

Image Based Lighting



C0417 – Advanced Computer Graphics: Photographic Image Synthesis

Abhijeet Ghosh

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Acquiring light probes - mirrored ball, fisheyes, stitched photos, scanning



Tiled Photographs – Nodal Acquisition Rig



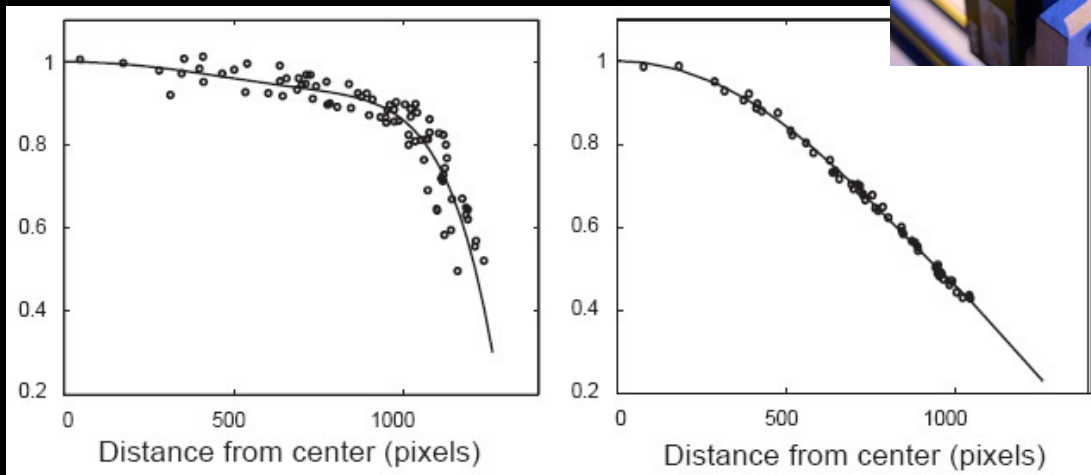
See also www.kaidan.com

Tiled Photographs



Can now stitch *in HDR*
with Autodesk Stitcher
or PtGUI

Fisheye Lens Radial Falloff Sigma 8mm Canon/Nikon



f/16

Sigma 8mm
fisheye lens

f/8

High-Res Probes Gallery

<http://gl.ict.usc.edu/Data/HighResProbes/>

Stitching multiple
images captured with
fish eye lens



New Grace
Cathedral



Doge's
Palace



Pisa Piazza



Banff Glacier



Ennis-Brown House

Scanning Panoramic Cameras (Panoscan, Spheron)

- **Pros:**
 - very high res (10K x 7K+)
 - Full sphere in one scan – no stitching
 - Good dynamic range, some are HDR
- **Issues:**
 - More expensive
 - Scans take a while



HDR-Cam

www.hdr-cam.com

8 sec – 1/8000 sec, 2 stops apart
24 stops of latitude
<30 sec. capture

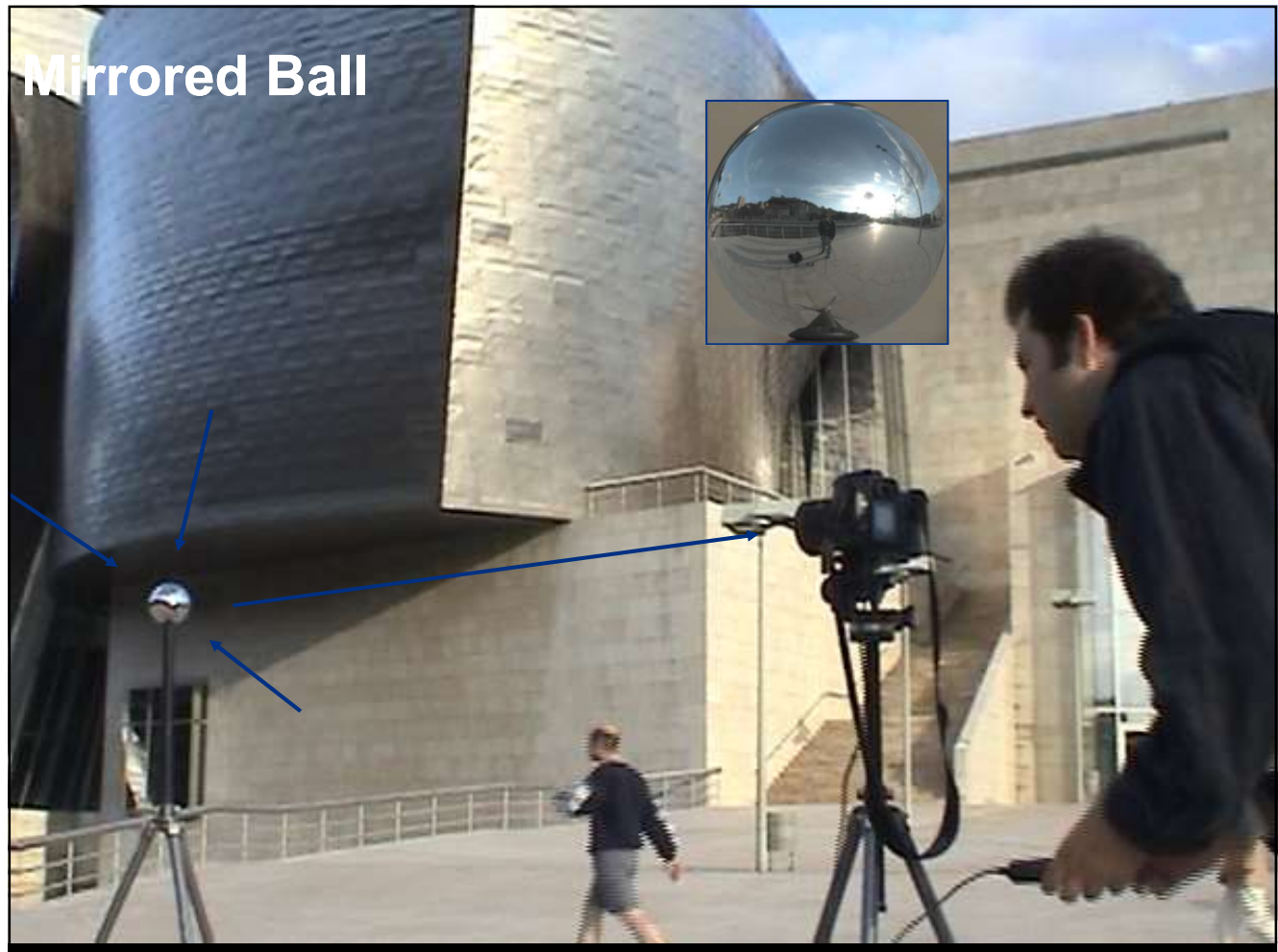


Hoyt Heatman

Consumer technology – Ricoh ThetaV

14MP – high resolution panorama
4K video!





Capturing Light Probes in the Sun

Oversaturation even
in shortest
exposure!



Can we recover the sun?



Saturated
light probe

$+$ α
(unknown)

\cdot
Point light

\approx



Unsaturated
light probe

Photograph Diffuse Sphere

Diffuse sphere
unsaturated in direct
sunlight



Can we recover the sun's energy α ?

- Solution: use both the saturated mirror ball and the unsaturated diffuse ball together to estimate α



Inverse rendering for unknown α

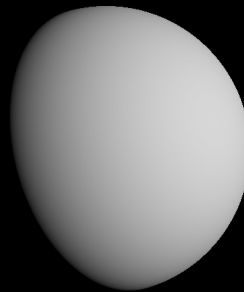


$+ \alpha \cdot$

\approx



$+$



\approx



Sky
(diffuse ball)

Sun
(diffuse ball)

Rendering
(diffuse ball)

Compare
with Photo
(diffuse ball)

Solve for Sun Scaling Factor



+ α



\approx



Diffuse Ball

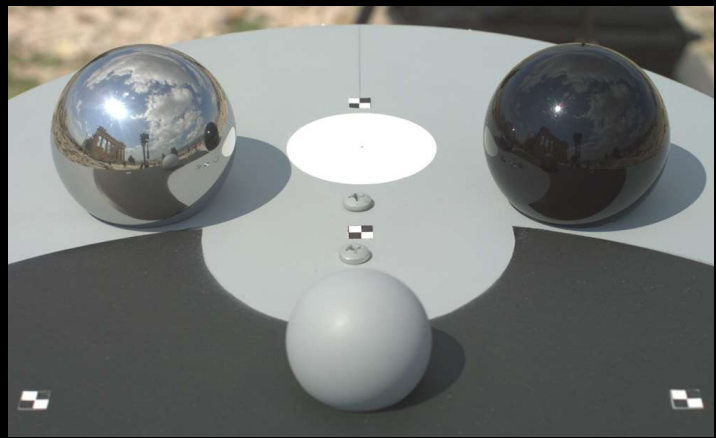
$$\alpha = (1.166, 0.973, 0.701)$$



Background plate

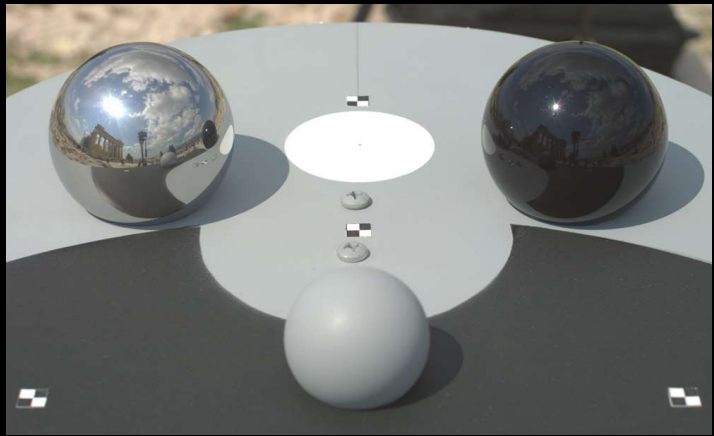


Measuring Natural Illumination in single shot



Measuring Natural Illumination in single shot

- Mirror ball for sky
- Diffuse ball for unsaturated sun
- Black ball for sun position!



Direct HDR Capture of the Sun and Sky

- Use Sigma 8mm fisheye lens and Canon EOS 1Ds to cover entire sky
- Use 3.0 ND filter on lens back to cover full range of light



Stumpfel, Jones, Wenger, Tchou, Hawkins, and Debevec. "Direct HDR Capture of the Sun and Sky". To appear in Afrigraph 2004.

Extreme HDR Image Series



1 sec
f/4



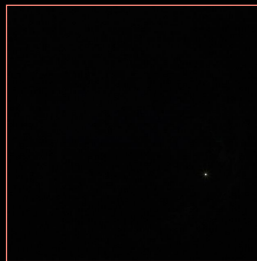
1/4 sec
f/4



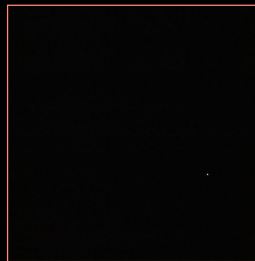
1/30 sec
f/4



1/30 sec
f/16



1/250 sec
f/16



1/1000 sec
f/16



1/8000 sec f/16

Extreme HDR Image Series

- sun closeup



1 sec
f/4



1/4 sec
f/4



1/30 sec
f/4



1/30 sec
f/16



1/250 sec
f/16



1/1000 sec
f/16



1/8000 sec f/16
only image that does not
saturate!