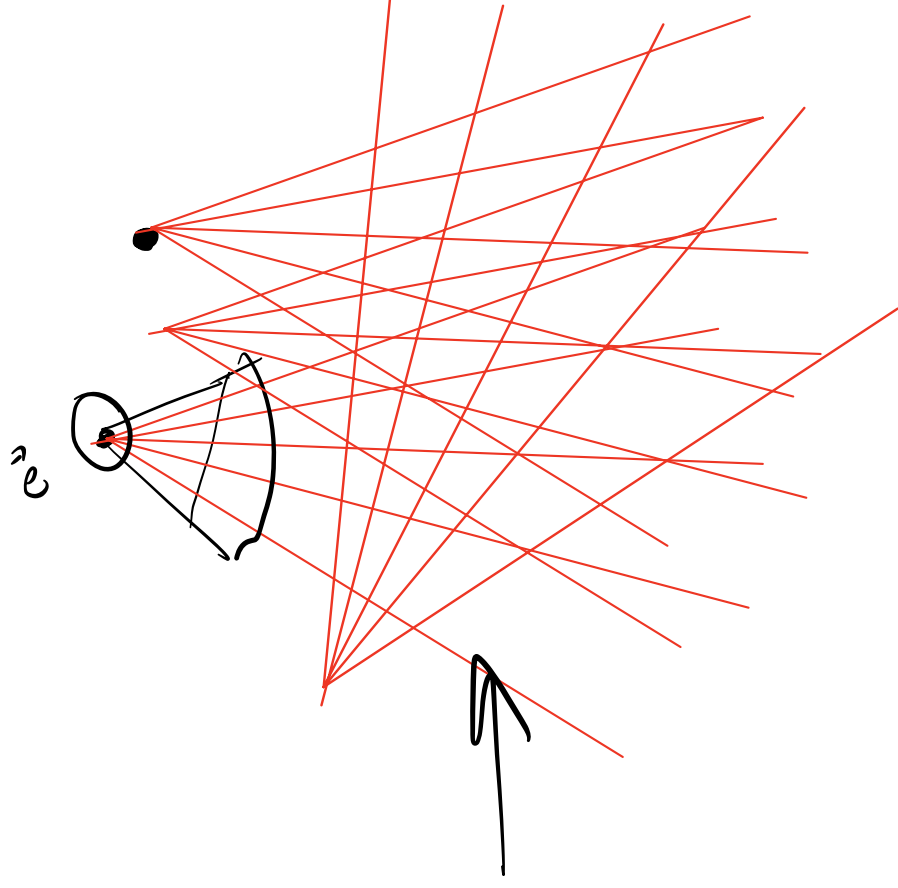


# Novel View Synthesis

# Announcements

- Grad presenters:
  - If you need anything printed, send it to me >1h ahead.
  - If you want to present from my computer, send it to me >1h ahead.



# The Plenoptic Function

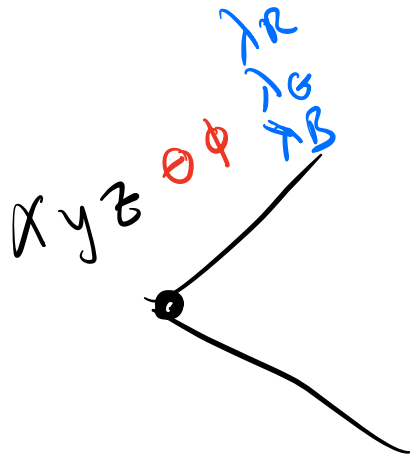
AKA radiance field is all you need

$$f: (\underbrace{x, y, z}, \underbrace{\phi, \theta}, \lambda) \rightarrow \mathbb{R}$$

position

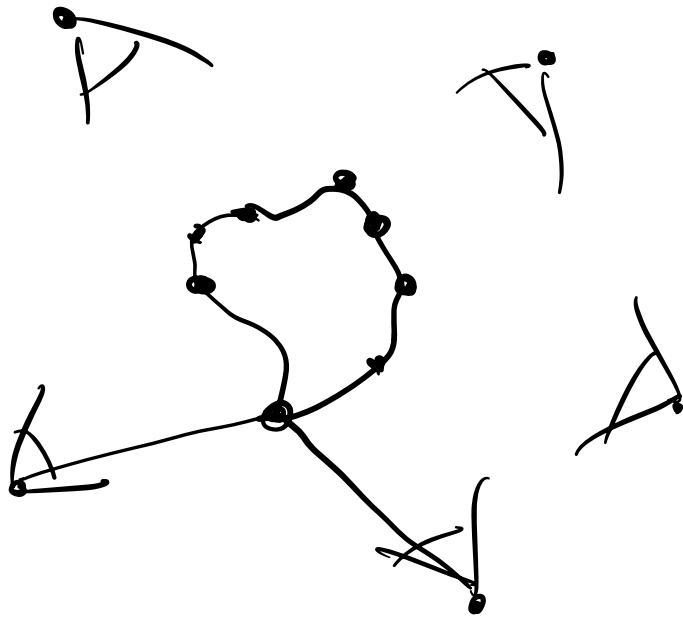
angle

↑  
wavelength

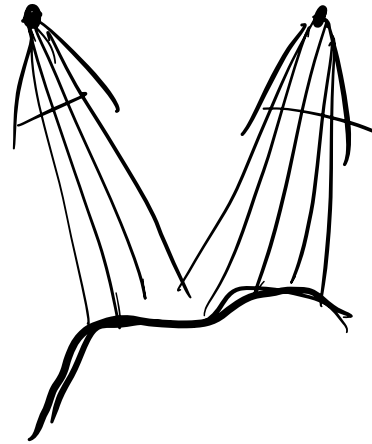


# Vision-then-Graphics

SFM



MVS



# Vision-then-Graphics

## Casual 3D Photography

PETER HEDMAN, University College London\*

SUHIB ALSISAN, Facebook

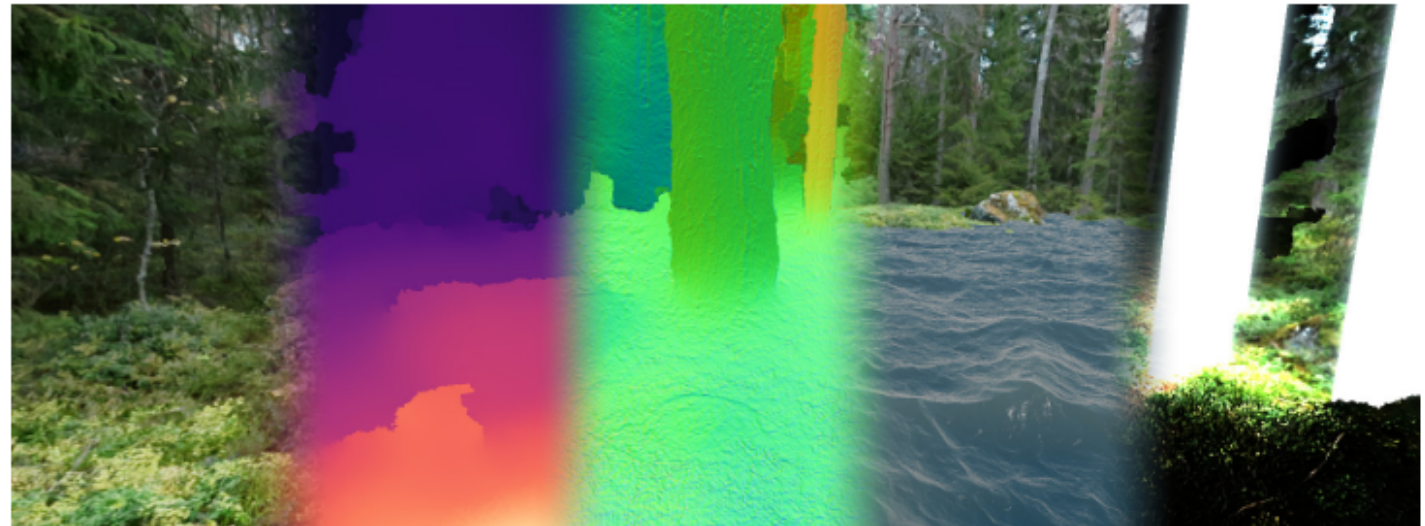
RICHARD SZELISKI, Facebook

JOHANNES KOPF, Facebook

<http://visual.cs.ucl.ac.uk/pubs/casual3d/>



Casual 3D photo capture



Color

Depth

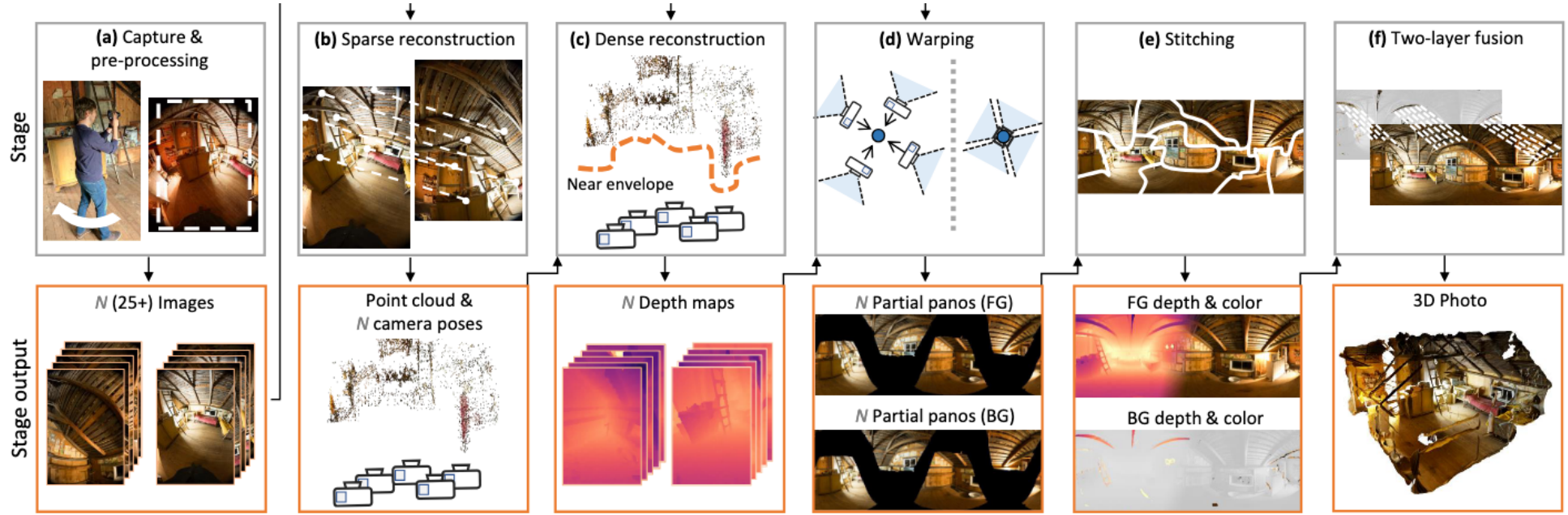
Normal map

Geometry-aware

Lighting

Reconstruction

Example Effects

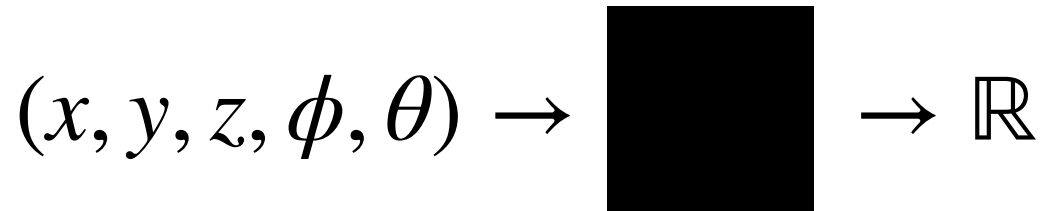


# Just Ask?

## NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis

Ben Mildenhall<sup>1\*</sup> Pratul P. Srinivasan<sup>1\*</sup> Matthew Tancik<sup>1\*</sup>  
Jonathan T. Barron<sup>2</sup> Ravi Ramamoorthi<sup>3</sup> Ren Ng<sup>1</sup>

<sup>1</sup>UC Berkeley   <sup>2</sup>Google Research   <sup>3</sup>UC San Diego



# Just Ask?

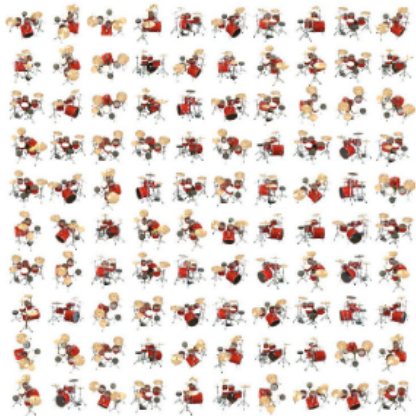
## NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis

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<sup>1</sup>UC Berkeley <sup>2</sup>Google Research <sup>3</sup>UC San Diego

$$(x, y, z, \phi, \theta) \rightarrow \blacksquare \rightarrow \mathbb{R}$$

Input Images



Optimize NeRF



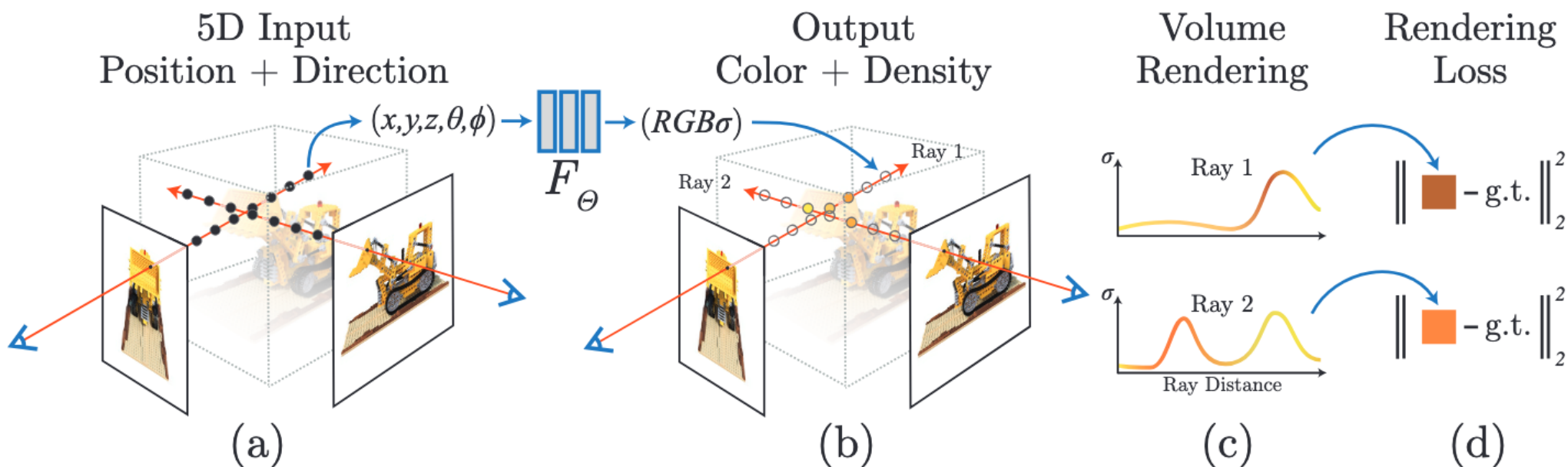
Render new views



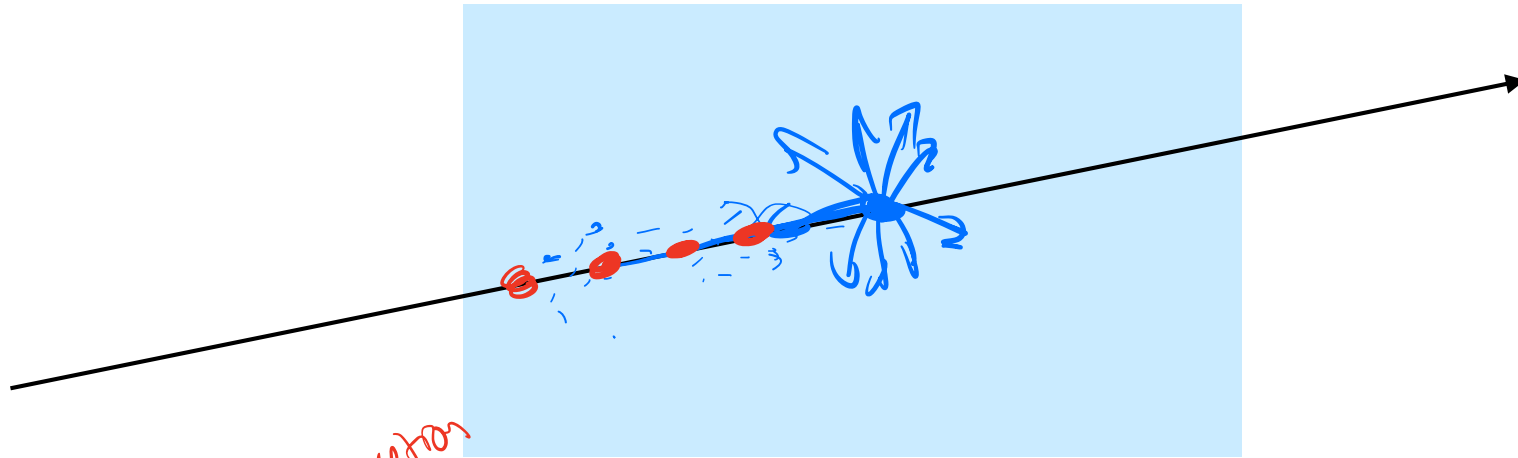


# Nerf: Details

Pose this as a **volume rendering** problem



# Volume Rendering: Uniform

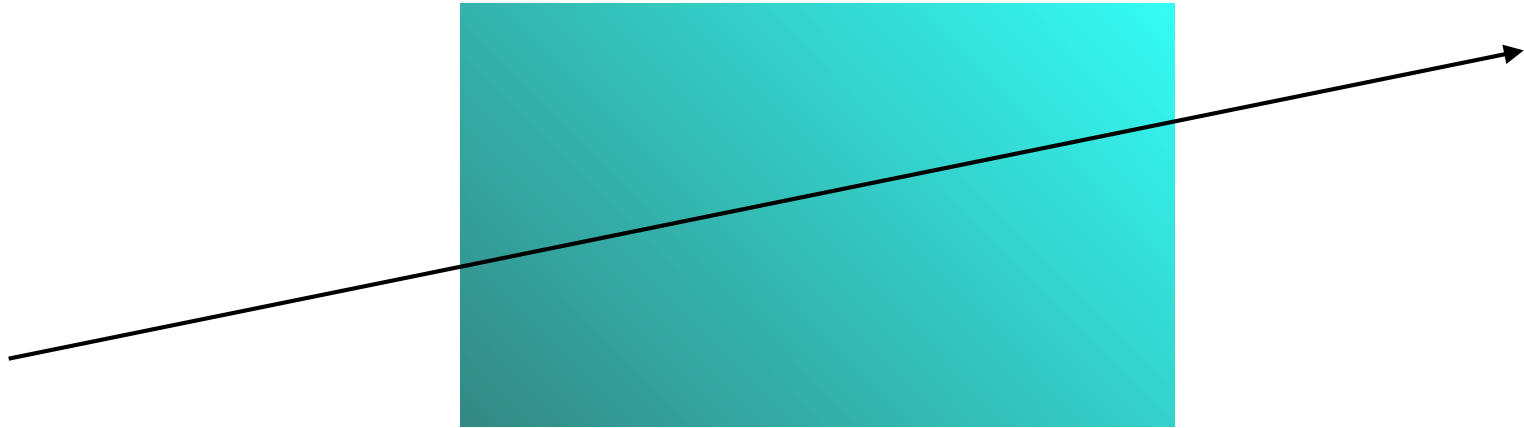


*absorption  
coefficient*

$$\underline{T(t) = \exp(-t\sigma)}$$

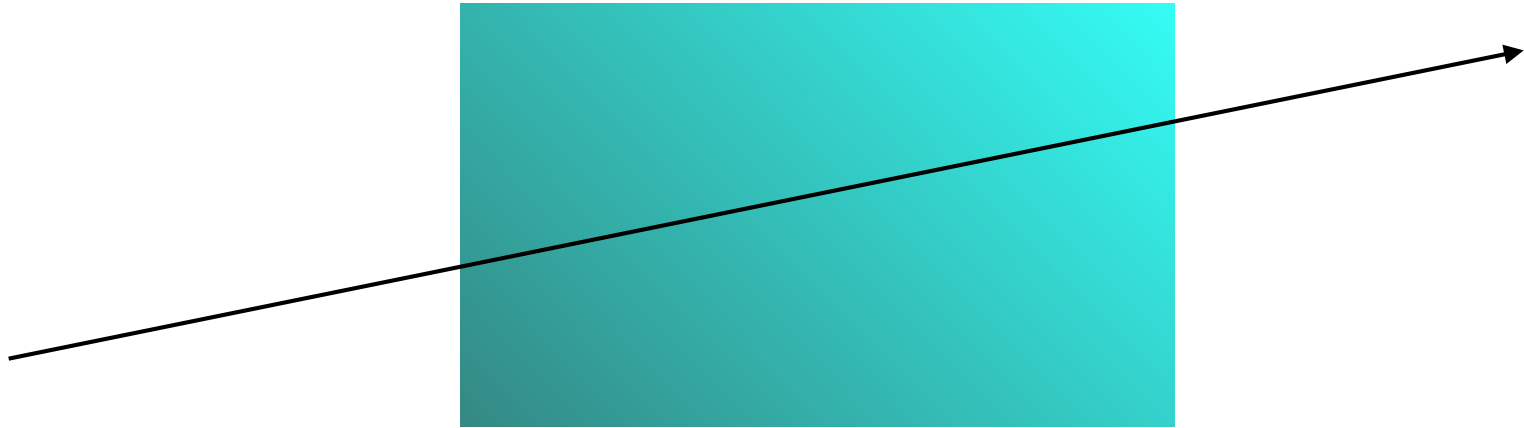
$$C(r) = \int_{t_n}^{t_f} \mathbf{c}(t)T(t)$$

# Volume Rendering: Nonuniform



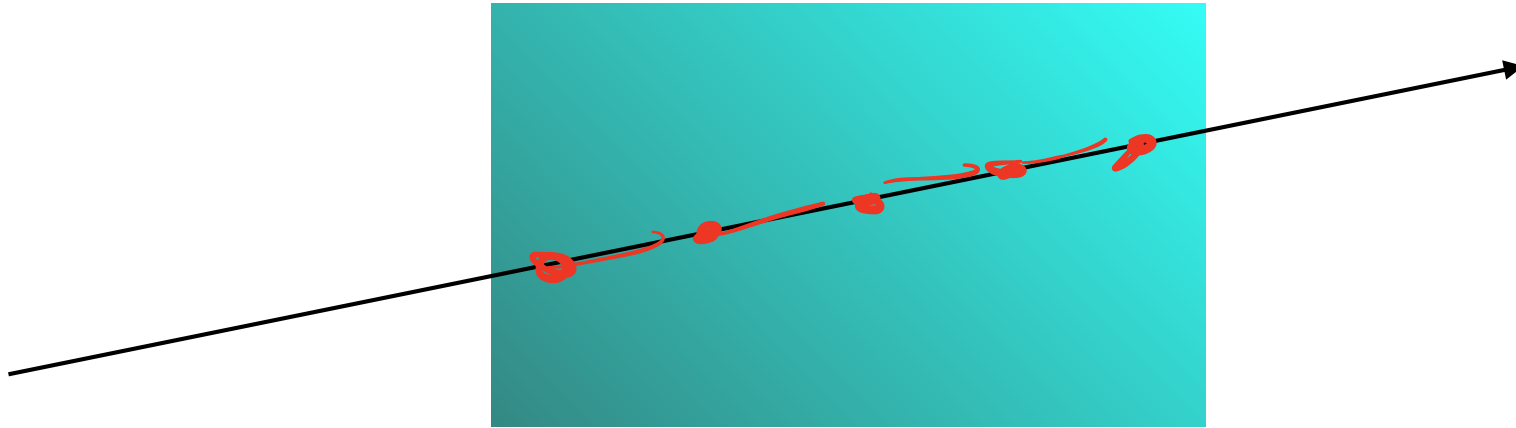
$$T(t) = \exp\left(-\int_{t_n}^{t_f} \sigma(\mathbf{r}(s)) ds\right) \quad \mathbf{C}(\mathbf{r}) = \int_{t_n}^{t_f} T(t) \sigma(\mathbf{r}(t)) \mathbf{c}(\mathbf{r}(t)) dt$$

# Volume Rendering: NeRF



$$T(t) = \exp\left(-\int_{t_n}^{t_f} \sigma(\mathbf{r}(s)) ds\right) \quad C(\mathbf{r}) = \int_{t_n}^{t_f} T(t) \sigma(\mathbf{r}(t)) \mathbf{c}(\mathbf{r}(t), \mathbf{d}) dt$$

# Volume Rendering: NeRF (Quadrature)

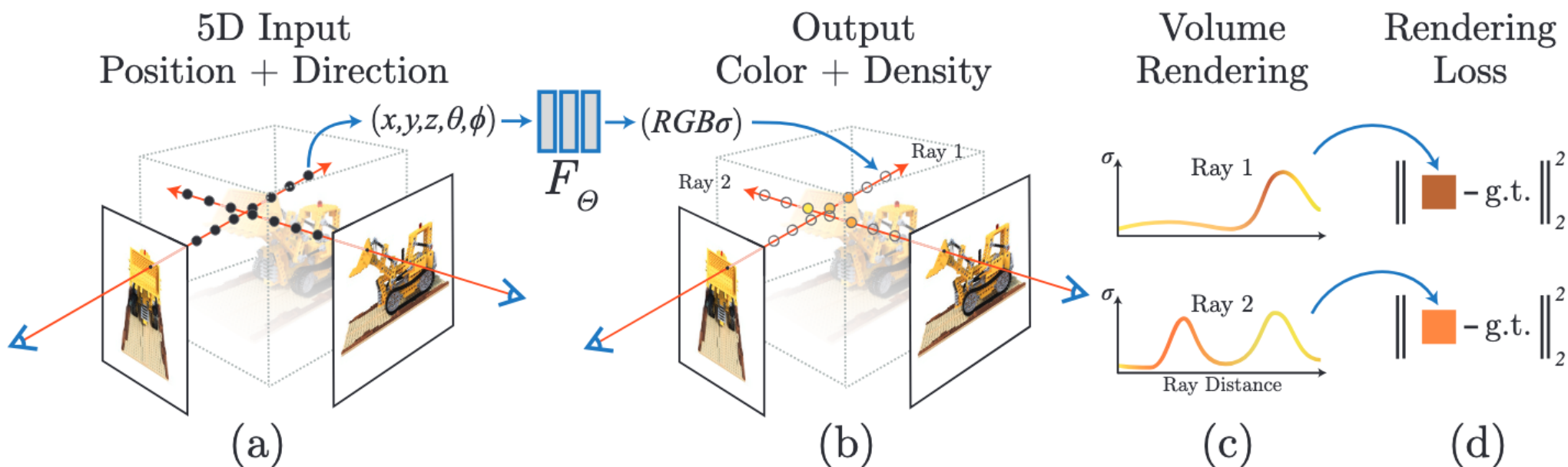


$$T_i = \exp\left(-\sum_{j=1}^{i-1} \sigma_j \delta_j\right)$$

$$\hat{C}(\mathbf{r}) = \sum_{i=1}^N T_i \underbrace{(1 - \exp(-\sigma_i \delta_i))}_{\text{red bracket}} \mathbf{c}_i$$

# Nerf: Details

Pose this as a **volume rendering** problem



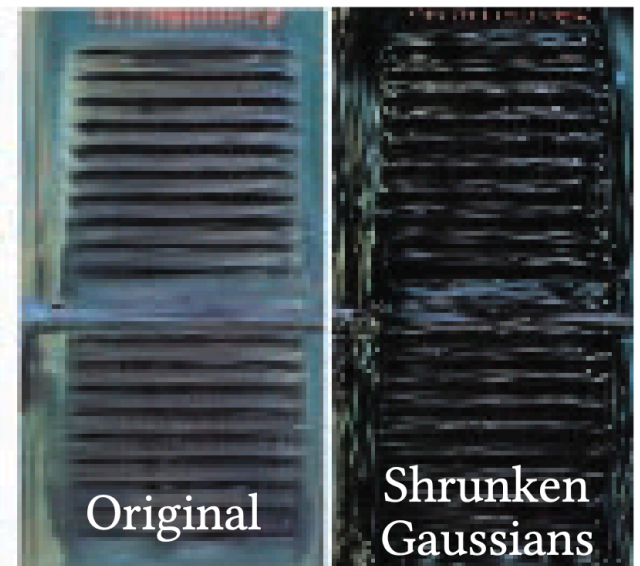
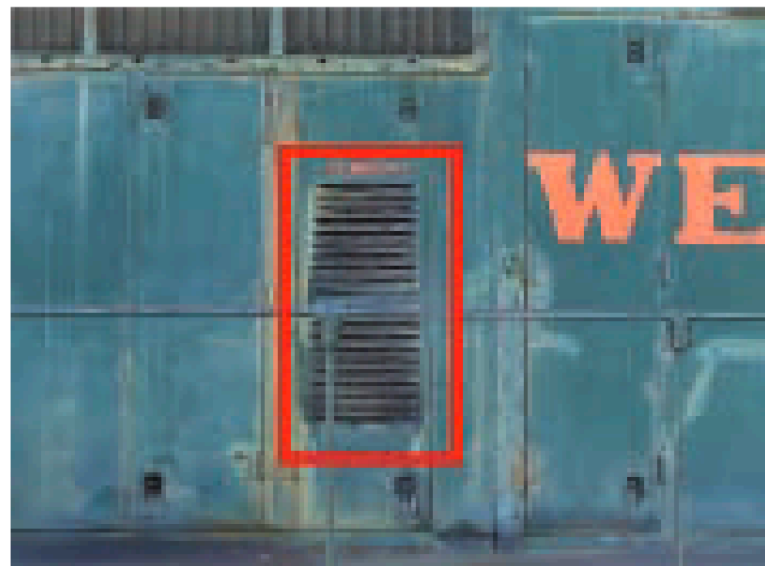
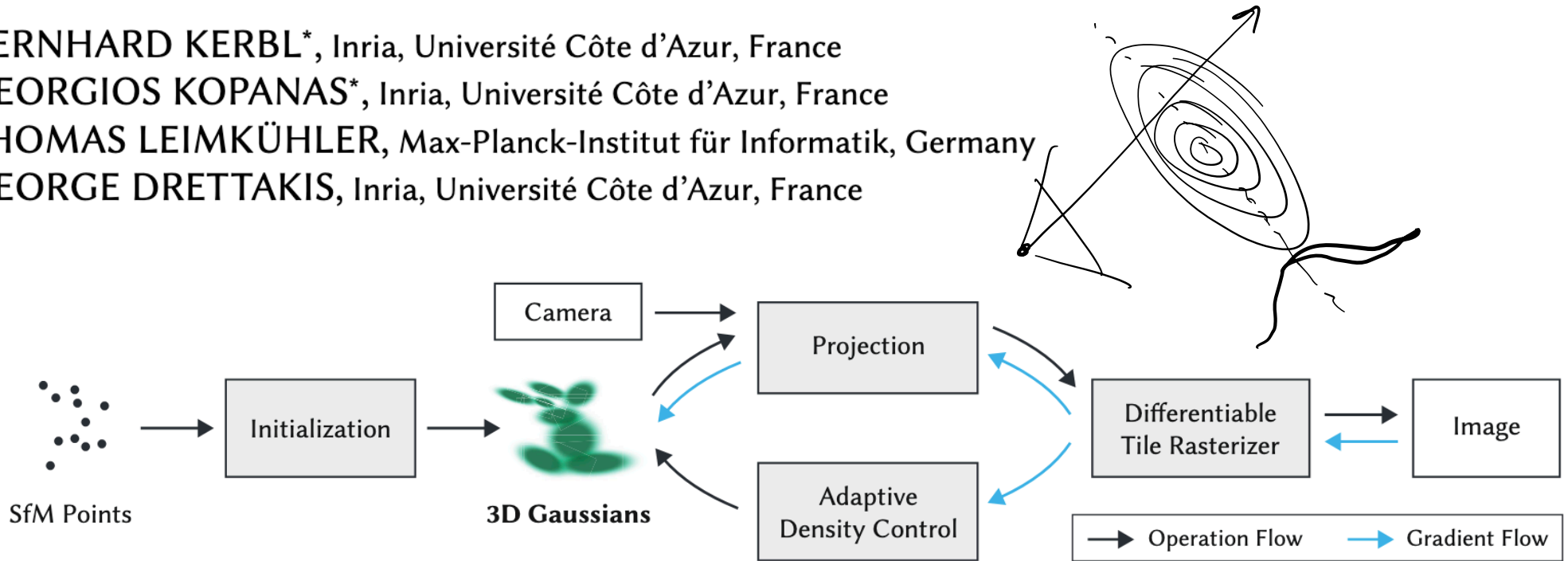
# 3D Gaussian Splatting for Real-Time Radiance Field Rendering

BERNHARD KERBL\*, Inria, Université Côte d'Azur, France

GEORGIOS KOPANAS\*, Inria, Université Côte d'Azur, France

THOMAS LEIMKÜHLER, Max-Planck-Institut für Informatik, Germany

GEORGE DRETTAKIS, Inria, Université Côte d'Azur, France



# Rasterization vs Raytracing: The battle rages on

## **EVER: Exact Volumetric Ellipsoid Rendering for Real-time View Synthesis**

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Yinda Zhang<sup>2</sup>

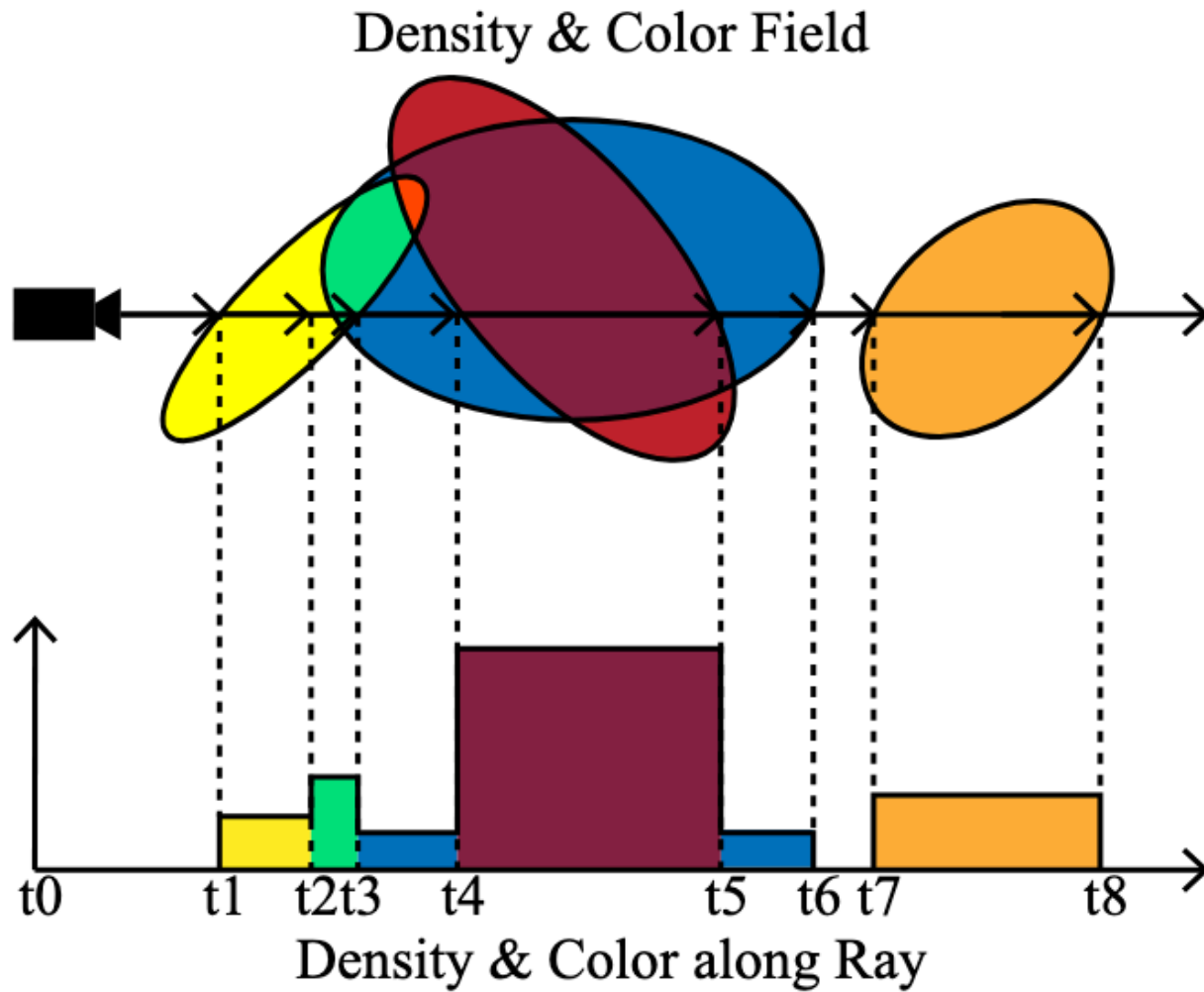
yindaz@google.com

<sup>1</sup>University of California, San Diego    <sup>2</sup>Google

<https://half-potato.gitlab.io/posts/ever/>

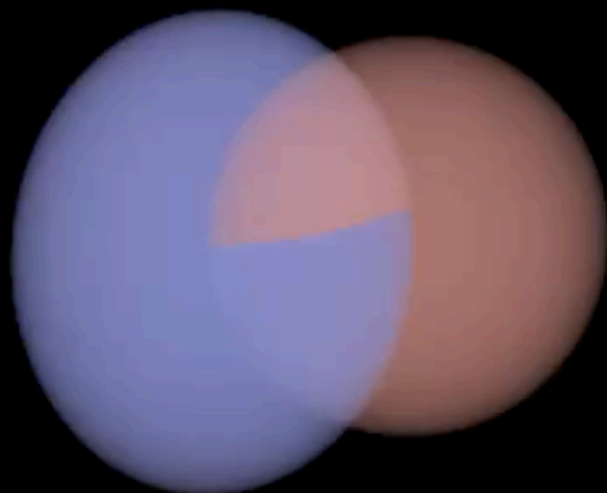


# EVER: Exact Volumetric Ellipsoid Rendering for Real-time View Synthesis

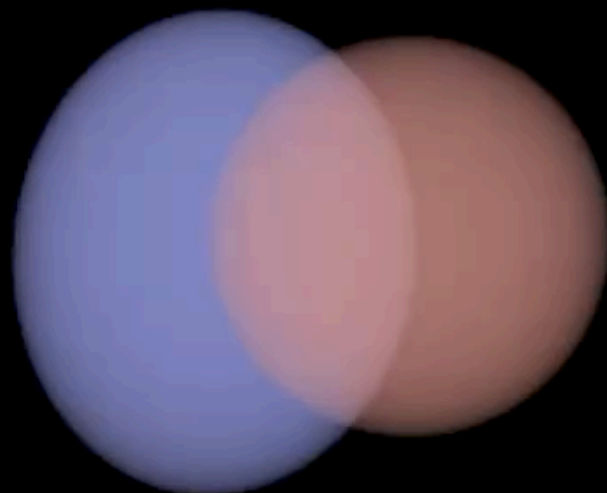


# EVER: Exact Volumetric Ellipsoid Rendering for Real-time View Synthesis

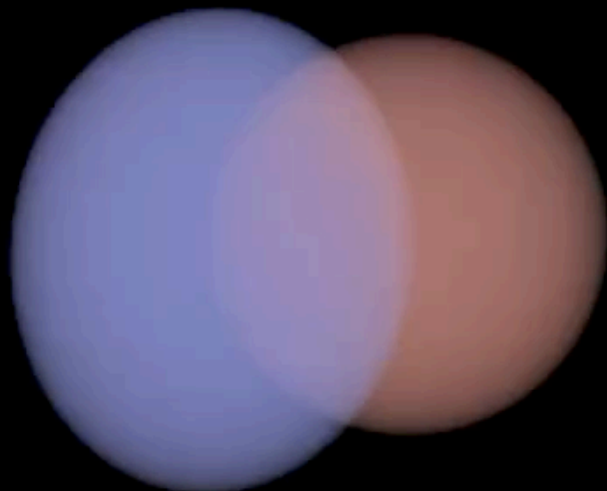
StopThePop  
Style



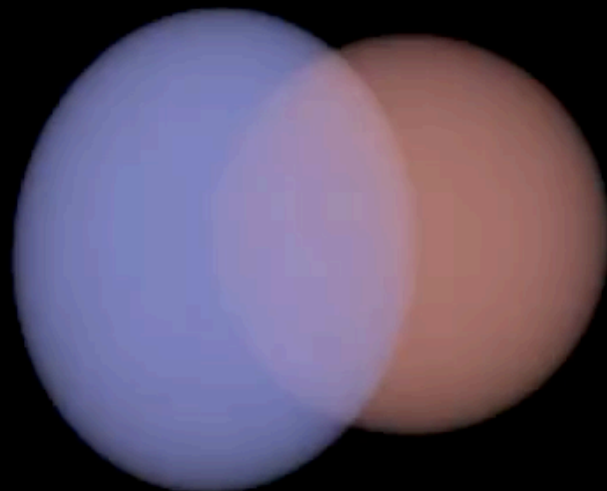
3DGS  
Style



Ground  
Truth

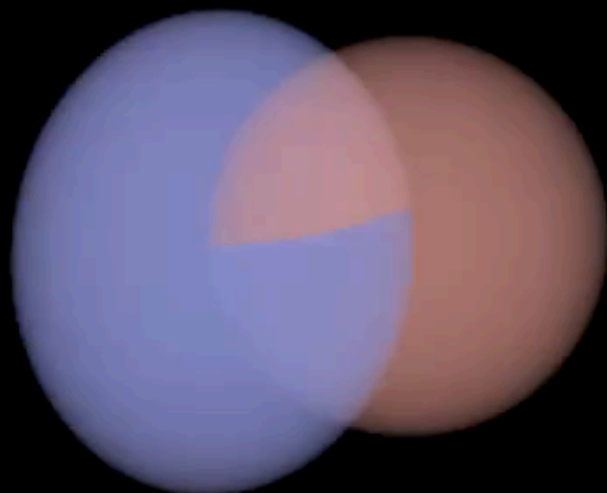


Ours

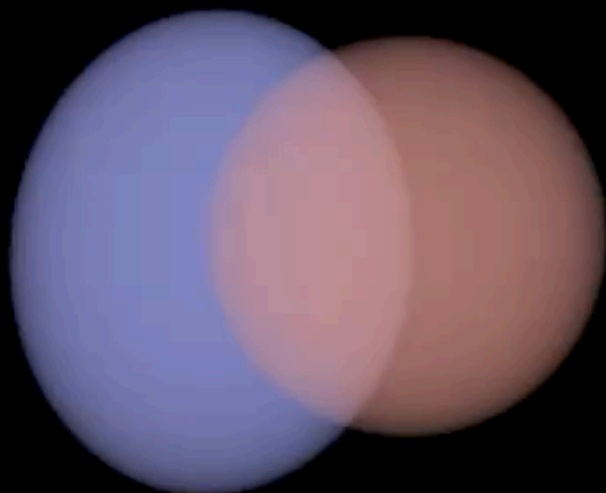


# EVER: Exact Volumetric Ellipsoid Rendering for Real-time View Synthesis

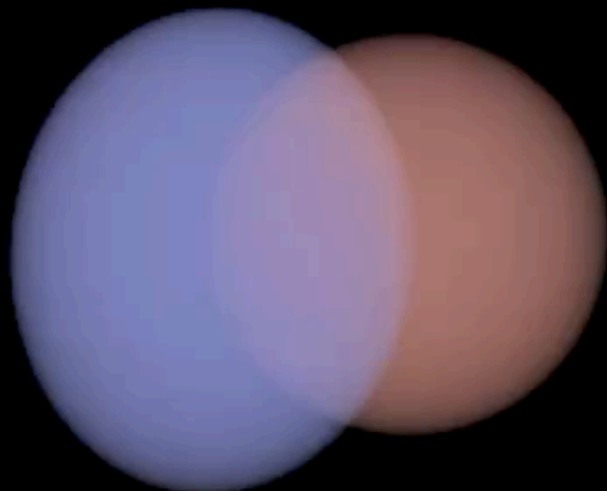
StopThePop  
Style



3DGS  
Style



Ground  
Truth



Ours

