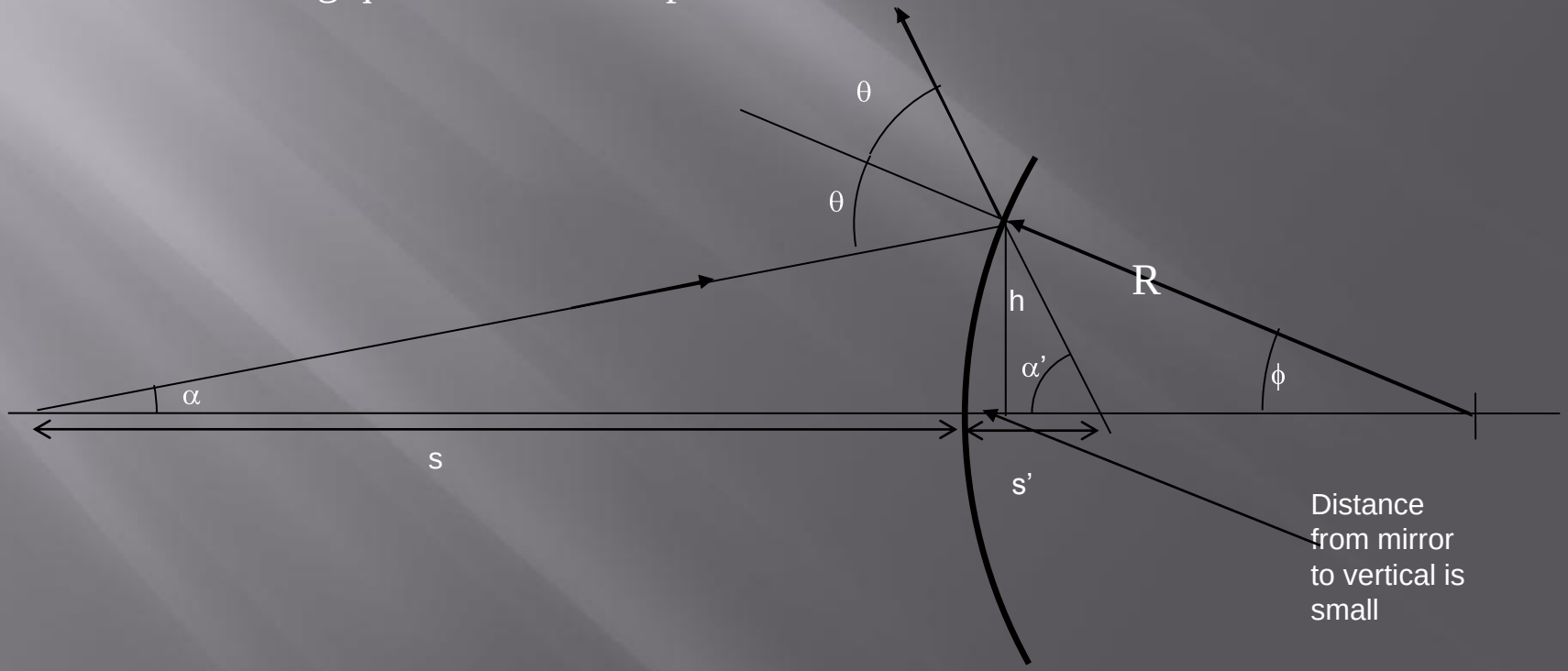
Assist students with derivation as students work and discuss as a class upon completion.

Derived results are then used in examples and homework

Tutorials serve as notes for the students.

Our goal is to determine the location of the image of a point source based upon the point sources distance from the mirror surface and the radius of curvature of the mirror.

- Consider a point source located a distance "**s**" away from the surface of a convex spherical mirror of radius R. This is shown in the diagram above. Imagine a light ray that makes an angle α from the horizontal axis and hits the mirror some height "h" above the horizontal axis.
- How would you determine where the image of the point source is formed? What is the distance of that image from the surface of the mirror?
- Additional leading questions for complete derivation



Does it work?

Because students do the work rather than being told, the class seems to progress more slowly than in straight lecture.

The students seem to understand optics better at the end of this process than if they were "shown" results

If interested you can download the materials developed from http://users.ipfw.edu/masters

We are writing instructional materials to go with the tutorials and laboratories.