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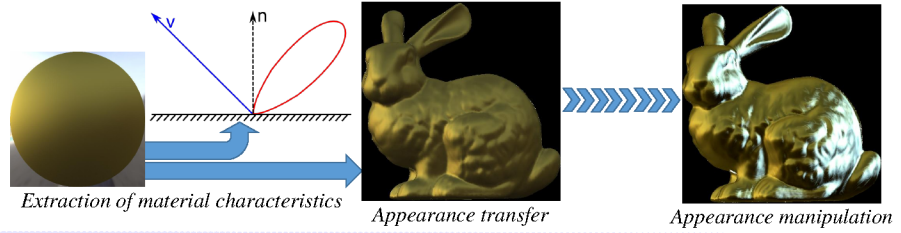
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# Transfer and Manipulation of Appearance from the Image of a Sphere

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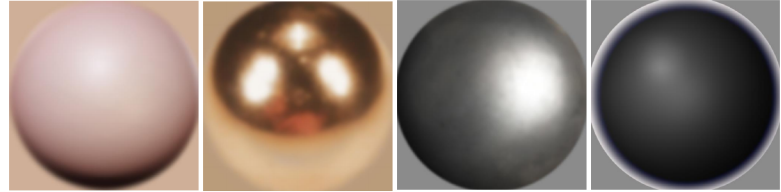
## Goals

- > **Vision:** Extract material characteristics from a single image of a sphere
- > **Graphics:** Transfer its appearance to another shape and manipulate material & lighting



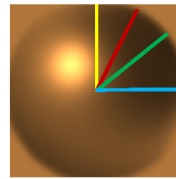
## Input Image

- > Image of a Sphere seen from an orthographic view
- > Obtained by photography, rendering, painting, matcaps (ZBrush™)
- > LitSphere [Sloan01]: use normal orientation for color look-up
- ✗ Does not permit manipulations of material or lighting...



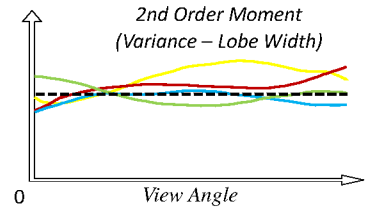
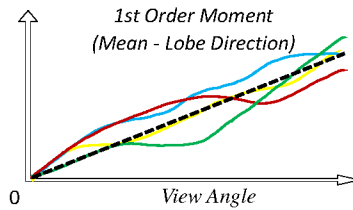
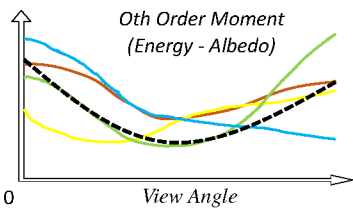
## Inferring Material Properties

- > Hypothesis: uniform BRDF defined by view-dependent Gaussian lobes
- > The Gaussian lobe is completely defined by the 0<sup>th</sup> to 2<sup>nd</sup> order moments
- > Lobe statistics (moments) observable through slices of input LitSphere
- > Use redundancy across slices to recover view-dependent lobe parameters



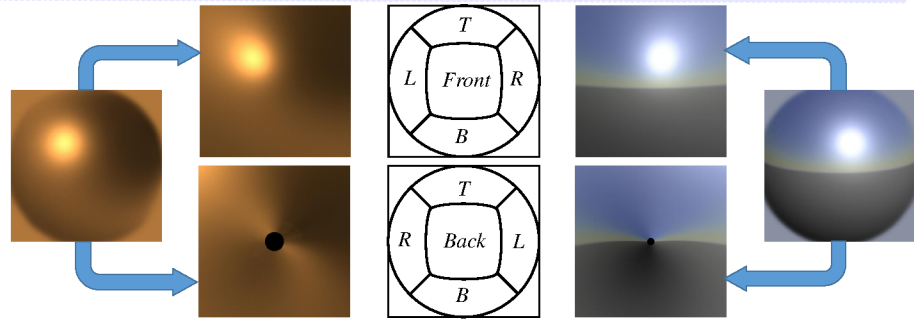
Statistics measured from slices show redundancy across viewing angles

Dashed lines represent the estimated BRDF lobe parameters



## Output Representation

- > **Pre-filtered environment lighting:** spherical map looked-up via lobe direction
- > Material parameters: albedo and lobe width profiles characterize lobe shapes
- > Directions reaching the back of our spherical map might not be filled in.
- ✗ They need to be reconstructed

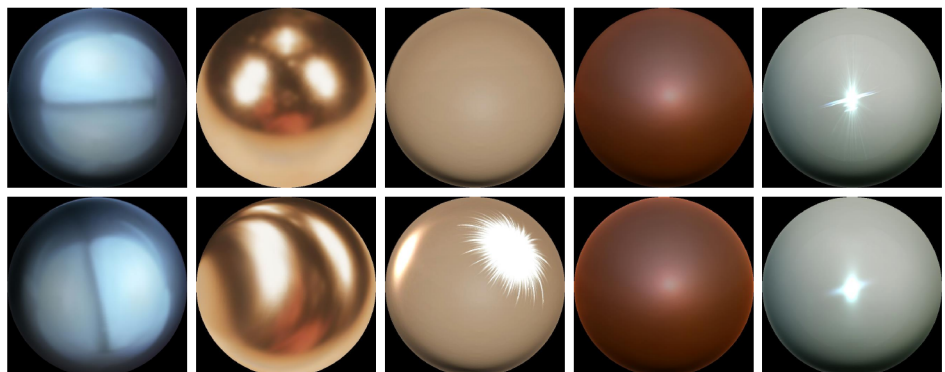


Paraboloid map visualization of our reconstructed spherical map

## Manipulation

Manipulation	Rotate Light	Warp Light	Add Light	Mat. Fresnel	Mat. Gloss
Re-filter Albedo	X	X	X	X	X
Re-filter Direction	X	X			
Re-filter Width			X		X

- > **Re-filtering** the spherical map using inferred material properties permit to manipulate appearance without knowledge of lighting
- > The table presents different types of manipulations and the lobe moments they rely upon
- > The resulting spherical map is readily used to shade arbitrary-shaped objects as with LitSpheres
- > Spatially-varying effects may be produced simply by varying filtering parameters on the surface



## Conclusions

- > A single image of a sphere contains **sufficient information** for the manipulation of appearance
- > BRDF **lobe moments** and their profiles could be considered as relevant characteristics to perception



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