Image-Based Lighting Tutorial

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Presented by Craig Hiller

Image Based Lighting

- Process of illuminating scenes and objects (real or synthetic) with images of light from the real world

- Based off of reflection-mapping technique

  - Panoramic images as texture maps on models to make shiny objects reflect their environments

Basic Steps

1. Capturing real-world illumination

2. Mapping the illumination onto a representation of the environment

3. Placing the 3D object inside the environment

4. Simulating the light from the environment illuminating the object

Capturing Light

- Need an omnidirectional and high dynamic range (HDR) image

  - Camera + Mirror Ball

  - Image Stitching

  - Scanning panoramic camera

Capturing Light

- Pixel values need to be proportionate to light levels

  - Accomplished via HDR photography
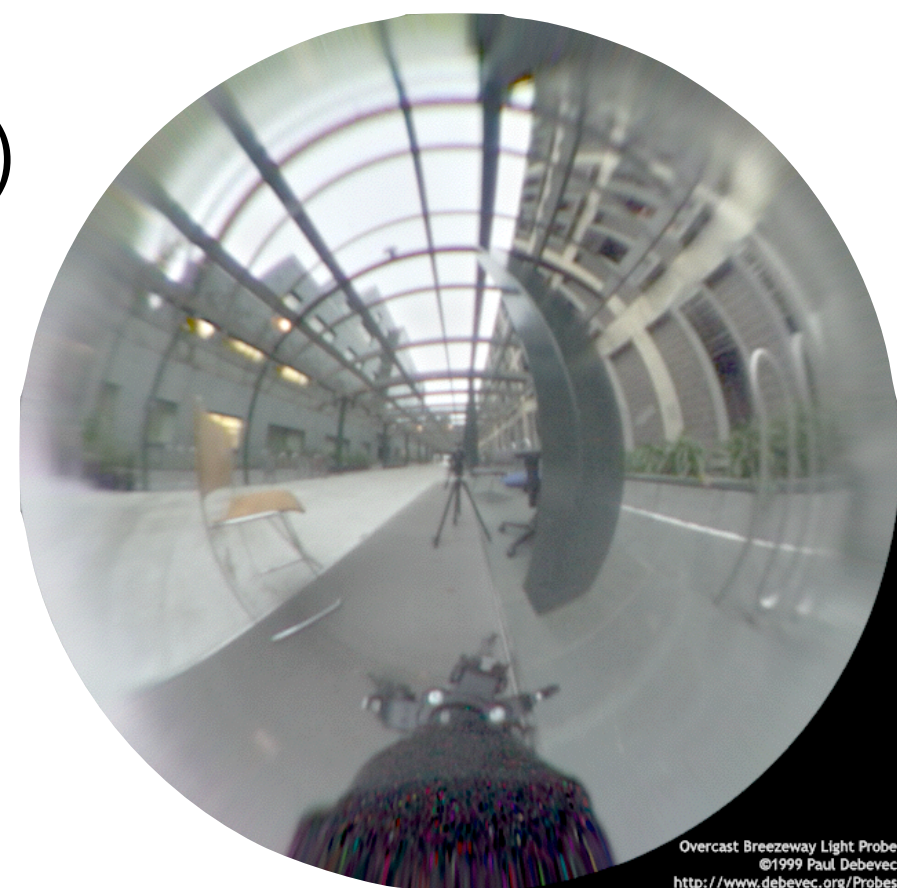
  - Normally non-linear due to displays
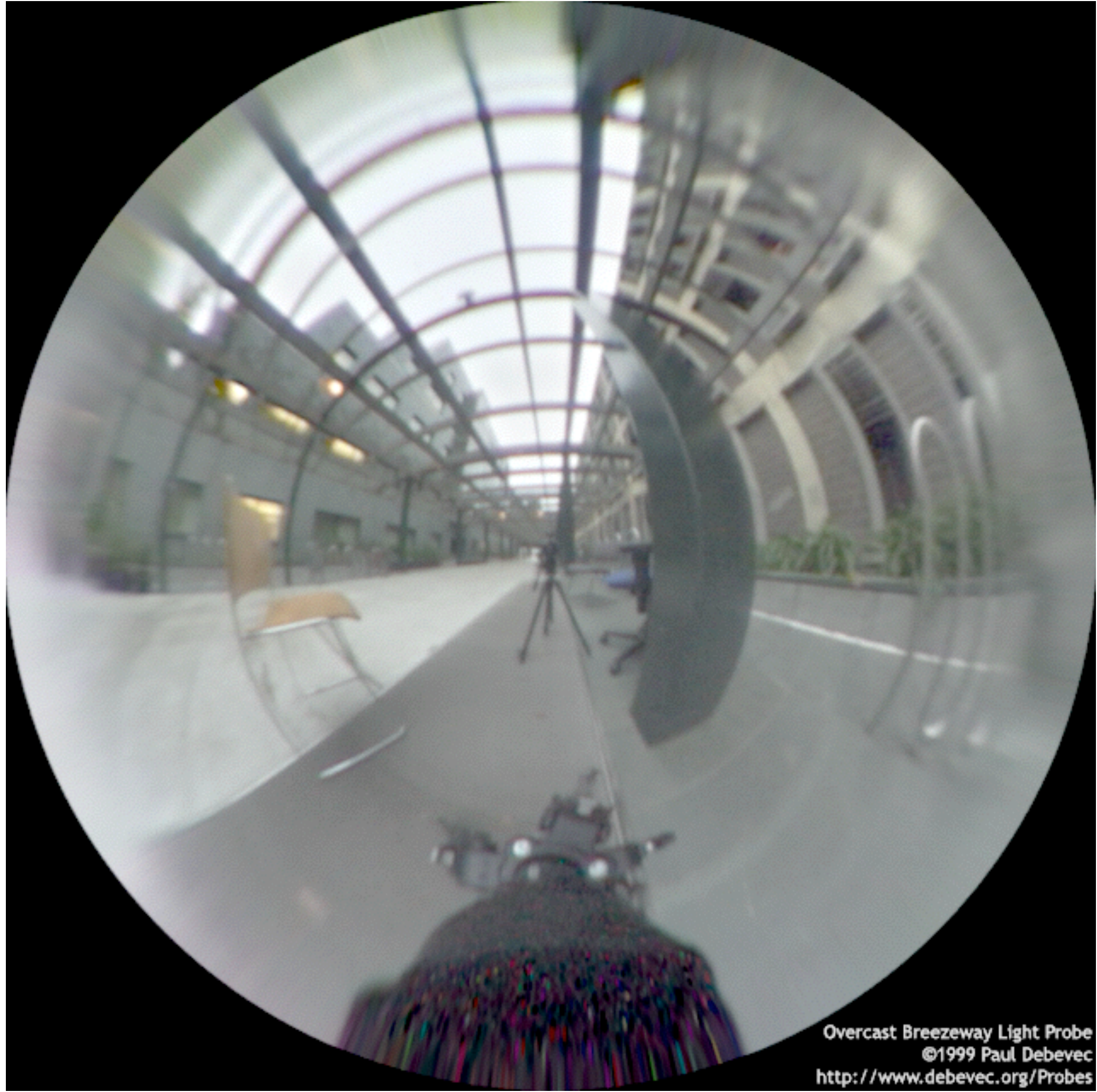
Overcast Breezeway Light Probe
©1999 Paul Debevec
http://www.debevec.org/Probes

Light Probe -> Environment

- Convert from (x,y,z) in scene to (u, v) in probe

  - -z is forward (outer edge of sphere)

  - +z is backward (center of sphere)

  - +y is up (towards top of sphere)

Light Probe -> Environment
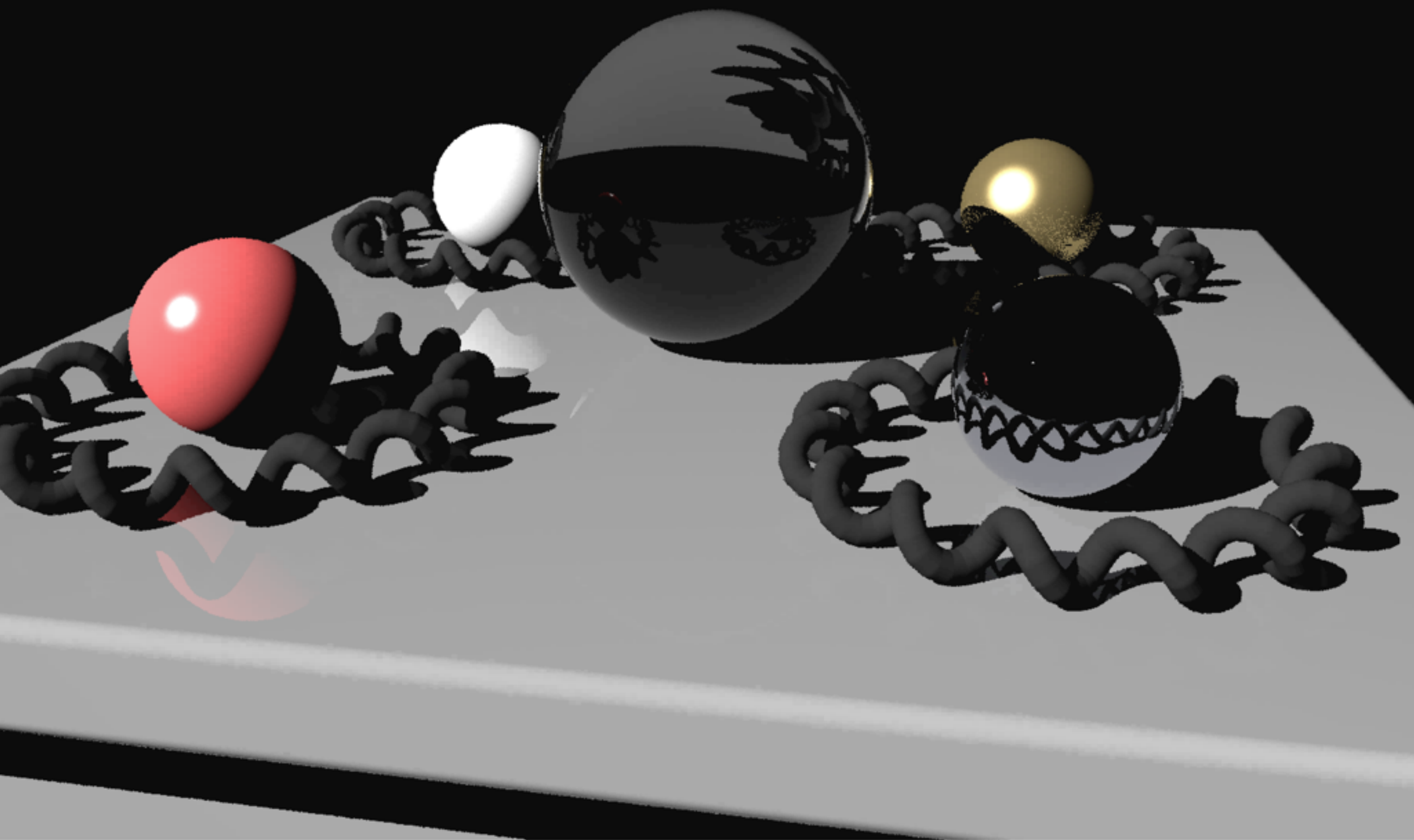
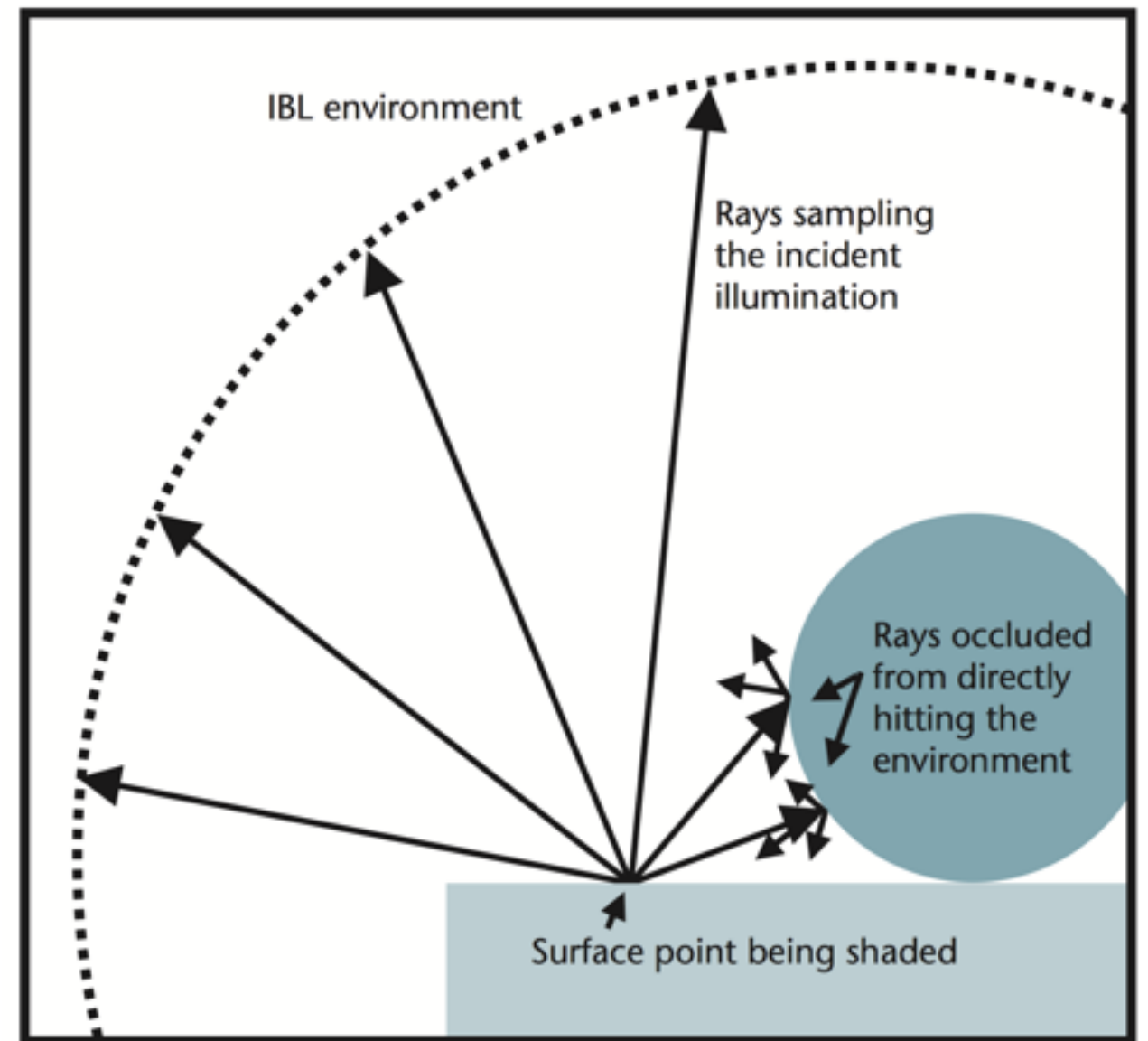d = sqrt(x*x + y*y)

r = 1/(2*Pi) * acos(z) / d

u = 0.5 + x*r

v = 0.5 + y*r

Rendering

- Trace rays from the camera to the scene

- When a ray hits the environment, takes value from light probe

- If a ray hits an object, sends out new rays to determine irradiance

- Compute the light reflected toward camera based on object's properties

IBL environment

Rays sampling the incident illumination

Rays occluded from directly hitting the environment

Surface point being shaded

Extensions

- Simulate light into large environments

- Use a simulated environment instead of light probe image

- Illuminate real-word objects

  - Need images illuminated under all lighting conditions

9 A computer model of the ruins of the Parthenon as illuminated just after sunset by a sky captured in Marina del Rey, California. Modeled by Brian Emerson and Yikuong Chen and rendered using the Arnold global illumination system.

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