

Image-Based Lighting

Luiz Velho
IMPA

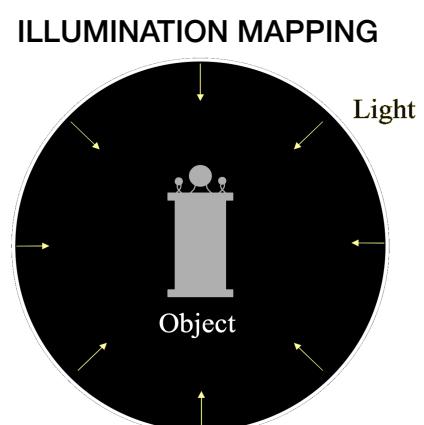
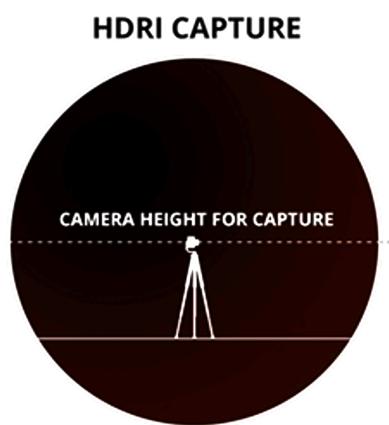
Based on Slides from Paul Debevec - SIGGRAPH 2003

Outlook

- Image-Based Lighting (IBL)
- Capturing Real-World Illumination
- Light Probes as Light Sources
- Illuminating Synthetic Objects with Real Light
- Rendering Synthetic Objects into Real Scenes
- Fiat Lux

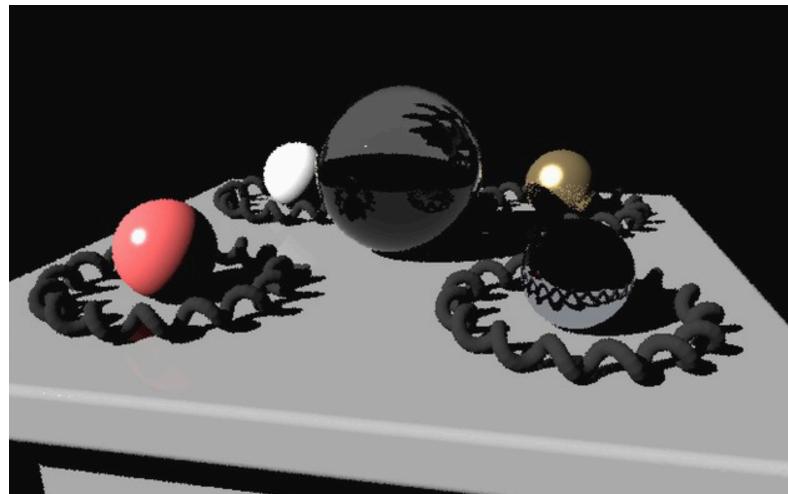
What is IBL?

Real Light Illumination



3D Scene

- Objects on a Table



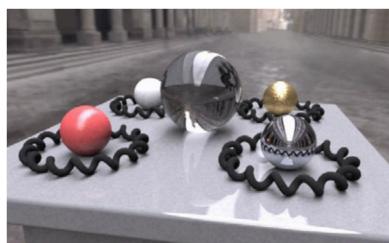
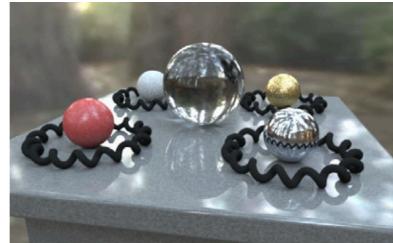
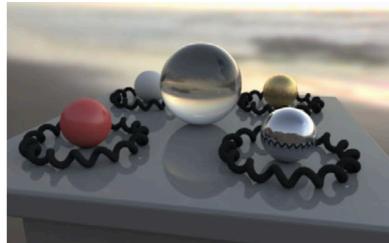
Real-World HDR Lighting Maps

- Environments from the Light Probe Image Gallery



Setting the Illumination

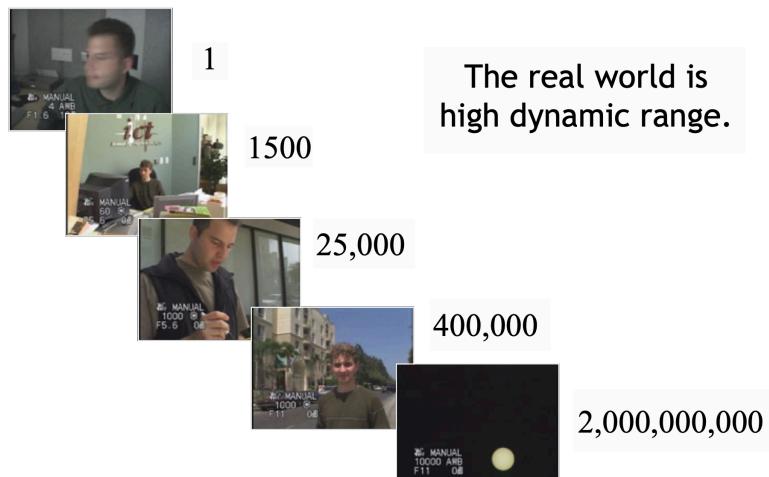
- Rendering with Light Maps



Capturing Real-World Illumination

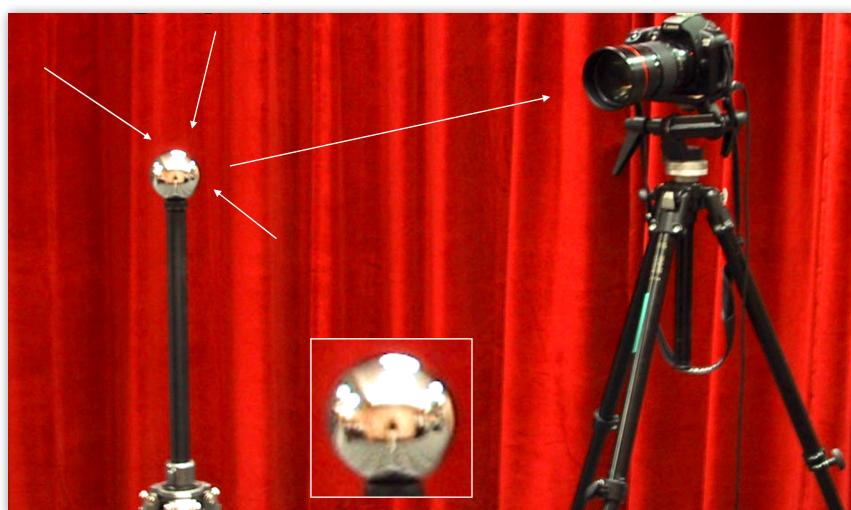
Dynamic Range in the Real World

- High Dynamic Range Imagery (HDRI)



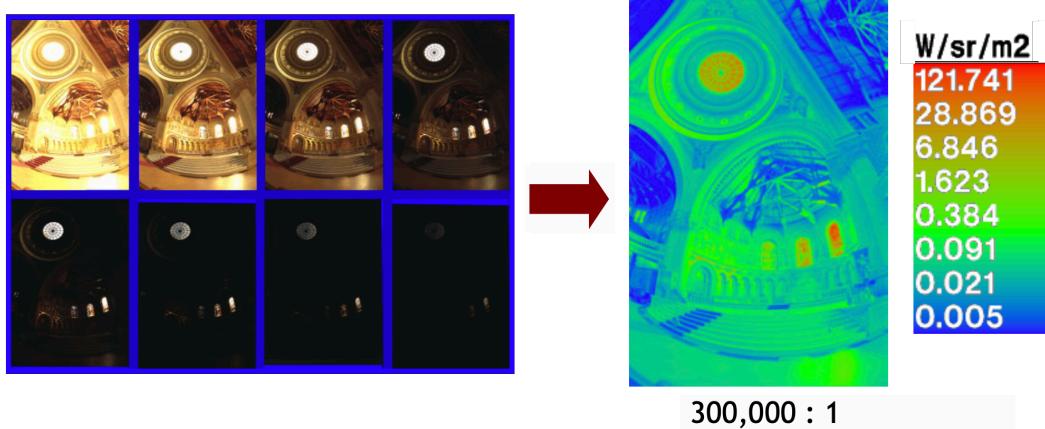
Panoramic (Omnidirectional) Photography

- Capturing HDR Light Maps



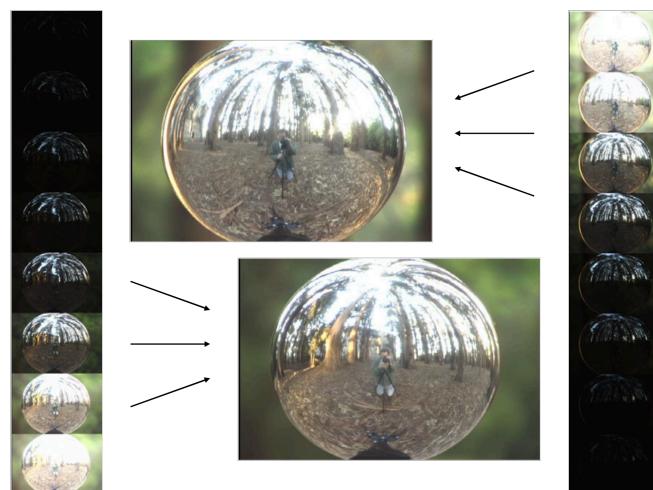
High-Dynamic Range Photography

- HDRI Generation by Varying Exposure (Bracketing)



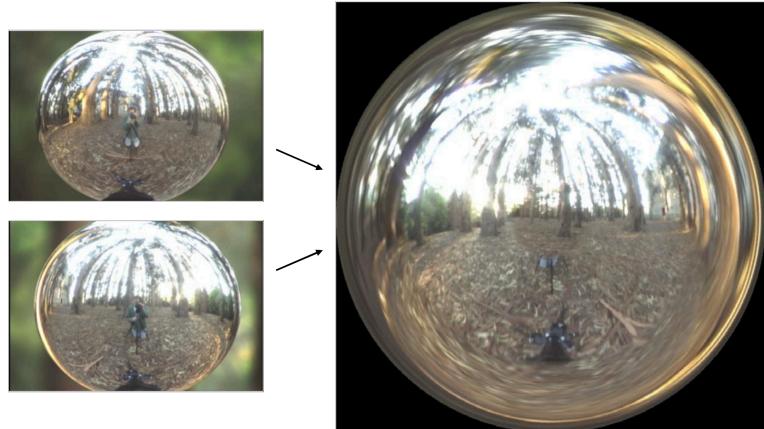
Acquiring the Light Probe

- Multiple Exposures with Mirrored Ball



Assembling the Light Map

- Integrating the HRD Light Maps



360 Image Representation

- Types of Omnidirectional Images



Mirrored Ball



Cube Map

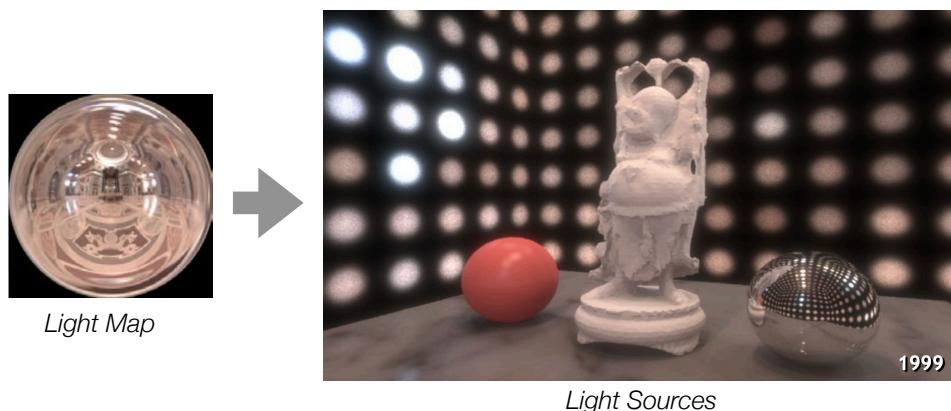


Latitude/Longitude

Light Probes as Light Sources

From Probes to Lights

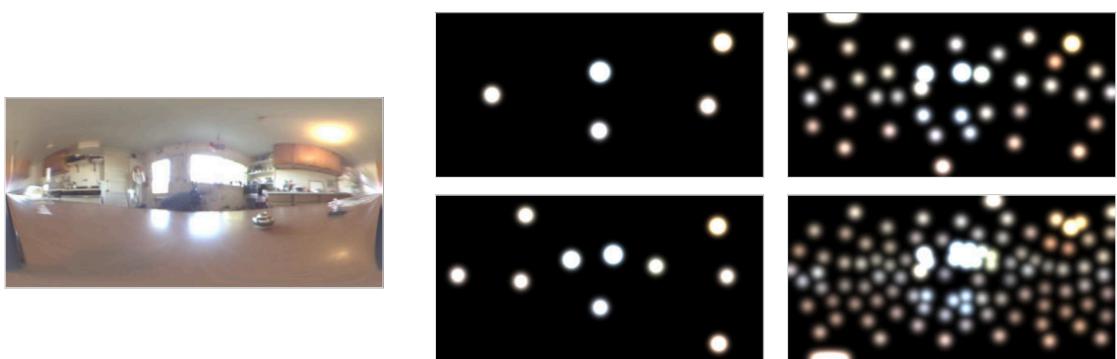
- Rendering Light Probes as Light Sources



Sampling Light Sources

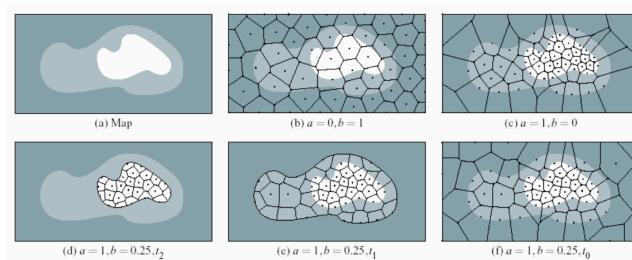
(Aldo Zang, MSc 2009)

- Converting a Light Map into Light Sources



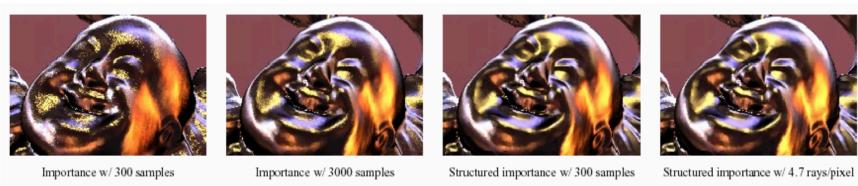
Sampling Light Rays

- Structured Importance Sampling of Environment Maps



(Agarwal, SIGGRAPH 2003)

(Zang, Sibgrapi 2009)

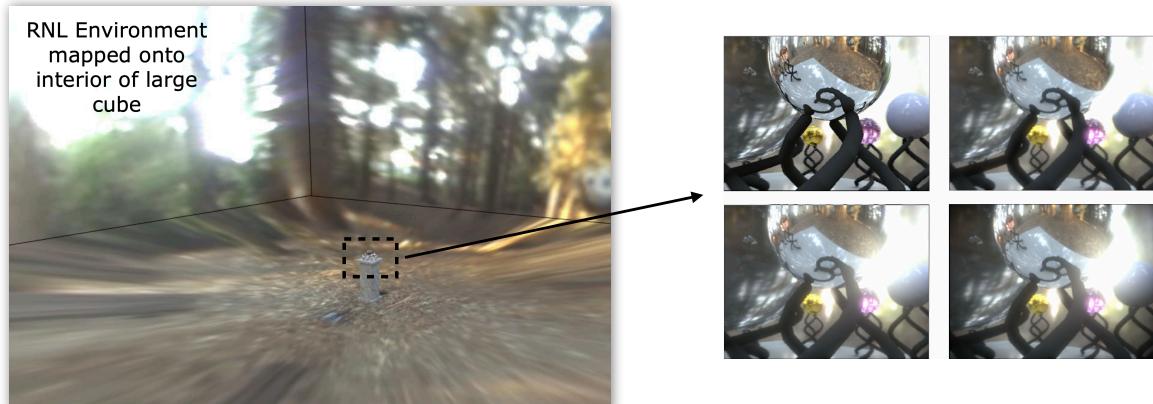


Illuminating Synthetic Objects with Real Light

Exposure Effects

Light Glow

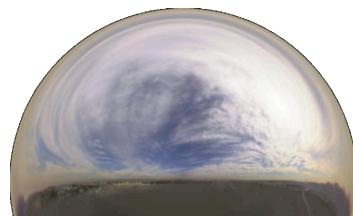
- Foreground Objects and Background



Skylight

Outdoor Light Probes

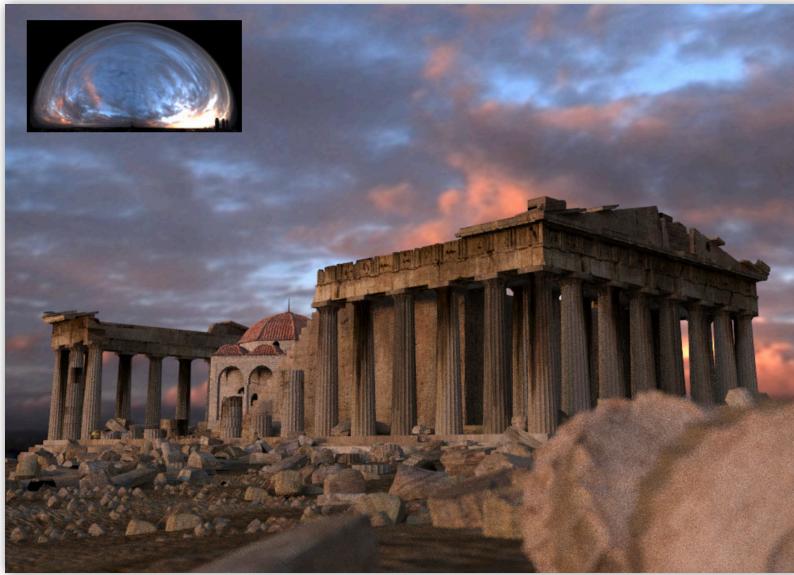
- Different Times of Day



Night



Twilight



Day



Dawn



**Rendering Synthetic Objects
into Real Scenes**

Compositing Objects into a Scene



Paul Debevec. *Rendering Synthetic Objects into Real Scenes: Bridging Traditional and Image-Based Graphics with Global Illumination and High Dynamic Range Photography*. SIGGRAPH 98.

Rendering into the Scene



Objects and Local Scene matched to Scene

Differential Rendering 1



Local scene w/o objects, illuminated by model

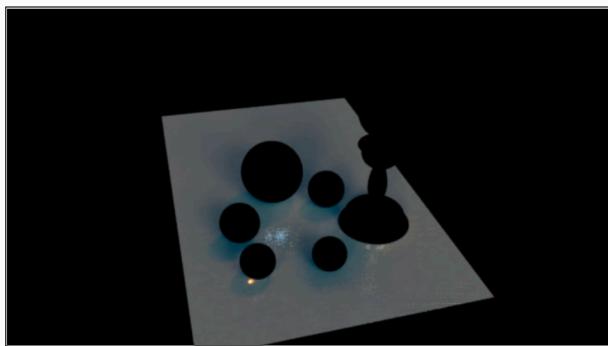
Differential Rendering 2



-



=



Differential Rendering 3



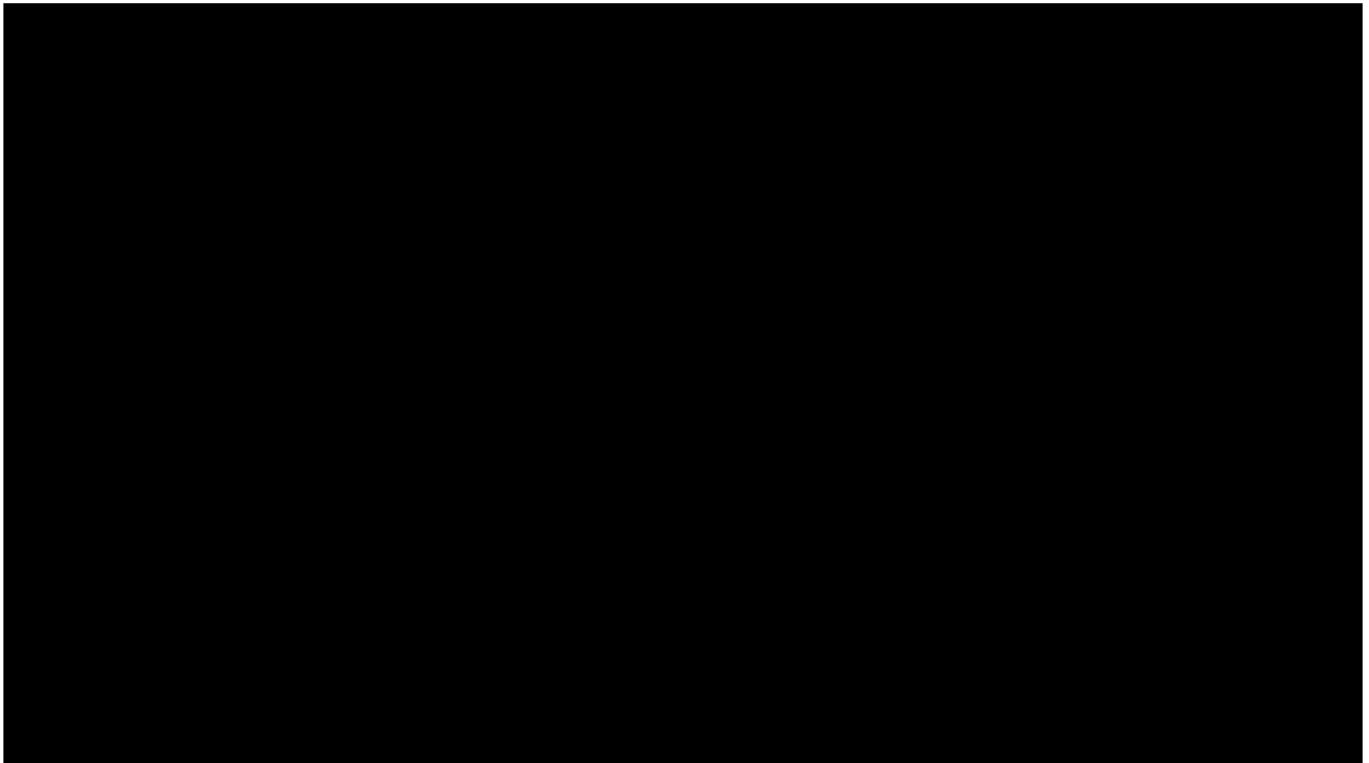
Final Result

Fiat Lux



IMAGE-BASED LIGHTING IN *FIAT LUX*

Paul Debevec, Tim Hawkins, Westley Sarokin, H. P. Duiker, Christine Cheng, Tal Garfinkel, Jenny Huang
SIGGRAPH 99 Electronic Theater



IBL @ CVPR 2021

Light Fields, Light Stages, and the Future of Virtual Production



Paul Debevec, Google Research & USC ICT



**Computational Cameras
and Displays 2021**

USC Institute for
Creative Technologies

debevec@gmail.com www.debevec.org 20 June 2021



