

# Simultaneous Acquisition of Polarimetric SVBRDF and Normals

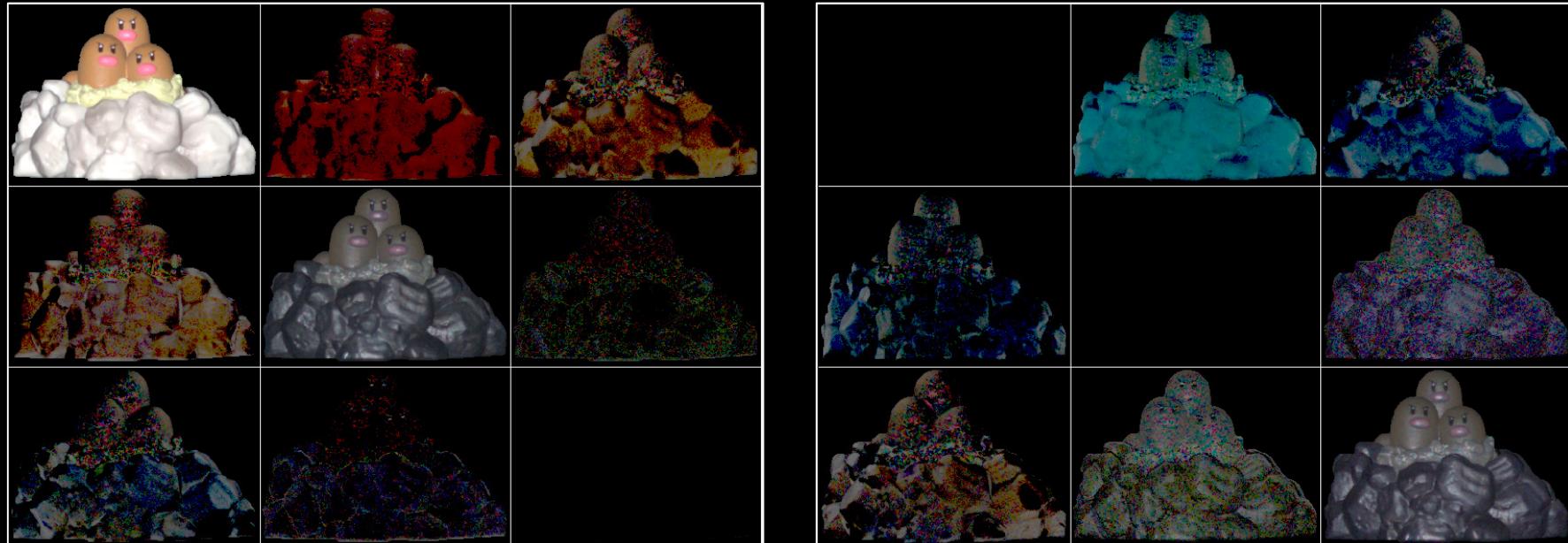
## Supplemental Material #2

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<sup>†</sup>KAIST    <sup>\*</sup> Microsoft Research Asia

# **POLARIMETRIC SHADING MATRIX FOR REAL SAMPLES**

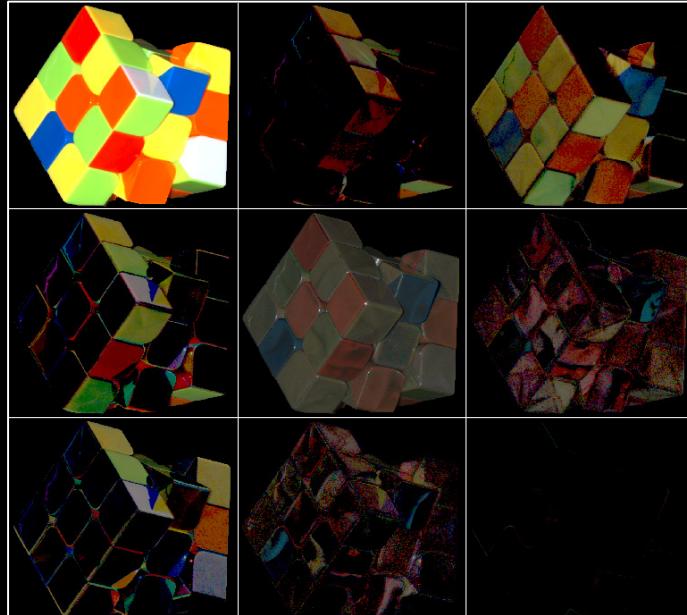
# Estimated Polarimetric Shading Matrix $\mathbf{H}$



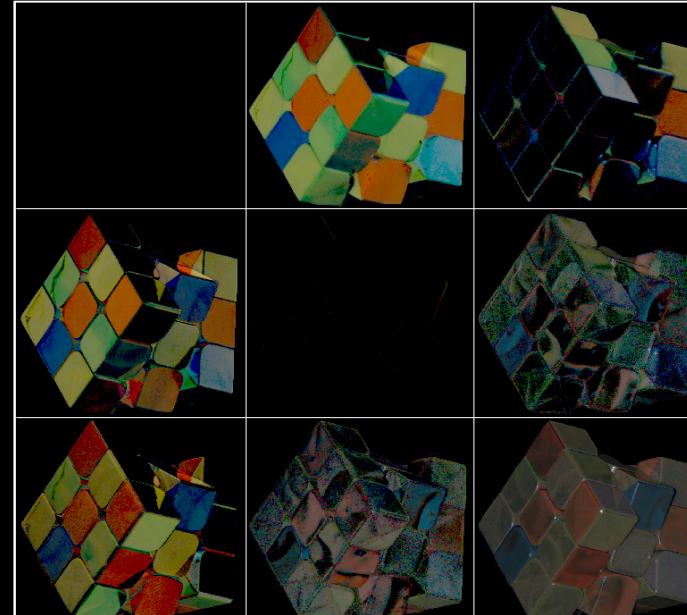
Positive

Negative

# Estimated Polarimetric Shading Matrix $\mathbf{H}$

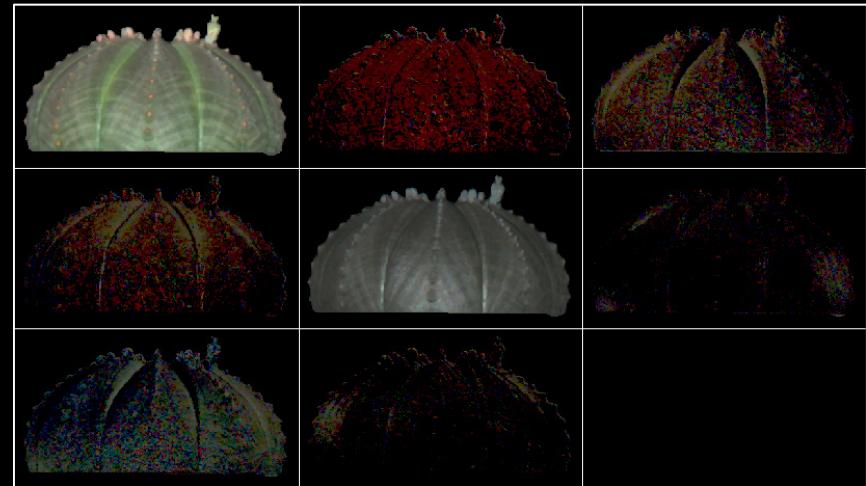


Positive

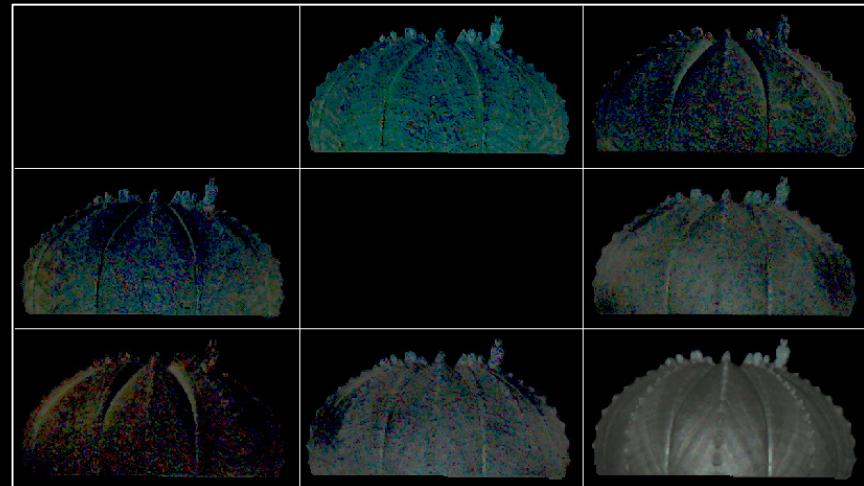


Negative

# Estimated Polarimetric Shading Matrix $\mathbf{H}$

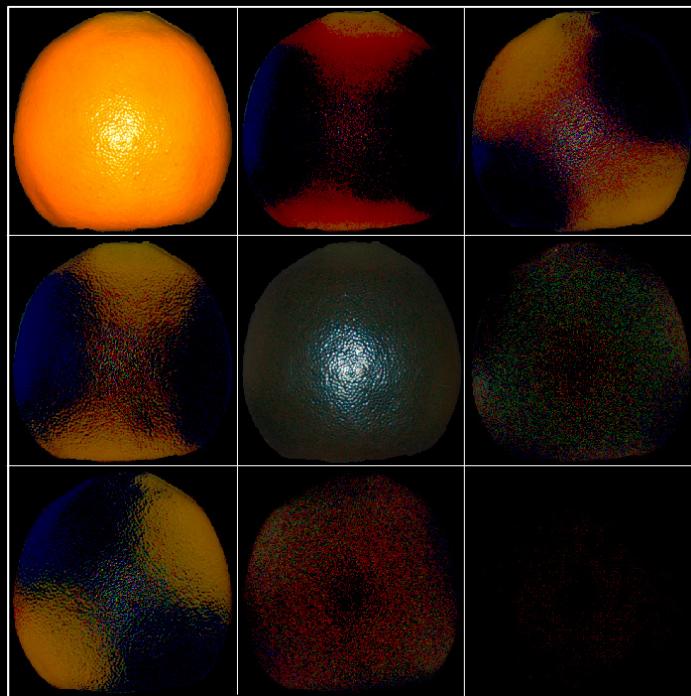


Positive

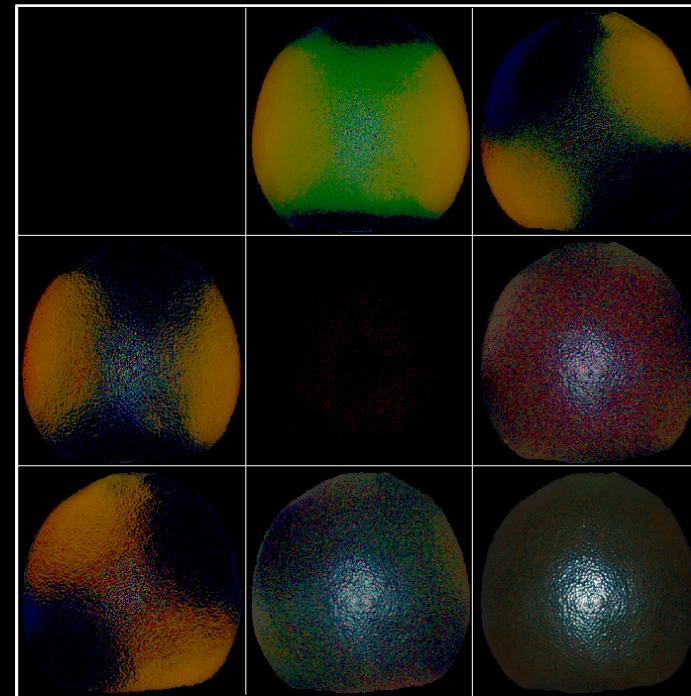


Negative

# Estimated Polarimetric Shading Matrix $\mathbf{H}$

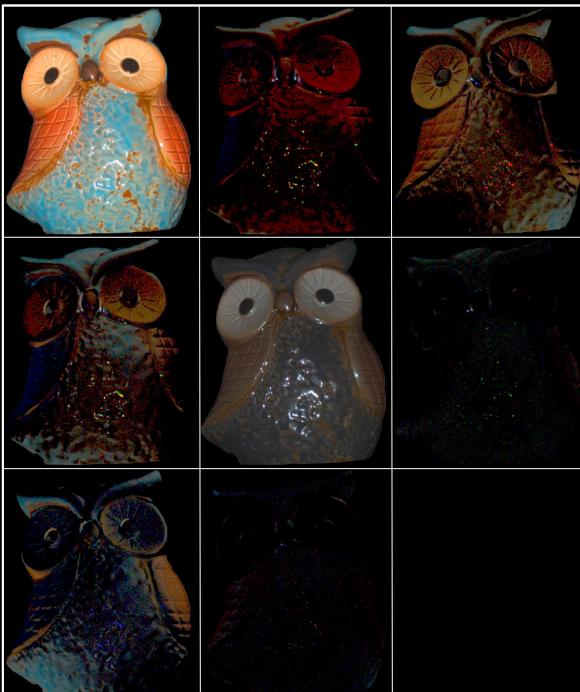


Positive



Negative

# Estimated Polarimetric Shading Matrix $\mathbf{H}$



Positive



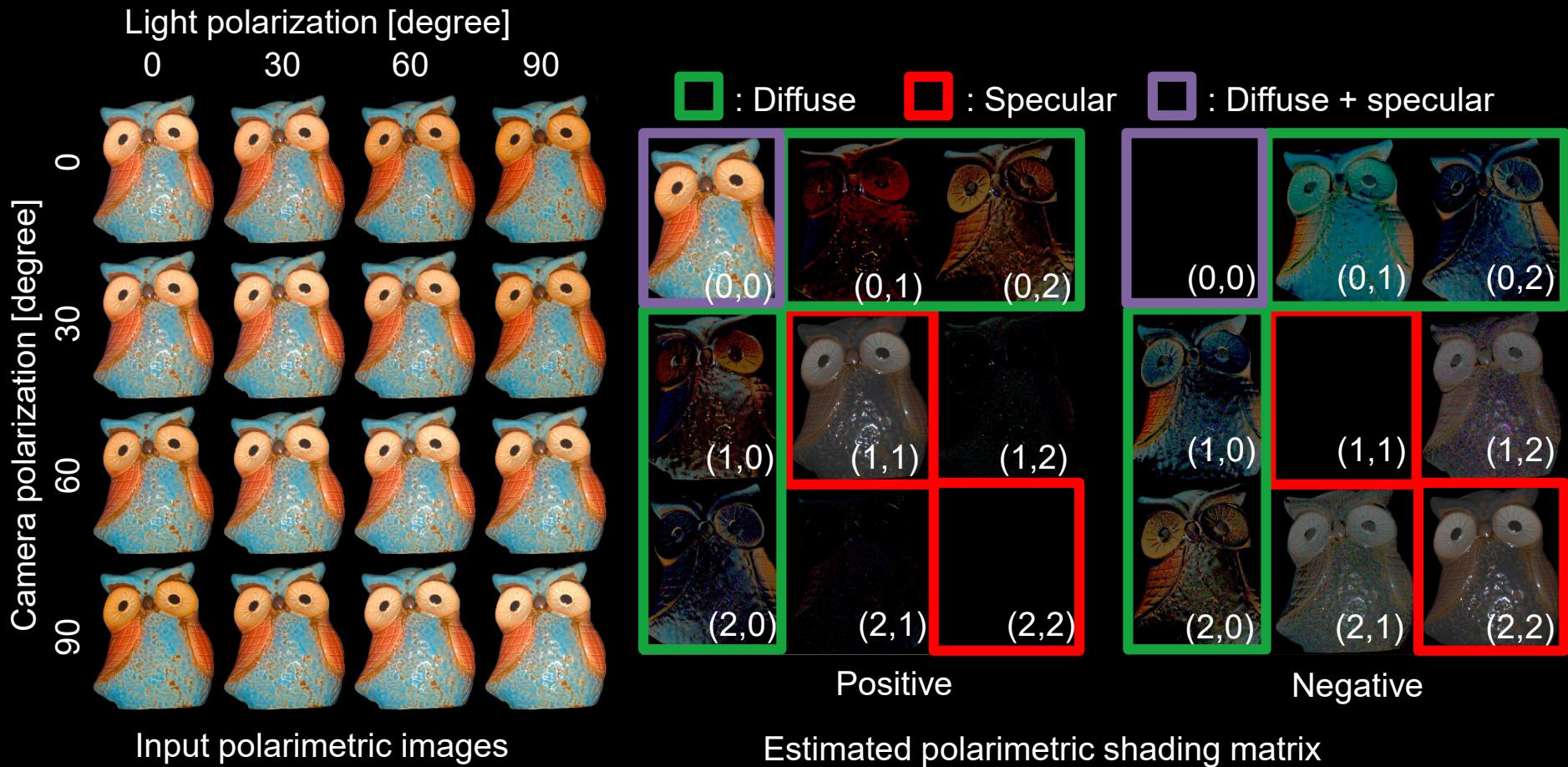
Negative

# EXTENDED FIGURES

# Extended Version of Figure 1



# Extended Version of Figure 4



# Extended Version of Figure 4



Specular + Diffuse component

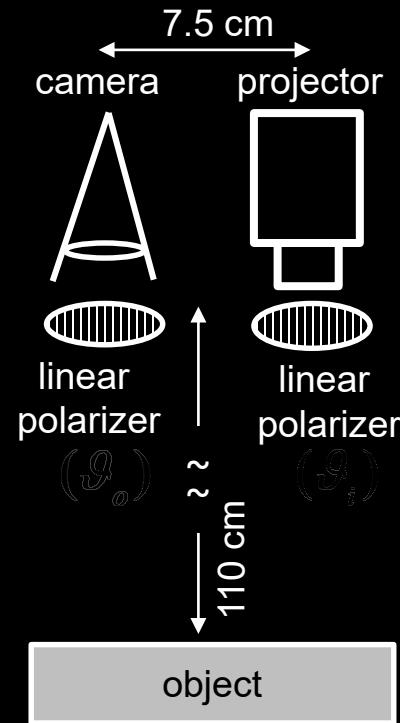
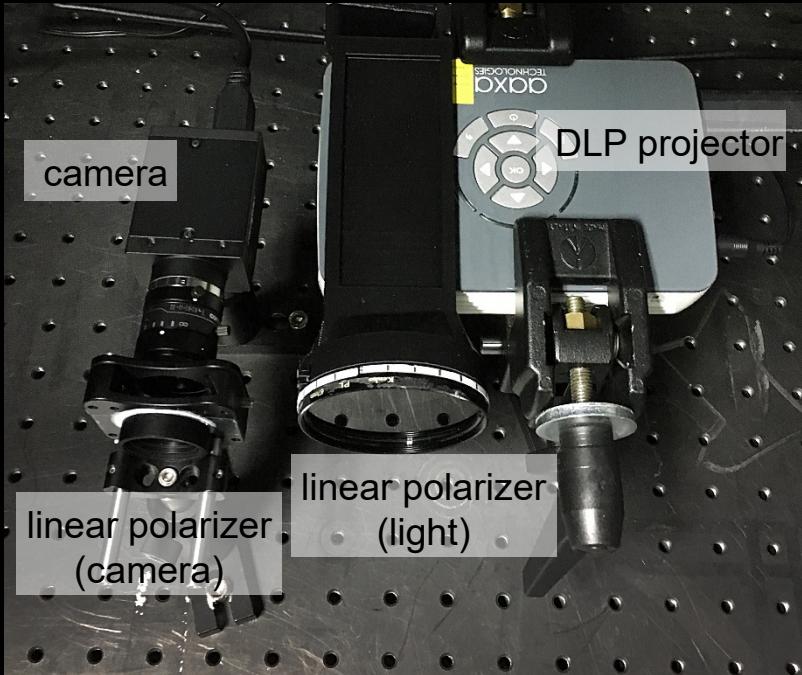


Specular component  $H_{00}^s$



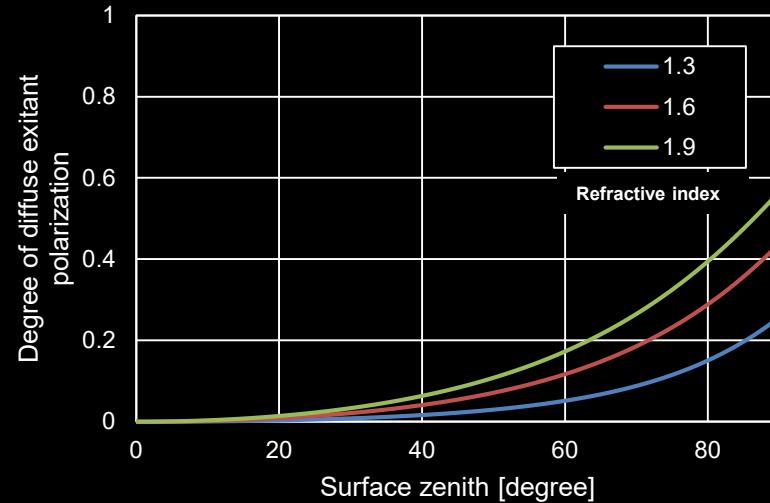
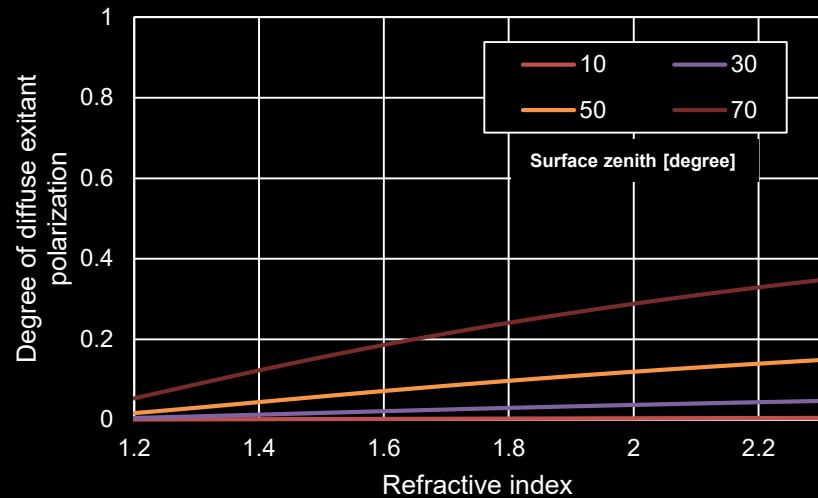
Diffuse component  $H_{00}^d$

# Extended Version of Figure 5



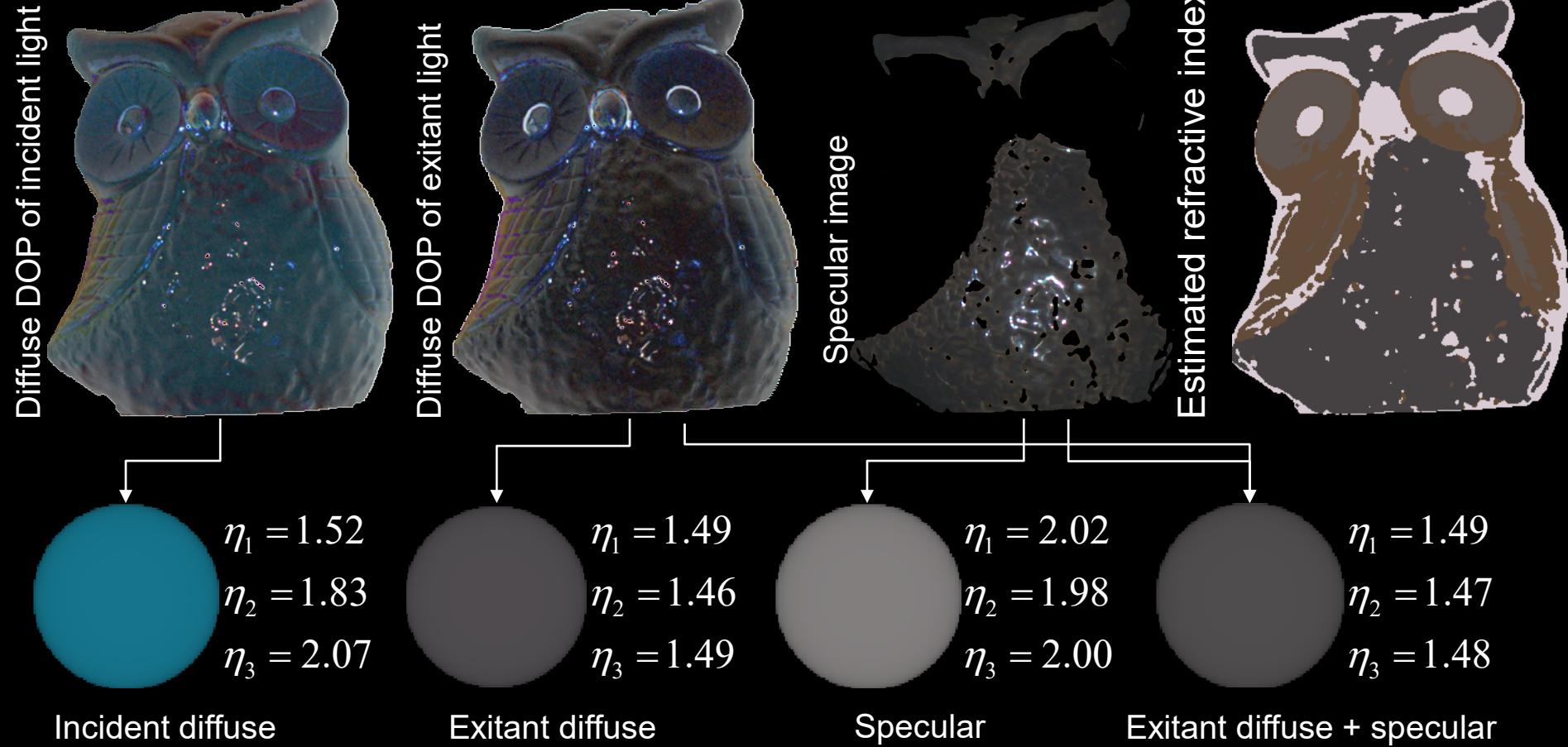
- Camera
  - FLIR Grasshopper GS3-U3-120S6C-C
  - 35mm lens
- DLP projector
  - AAXAP450Pro, 450 lumen

# Extended Version of Figure 6

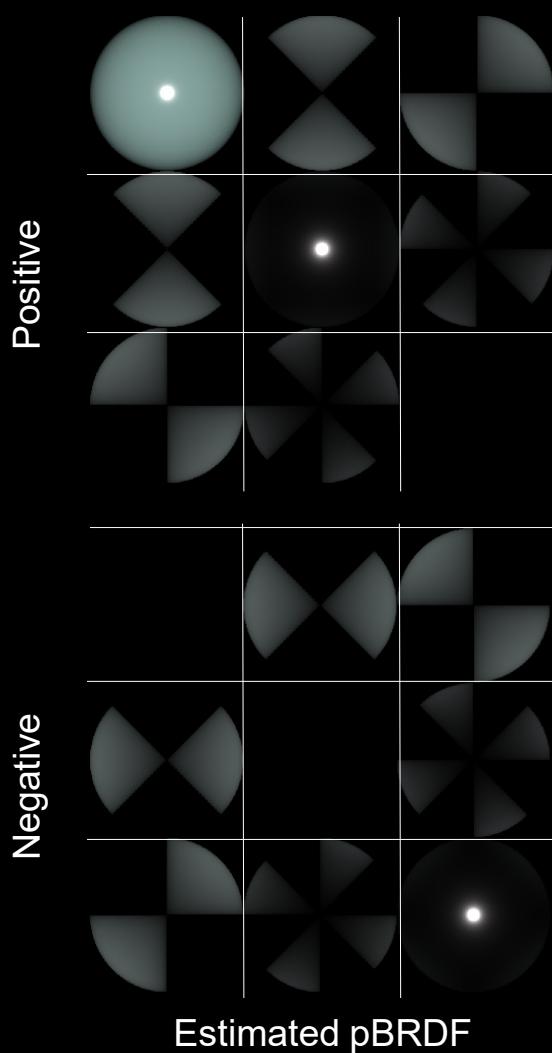
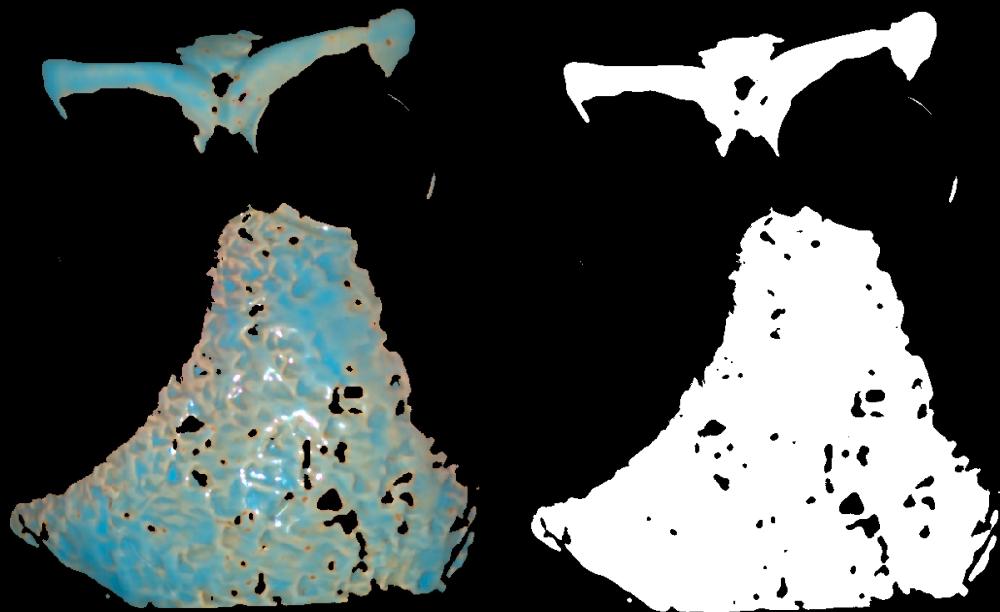


Degree of diffuse exitant polarization  
as the function of refractive index and surface zenith angle

# Extended Version of Figure 7



# Extended Version of Figure 8

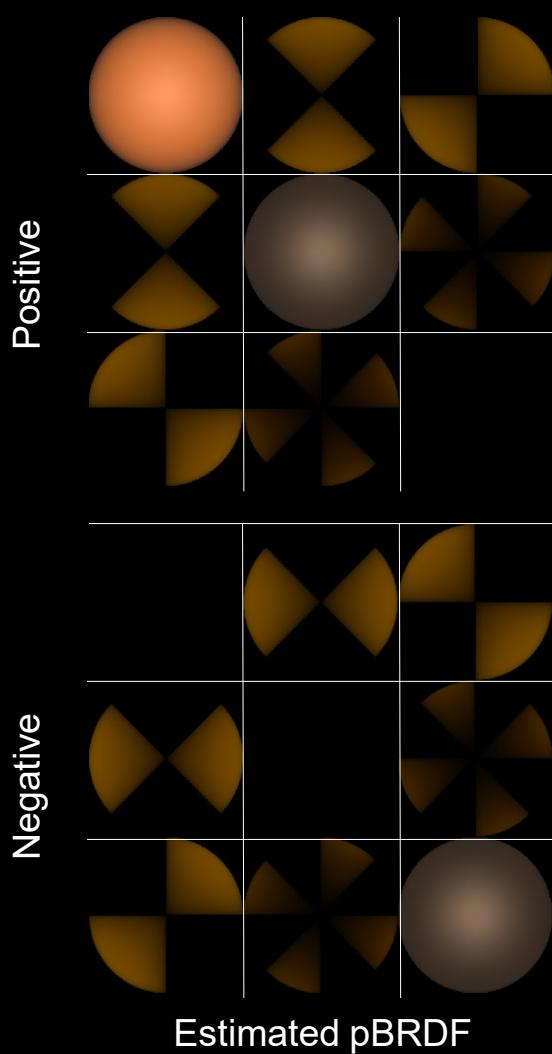


# Extended Version of Figure 8

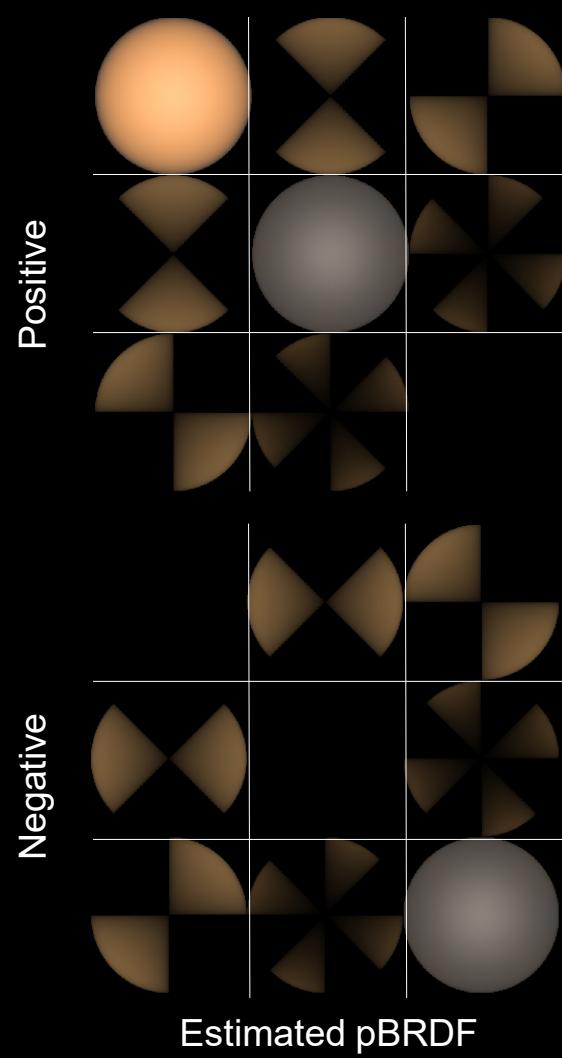


Polarimetric shading element

Weight map



# Extended Version of Figure 8



# Extended Version of Figure 8

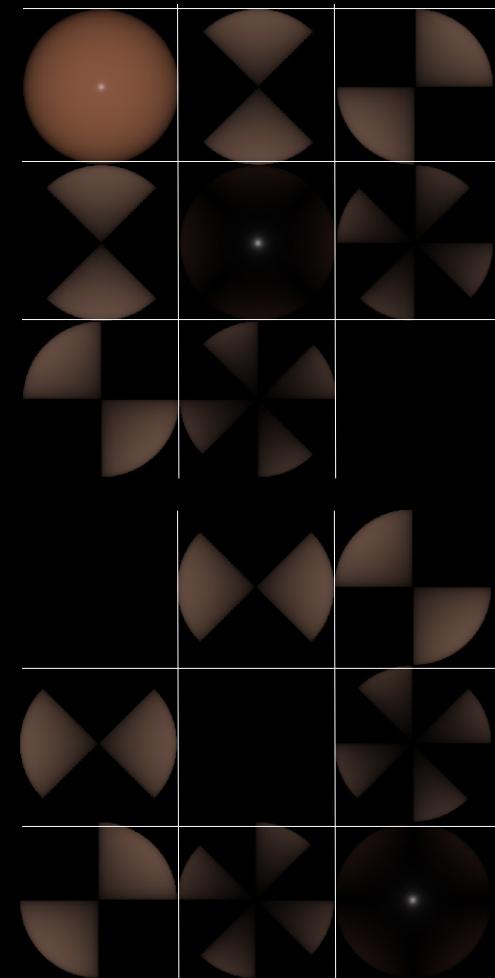


Polarimetric shading element



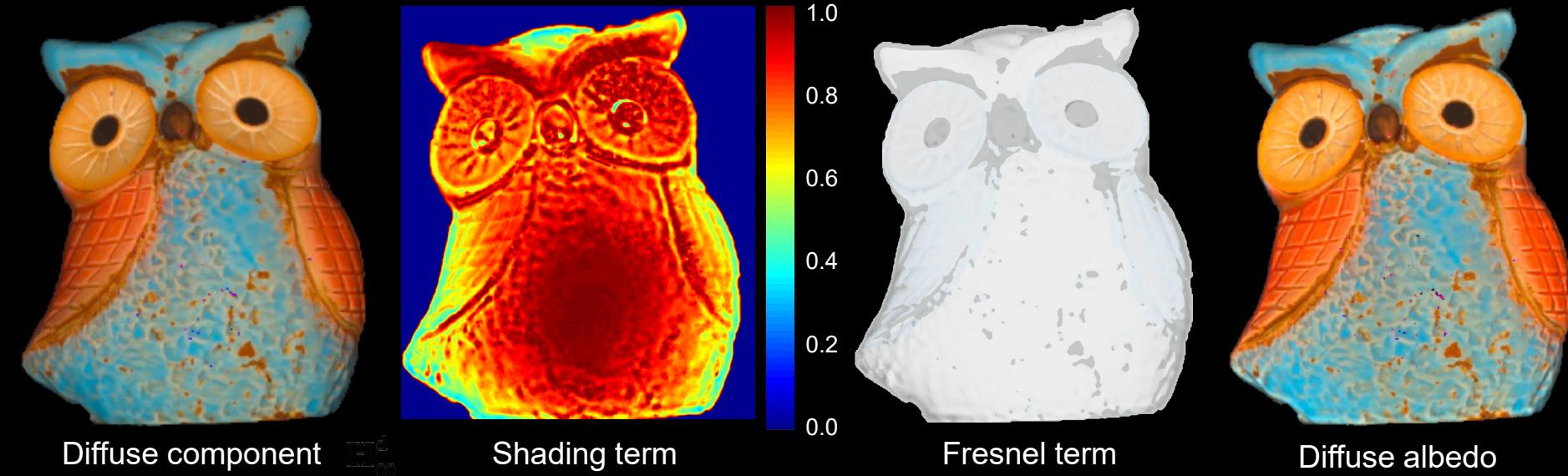
Weight map

Positive  
Negative

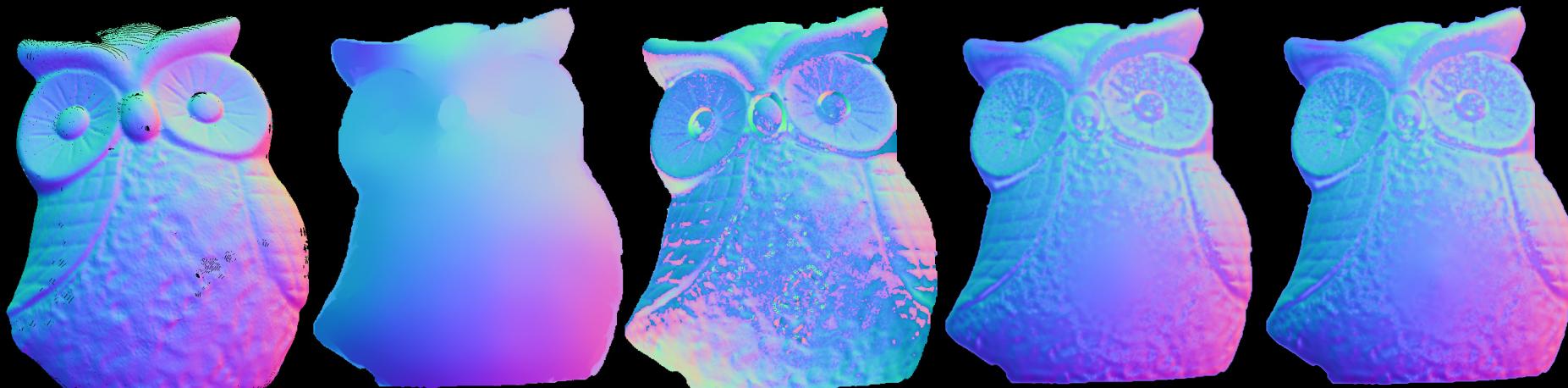


Estimated pBRDF

# Extended Version of Figure 9



# Extended Version of Figure 10



Ground truth  
normals

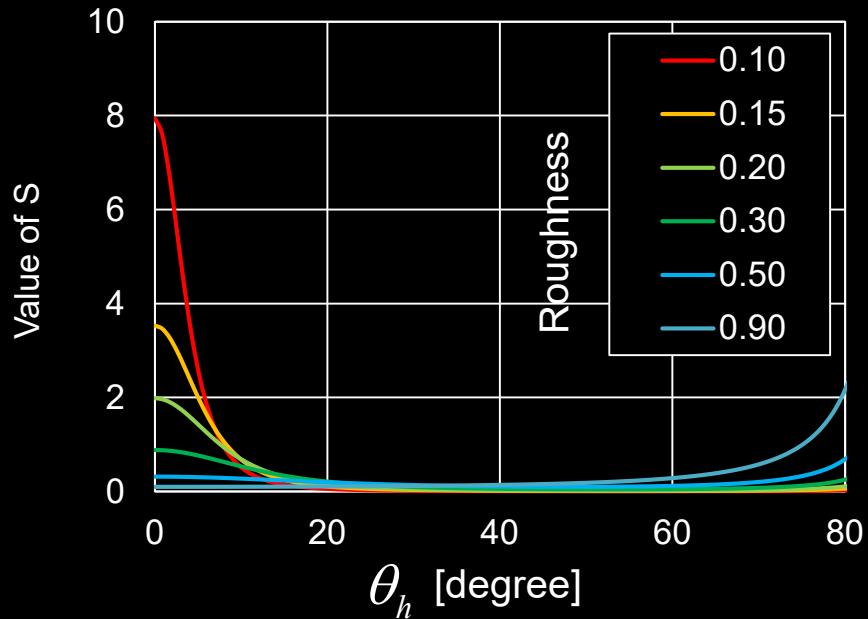
Structured-light  
normals

Polarization  
normals

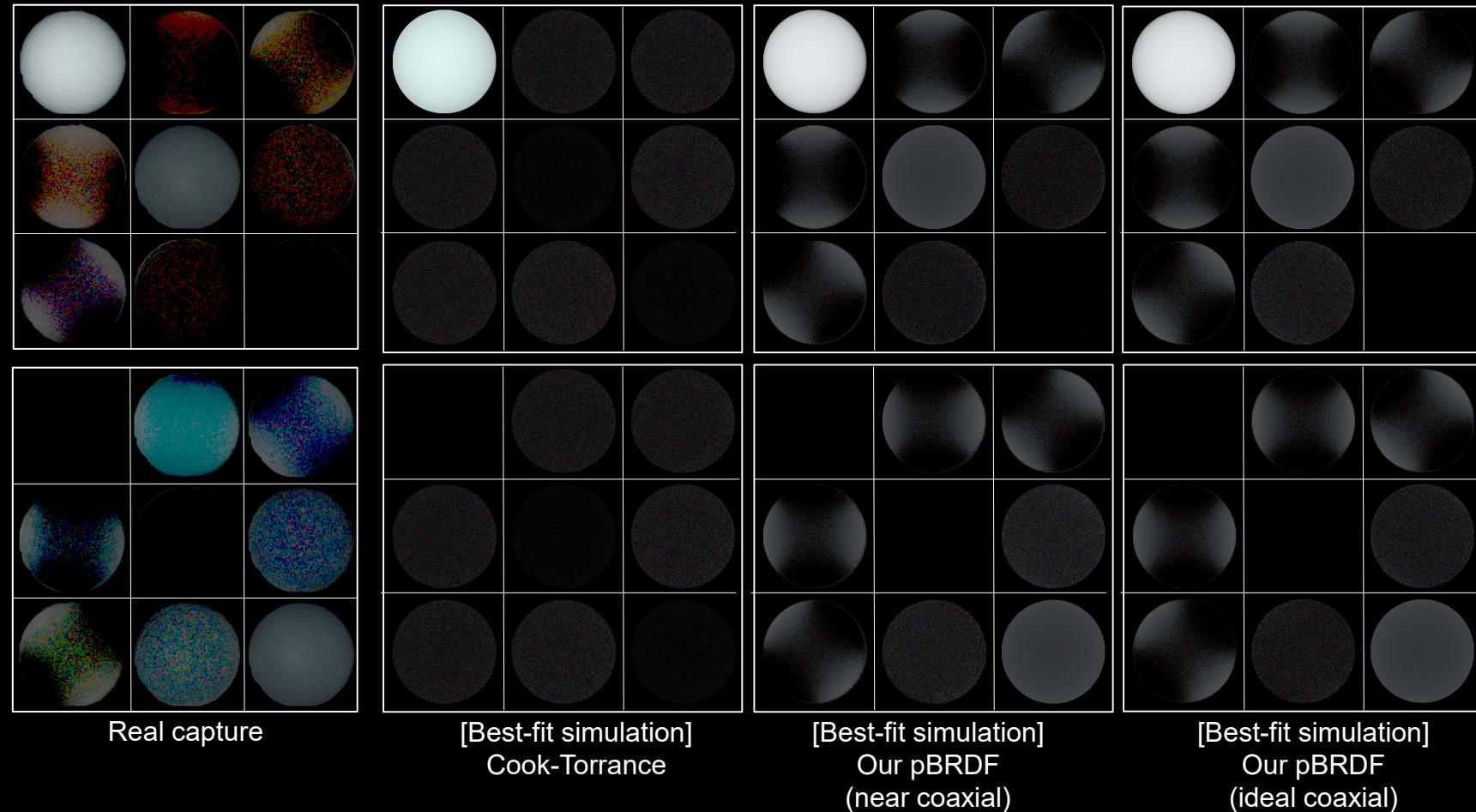
Diffuse  
normals

Diffuse/specular  
normals

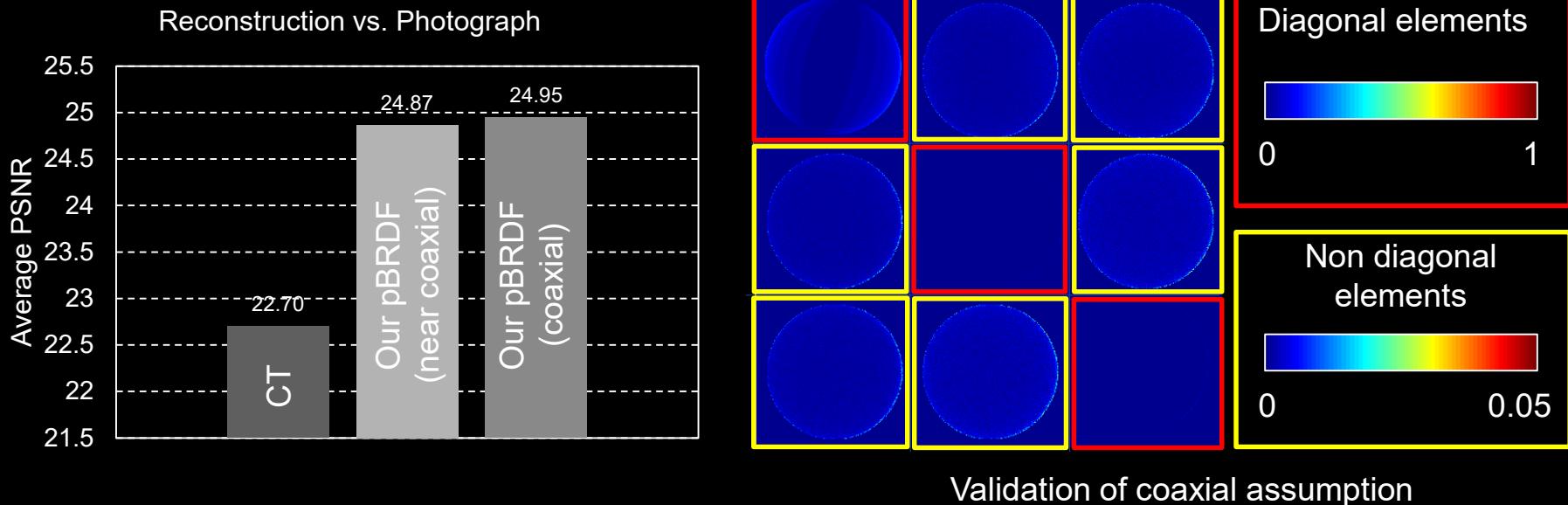
# Extended Version of Figure 11



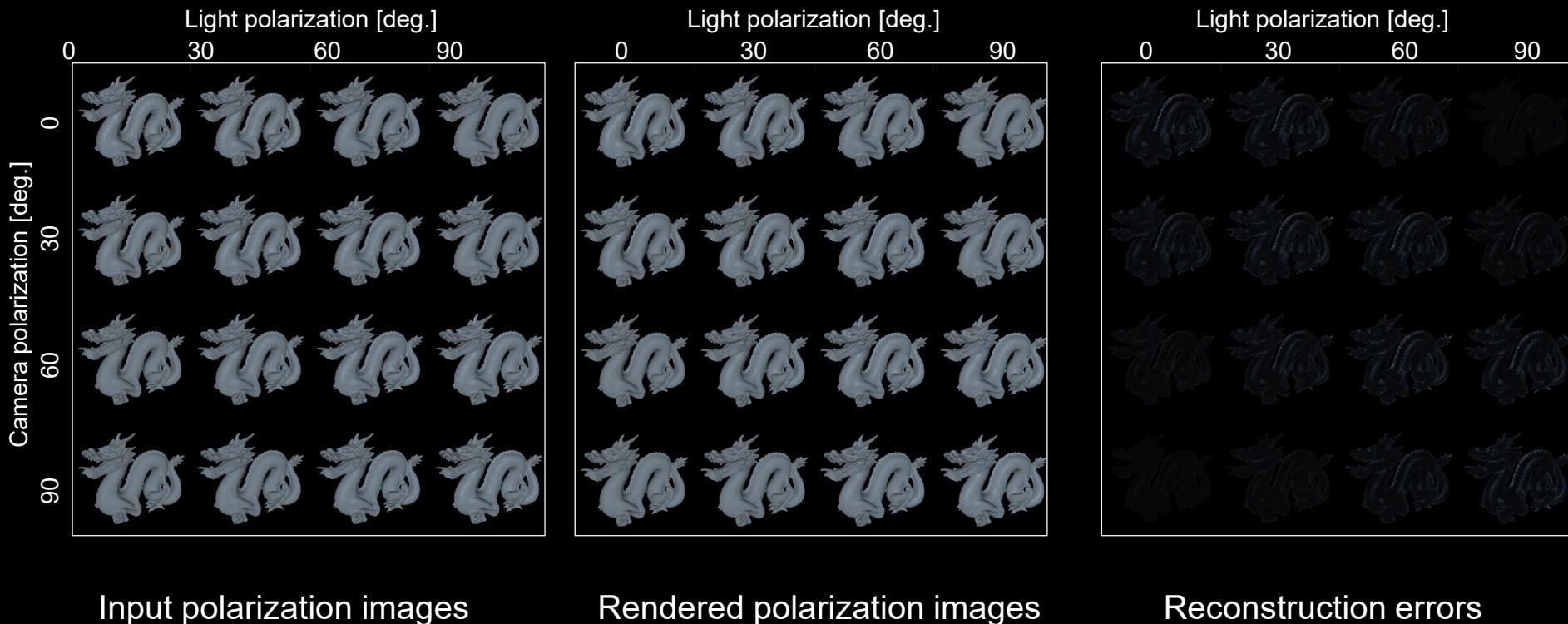
# Extended Version of Figure 12



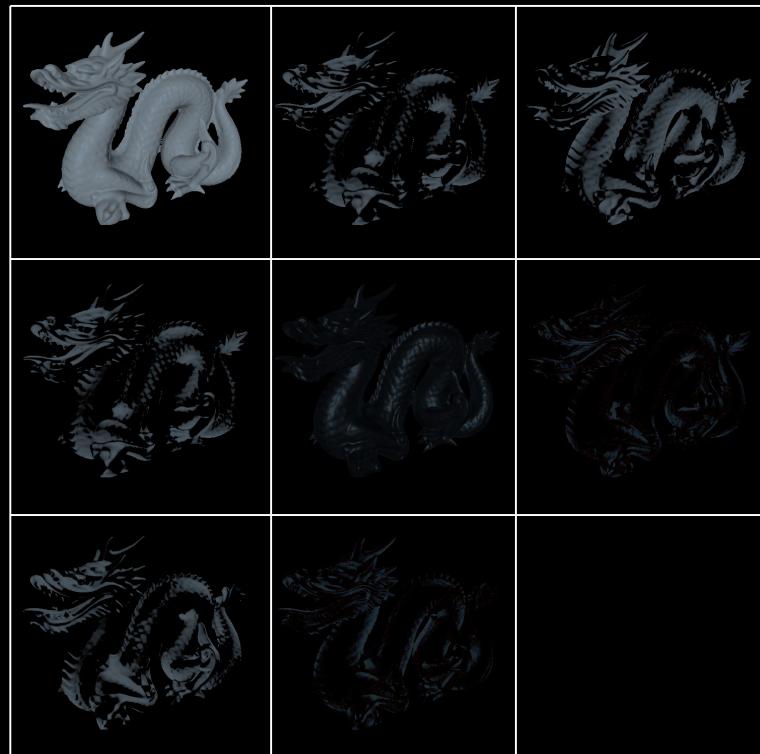
# Extended Version of Figure 12



# Extended Version of Figure 13



# Extended Version of Figure 13



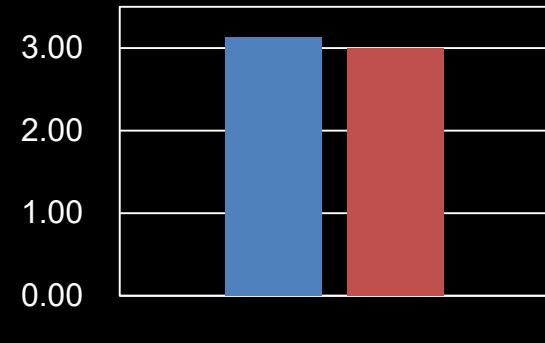
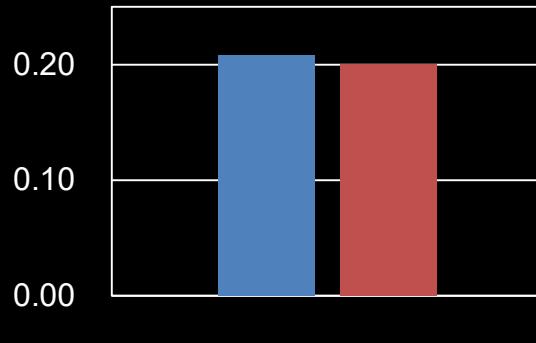
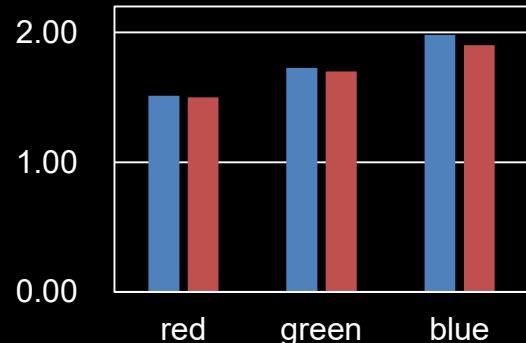
Estimated  $\mathbf{H}$  (positive)



Estimated  $\mathbf{H}$  (negative)

# Extended Version of Figure 13

■ : Estimation ■ : GT



Values (Est./GT)

R: 1.51/1.50

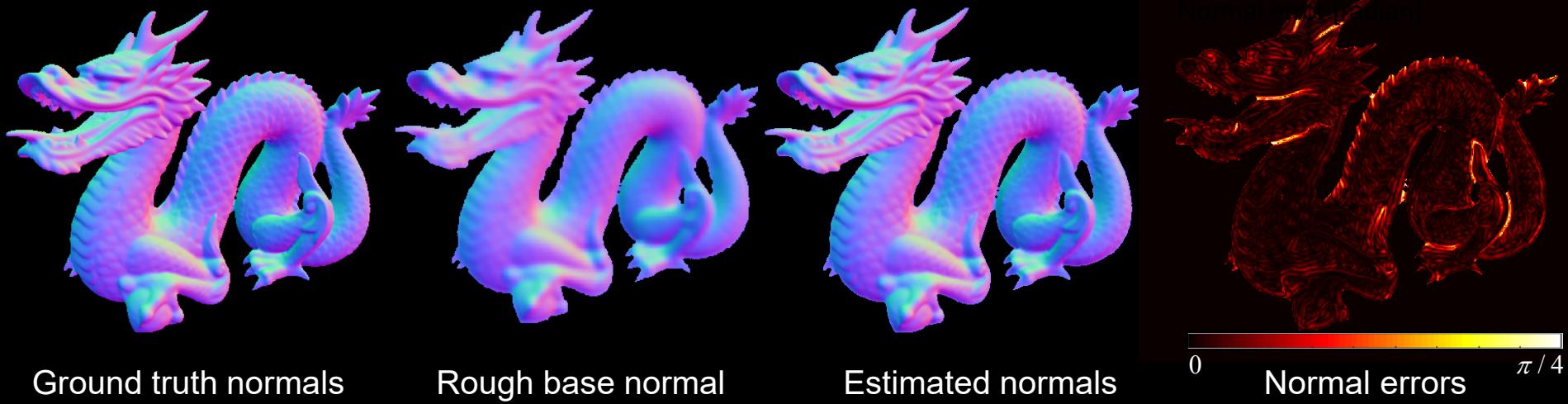
G: 1.73/1.70

B: 1.98/1.90

0.21/0.20

3.14/3.00

# Extended Version of Figure 13



# Extended Version of Figure 13



Ground truth diffuse albedo



Estimated diffuse albedo



Diffuse albedo errors

# Extended Version of Figure 14



Diffuse albedo



Specular roughness



Specular coefficient



Polarimetric rendering



Photograph



Refractive index



Normals

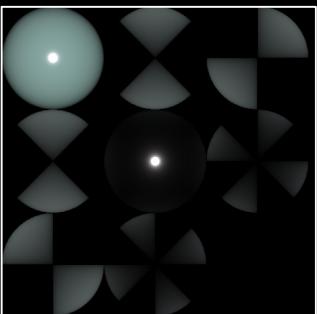


Structured light

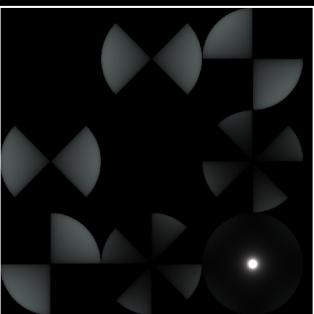
# Extended Version of Figure 14



Weight



Positive

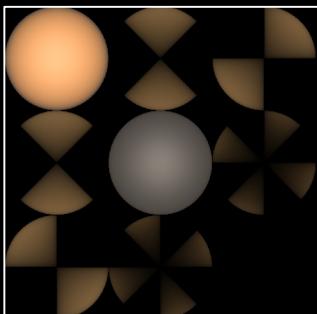


Negative

Material #1

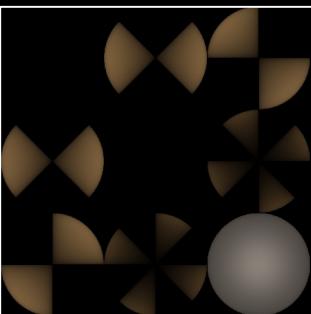


Weight



Positive

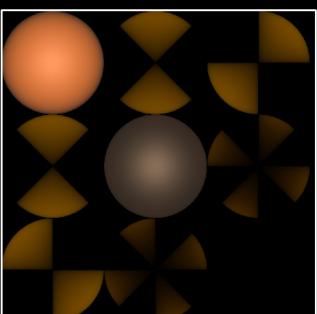
Material #2



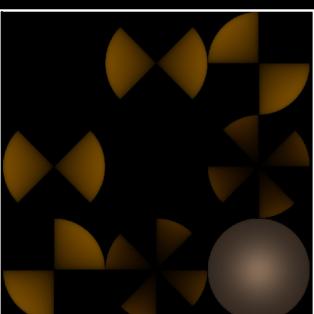
Negative



Weight



Positive

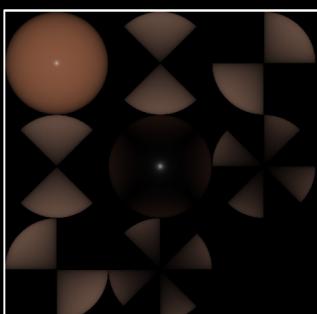


Negative

Material #3

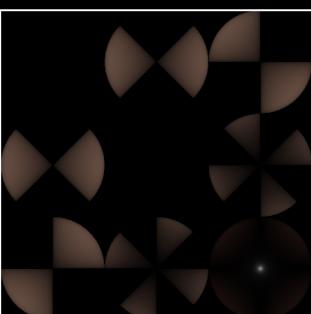


Weight



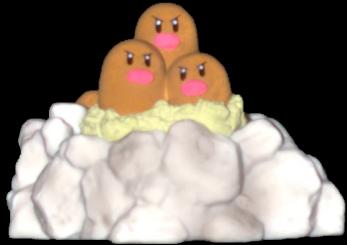
Positive

Material #4



Negative

# Extended Version of Figure 14



Diffuse albedo



Specular roughness



Specular coefficient



Polarimetric rendering



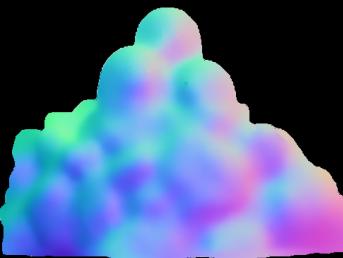
Photograph



Refractive index

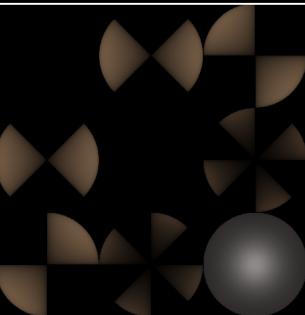
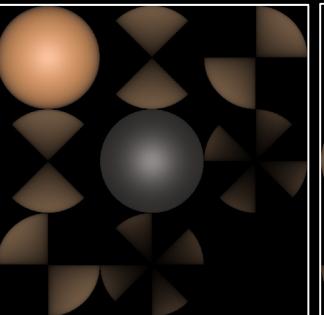
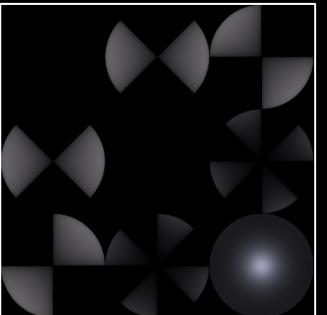
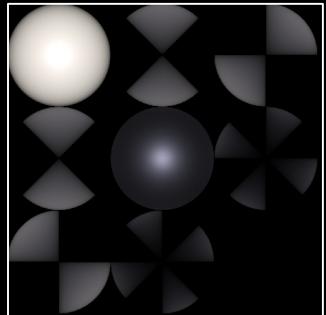
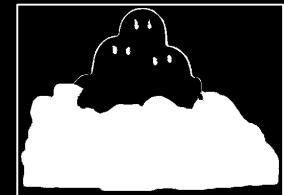


Normals



Structured light

# Extended Version of Figure 14



Weight

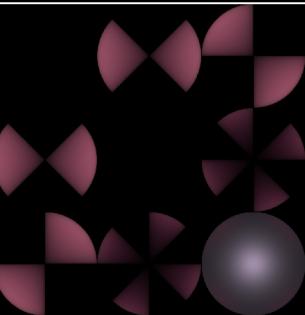
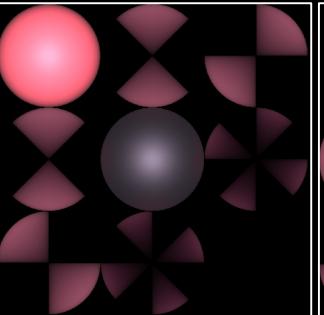
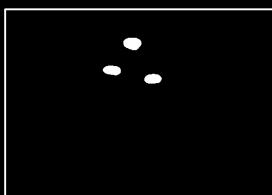
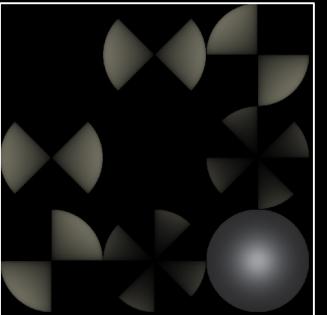
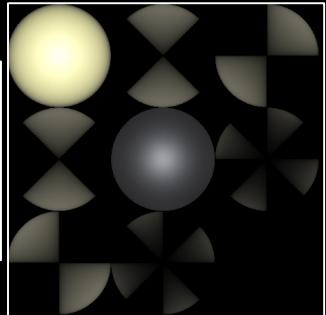
Positive

**Material #1**

Weight

Positive

**Material #2**



Weight

Positive

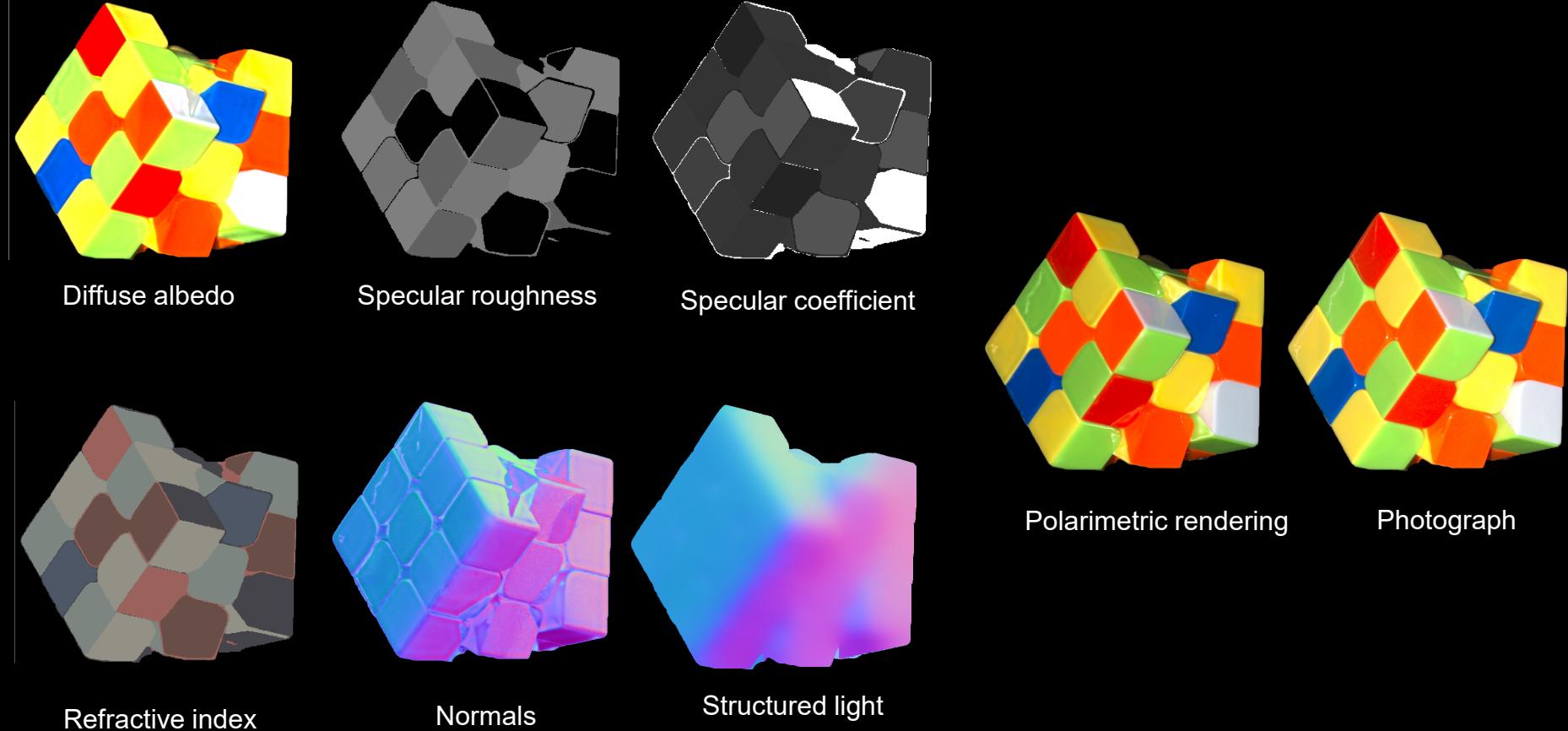
**Material #3**

Weight

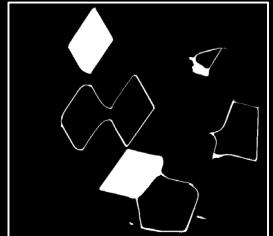
Positive

**Material #4**

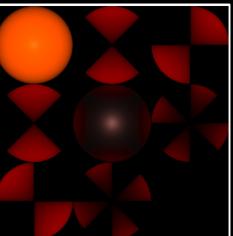
# Extended Version of Figure 14



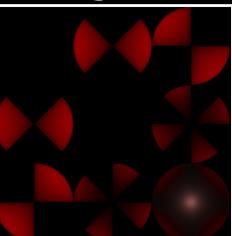
# Extended Version of Figure 14



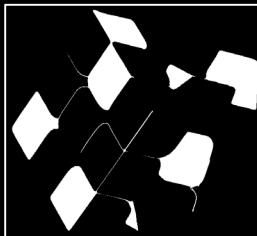
Weight



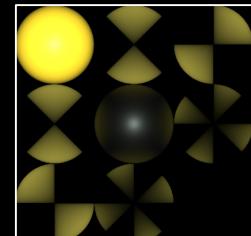
Positive



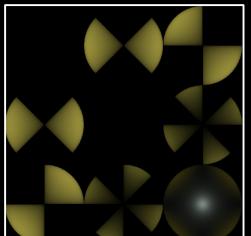
Negative



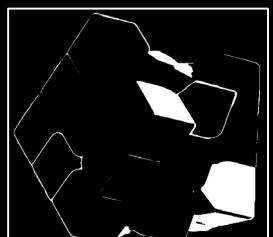
Weight



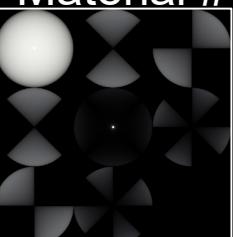
Positive



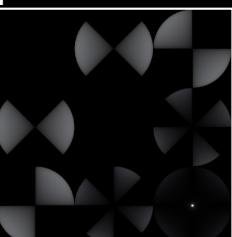
Negative



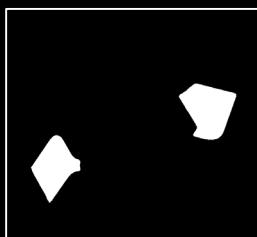
Weight



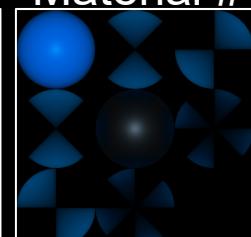
Positive



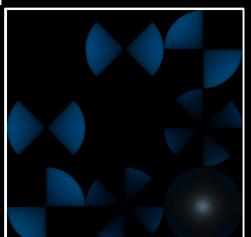
Negative



Weight



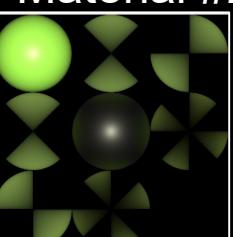
Positive



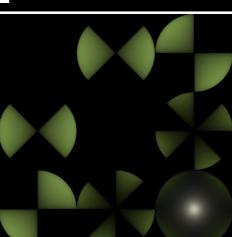
Negative



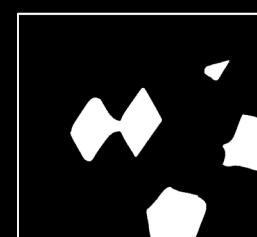
Weight



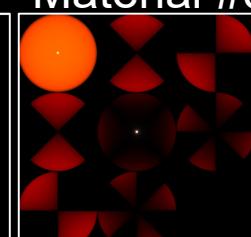
Positive



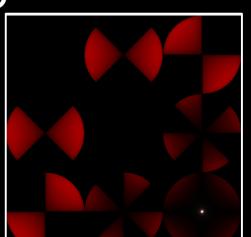
Negative



Weight



Positive



Negative

Material #1

Material #2

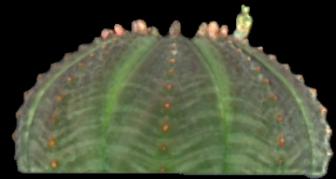
Material #3

Material #4

Material #5

Material #6

# Extended Version of Figure 14



Diffuse albedo



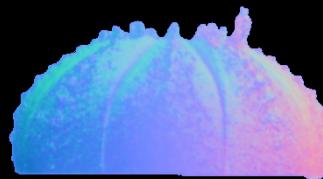
Specular roughness



Specular coefficient



Refractive index



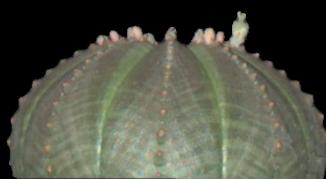
Normals



Structured light

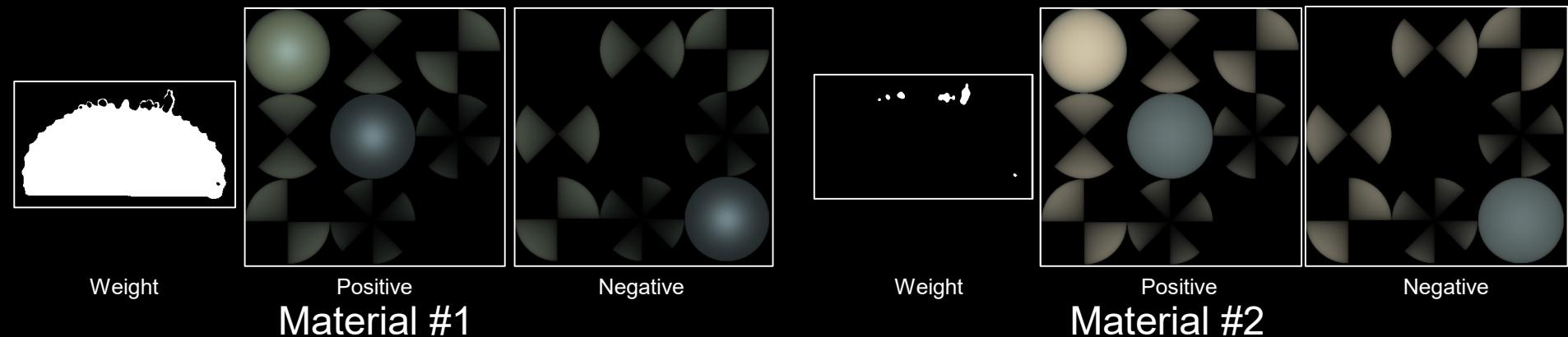
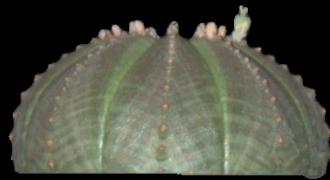


Polarimetric rendering

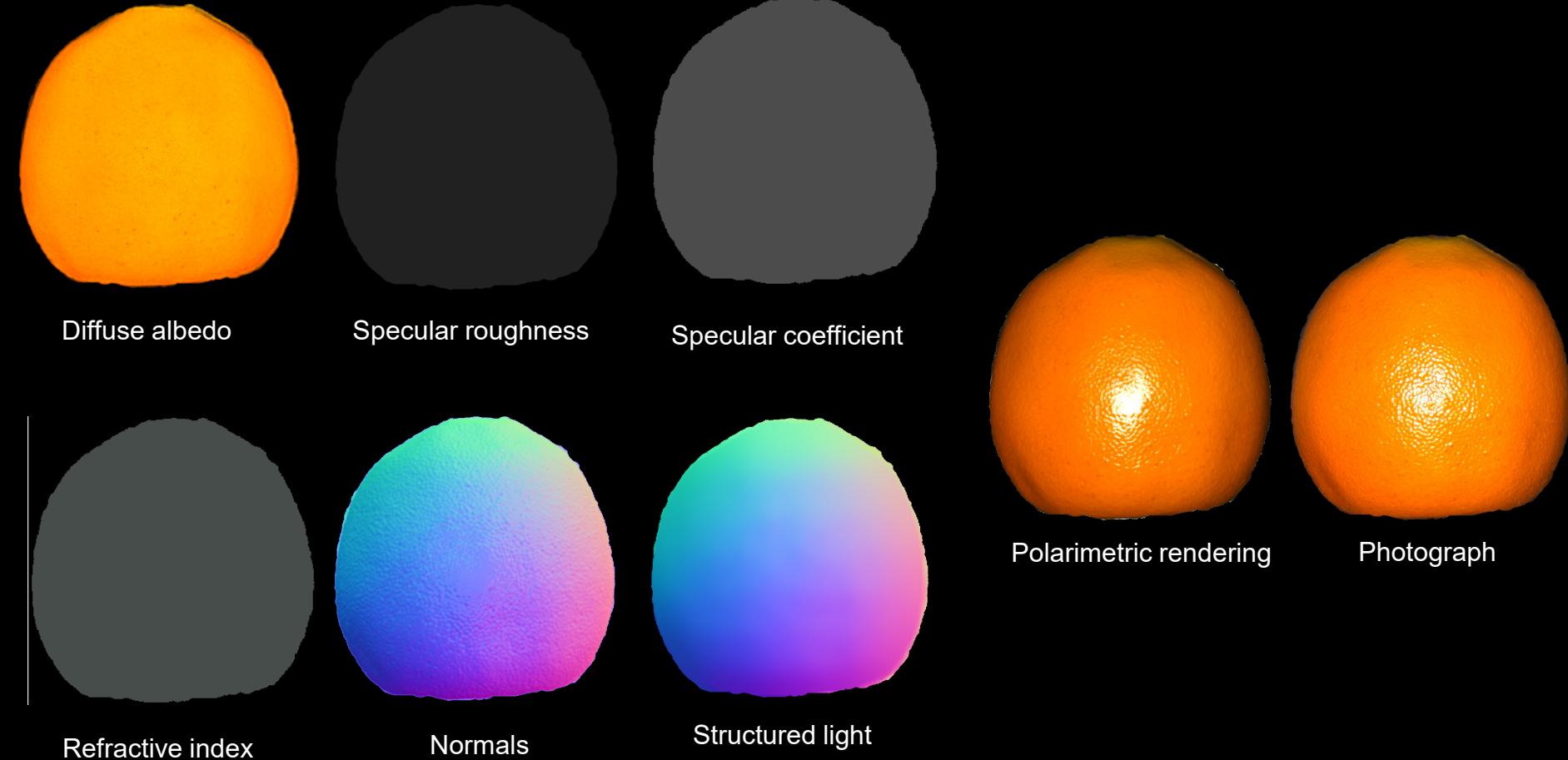


Photograph

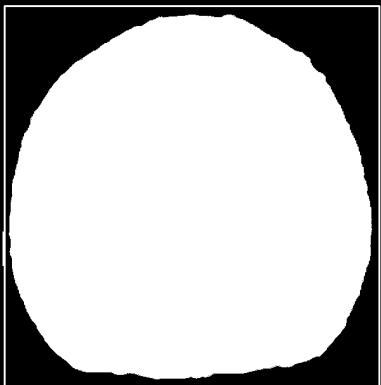
# Extended Version of Figure 14



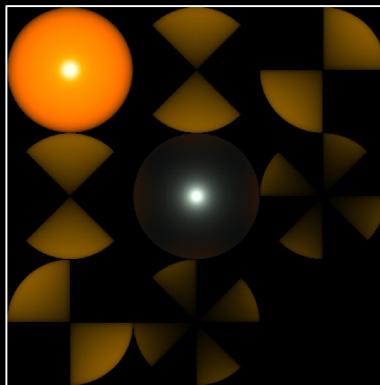
# Extended Version of Figure 14



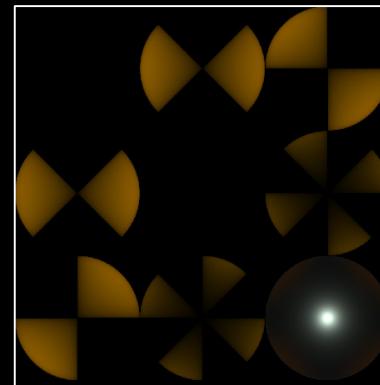
# Extended Version of Figure 14



Weight



Positive



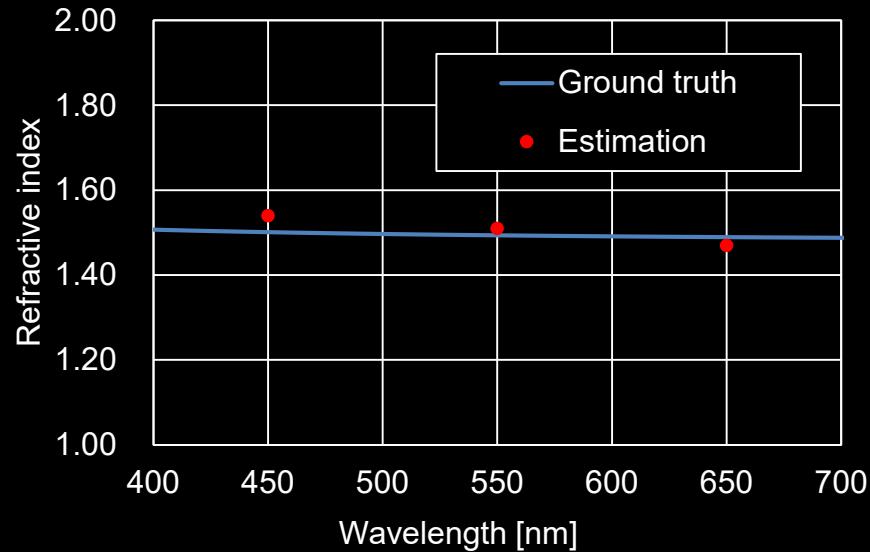
Negative



# Extended Version of Figure 15



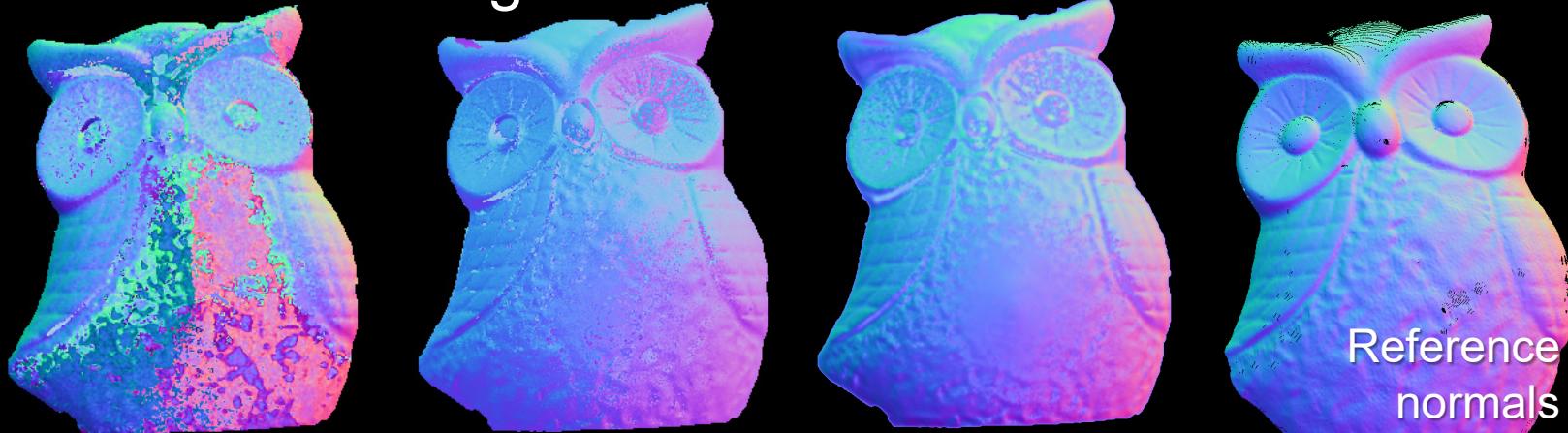
Real object (Acrylic paint)



Refractive index

# Extended Version of Figure 16

Normals



Reference  
normals

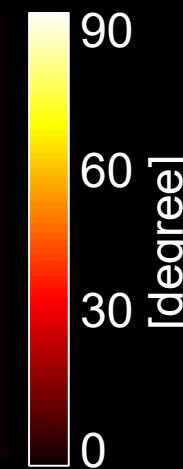
Error



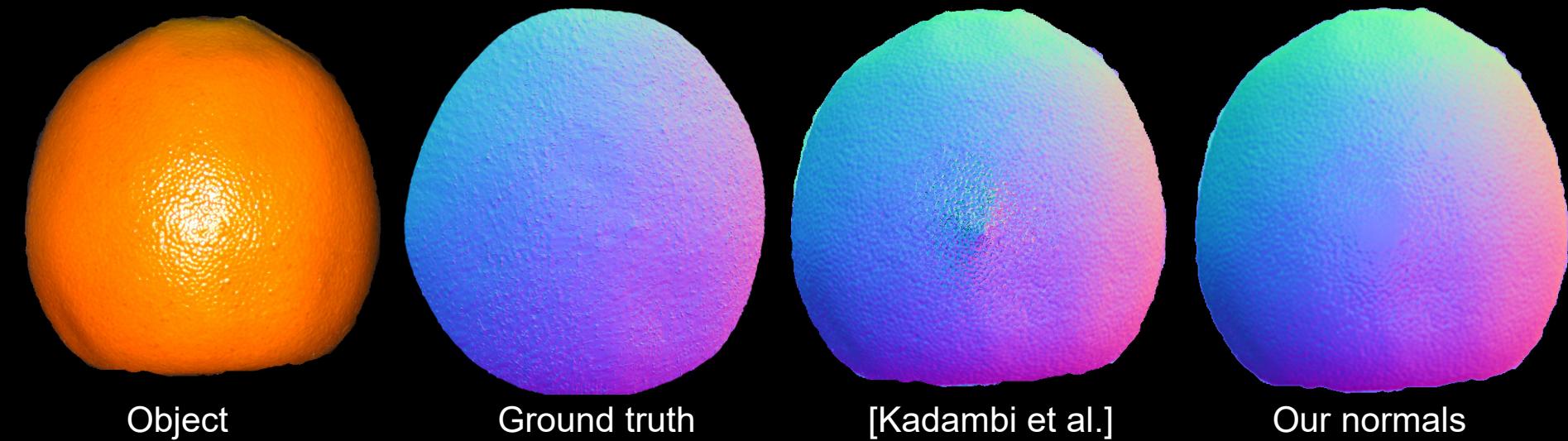
[Miyazaki et al.]

[Kadambi et al.]

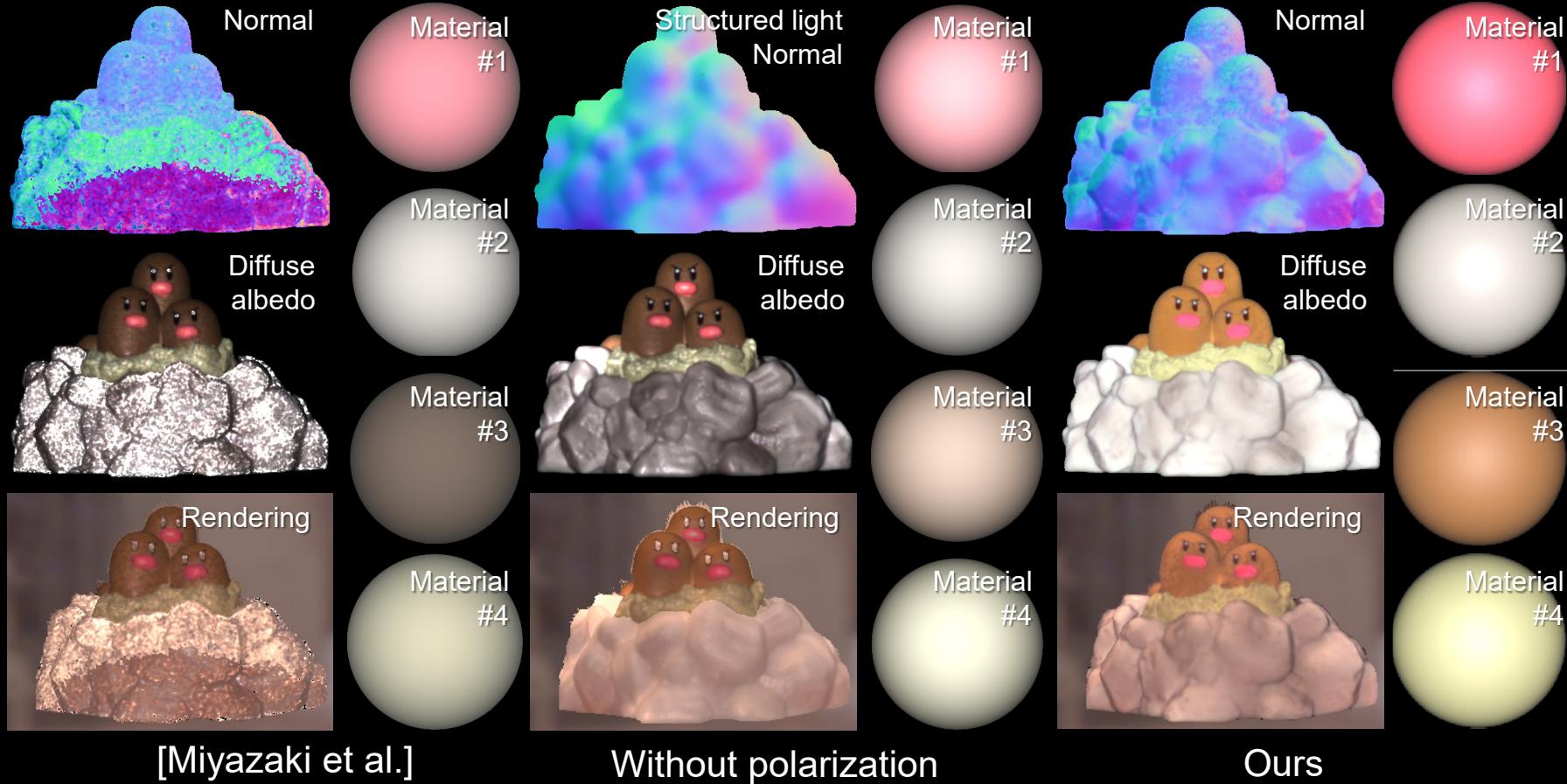
Ours



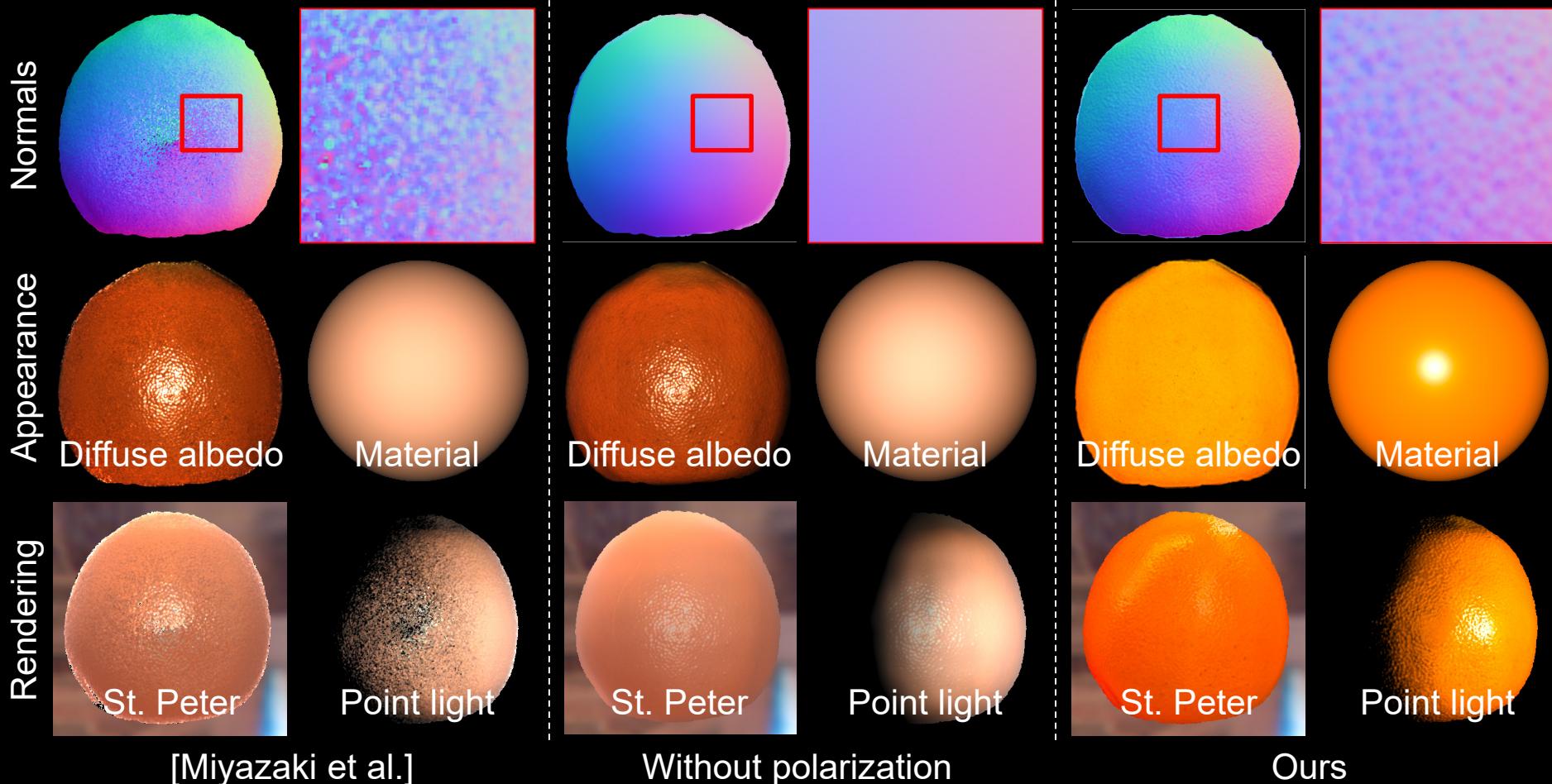
# Extended Version of Figure 17



# Extended Version of Figure 18

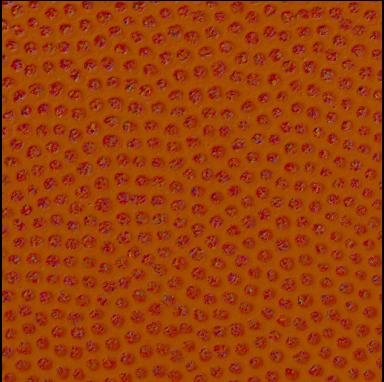
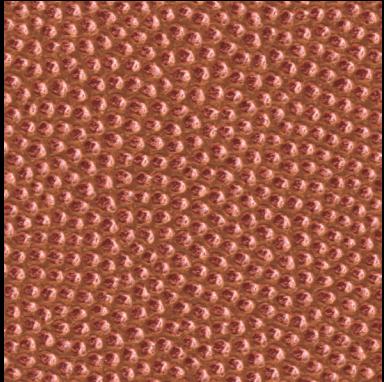


# Extended Version of Figure 18

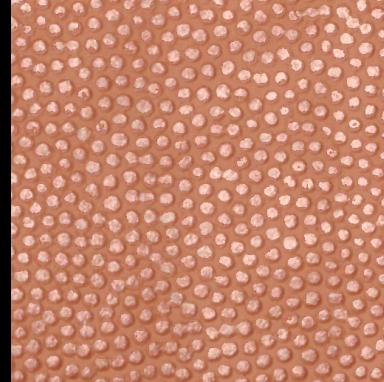
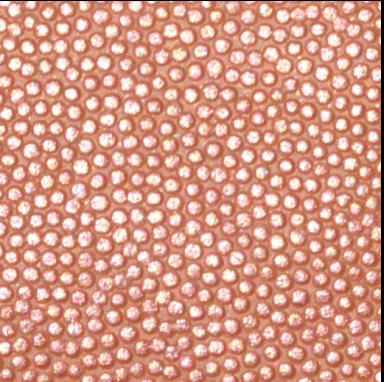


# Extended Version of Figure 19

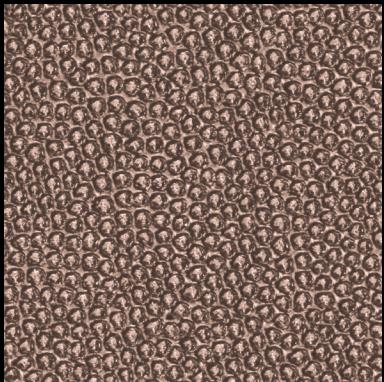
Diffuse



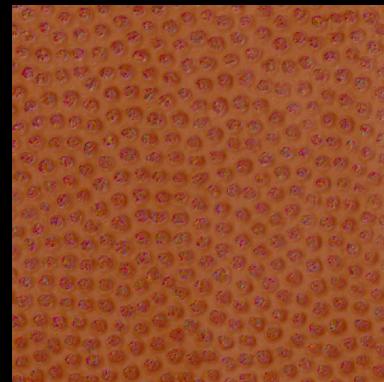
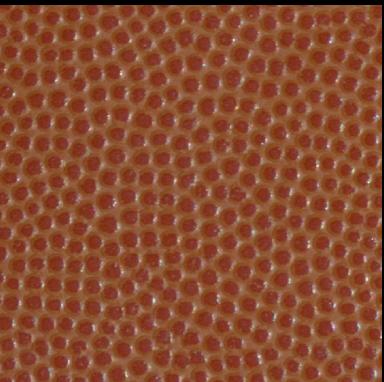
Original illum.



Specular



Novel illum.



[Aittala et al.]

Ours

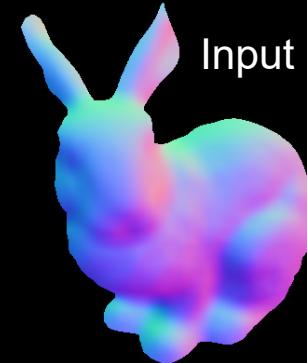
Reference  
photograph

Our rendering

# Extended Version of Figure 20



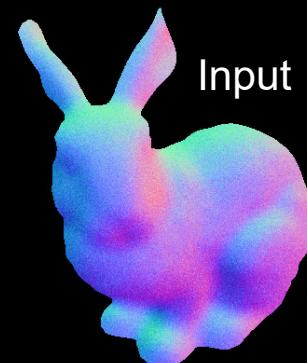
Reference normals



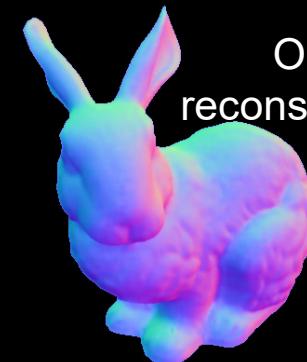
Input  
Rough normals without noise



Our  
reconstruction



Input  
Rough normals with noise



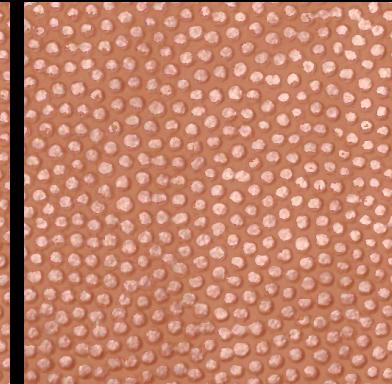
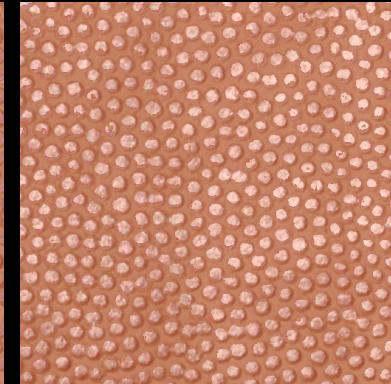
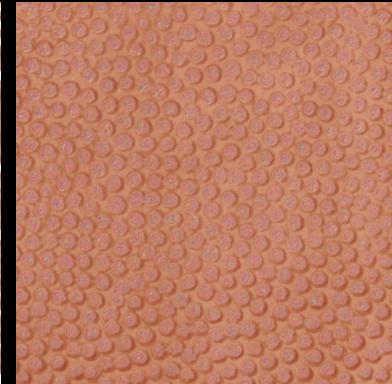
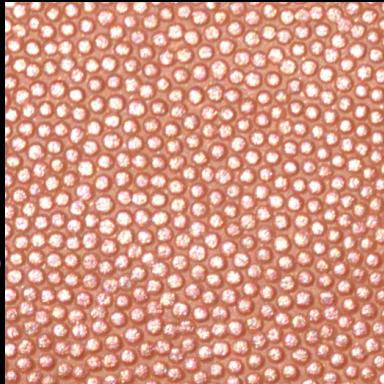
Our  
reconstruction

# Extended Version of Figure 20

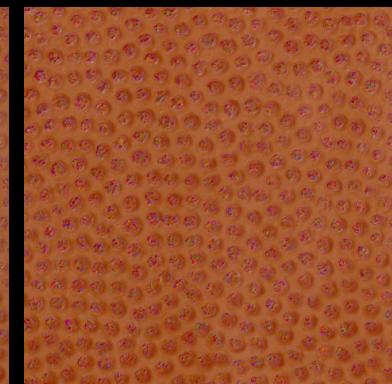
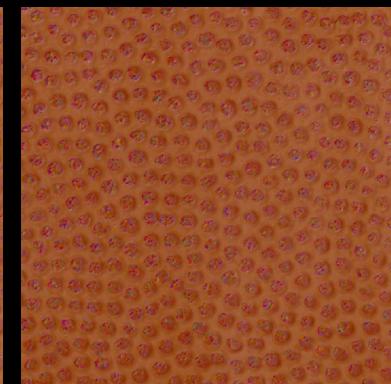
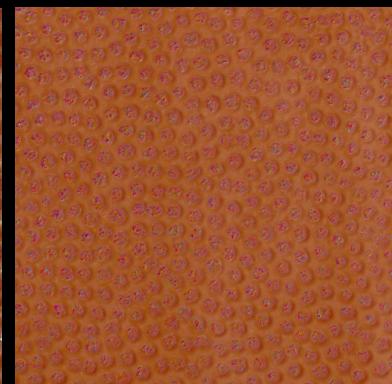
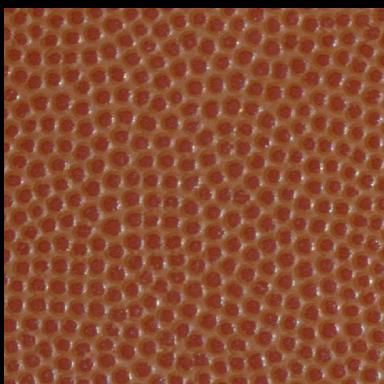
	Without noise/with noise/GT							
Diffuse albedo	Red	1.18/1.15/1.20	Green	1.17/1.19/1.20	Blue	1.16/1.25/1.20		
Refractive index		1.29/1.36/1.30		1.63/1.83/1.65		1.96/2.33/2.00		
Roughness	0.20/0.19/0.20							
Specular coefficient	6.22/3.73/5.00							
Surface normals	Average deviation angles from GT: 5.84/6.39 deg.							

# Extended Version of Figure 21

Original illum.



Novel illum.



Reference  
photograph

Our rendering  
(# of materials: 1)

Our rendering  
(# of materials: 2)

Our rendering  
(# of materials: 3)