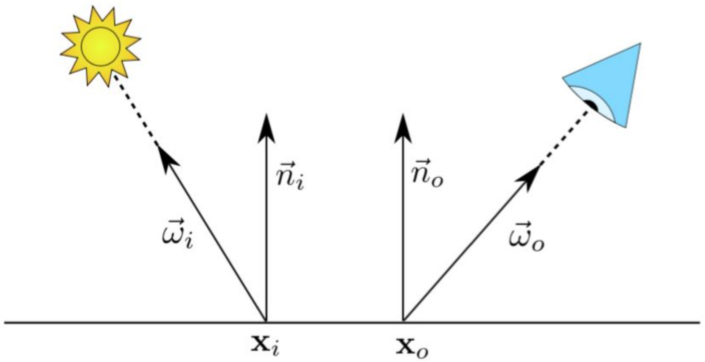
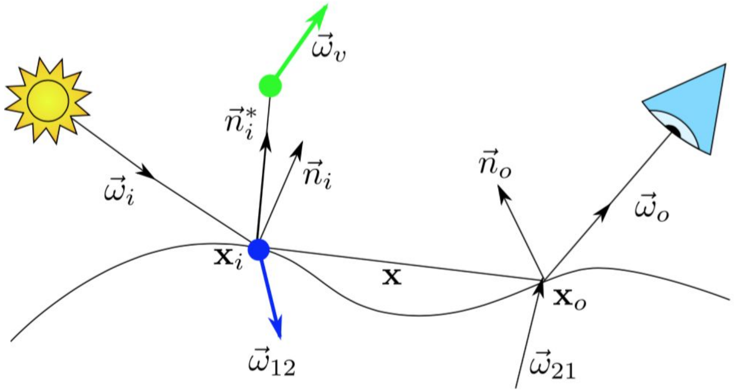
Directional Dipole for Subsurface Scattering

Pan An

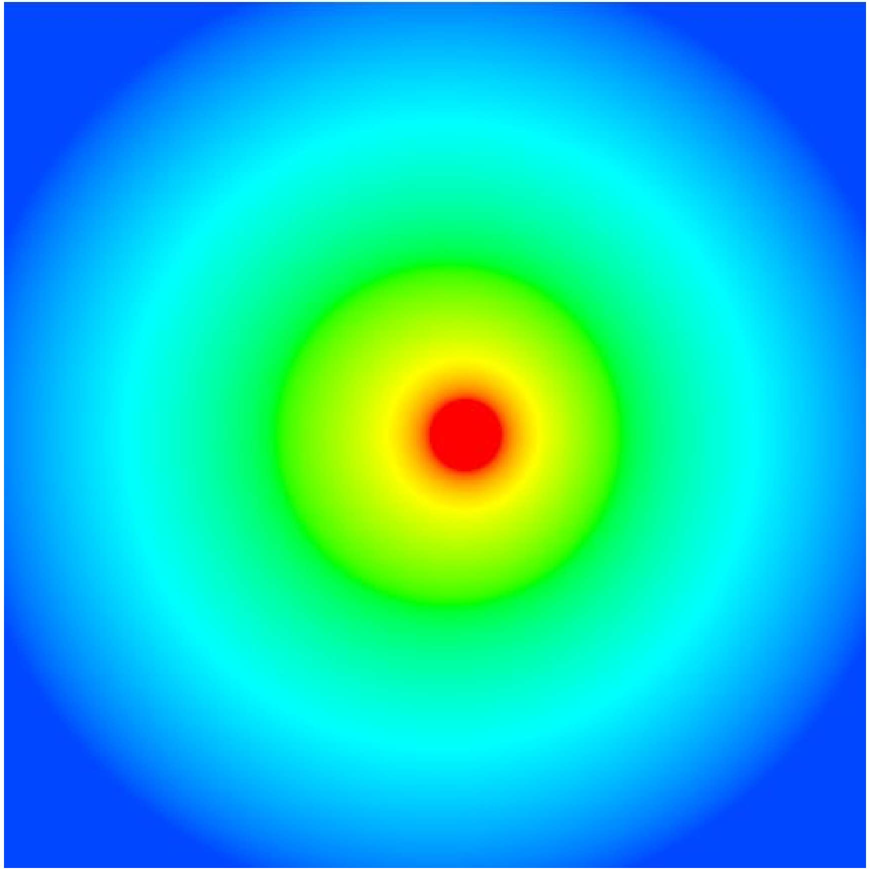
BSSRDF vs Directional Methods

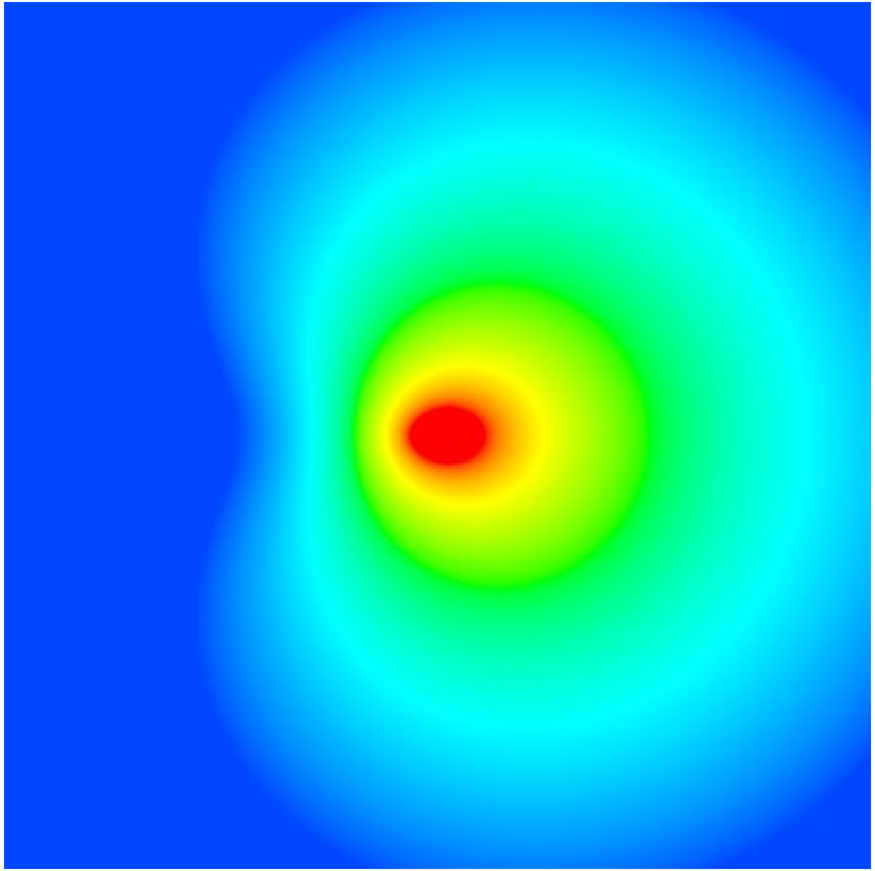
BSSRDF considers all medium as infinite deep.



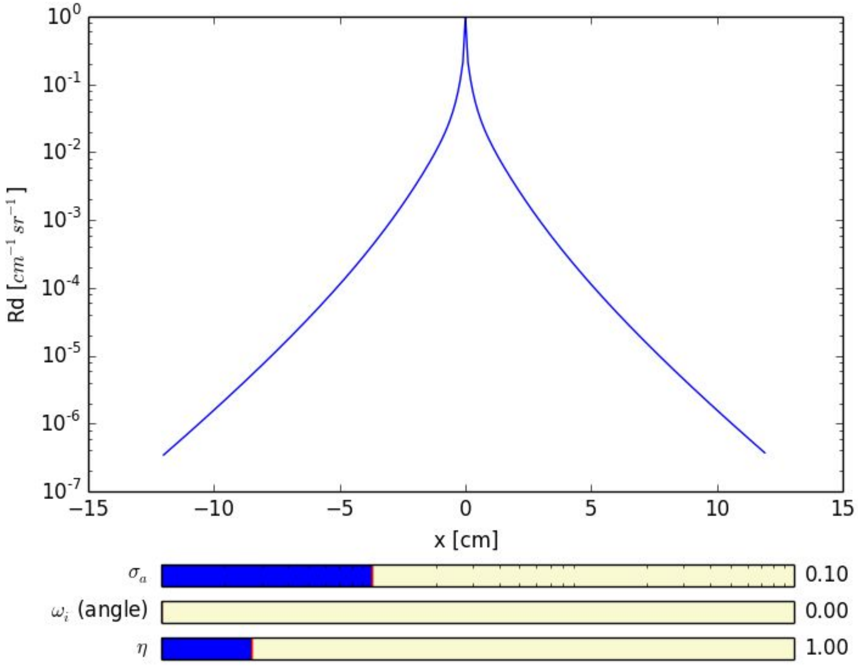


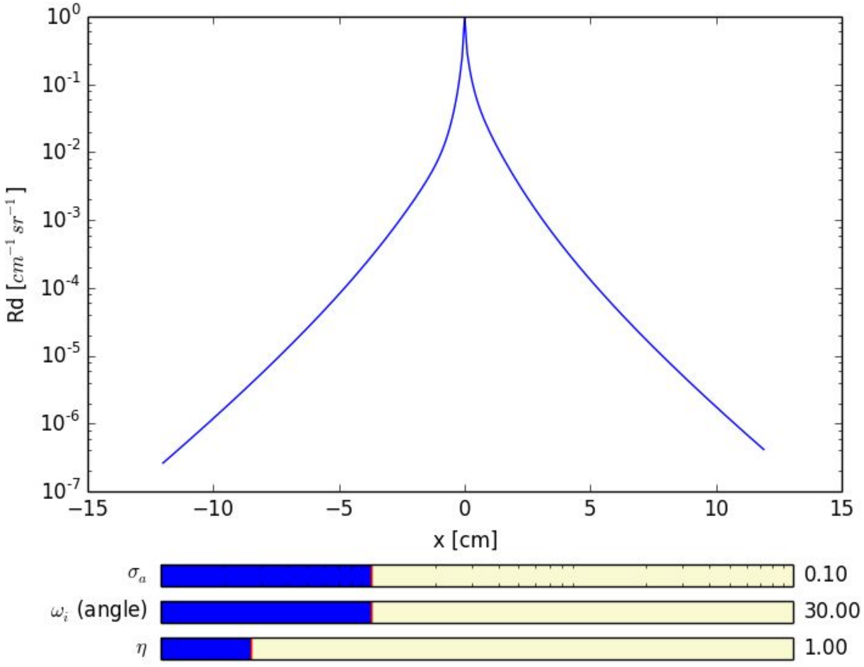
BSSRDF vs Directional Methods



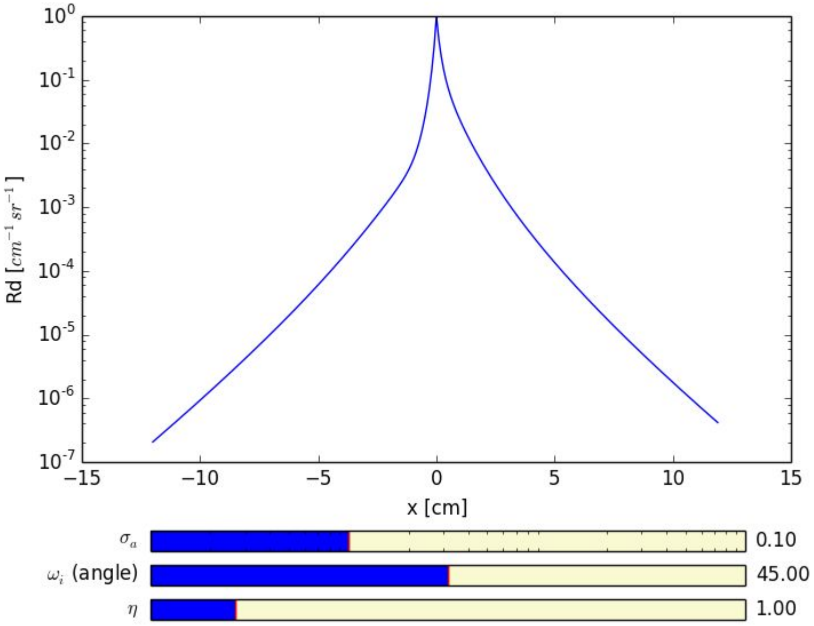


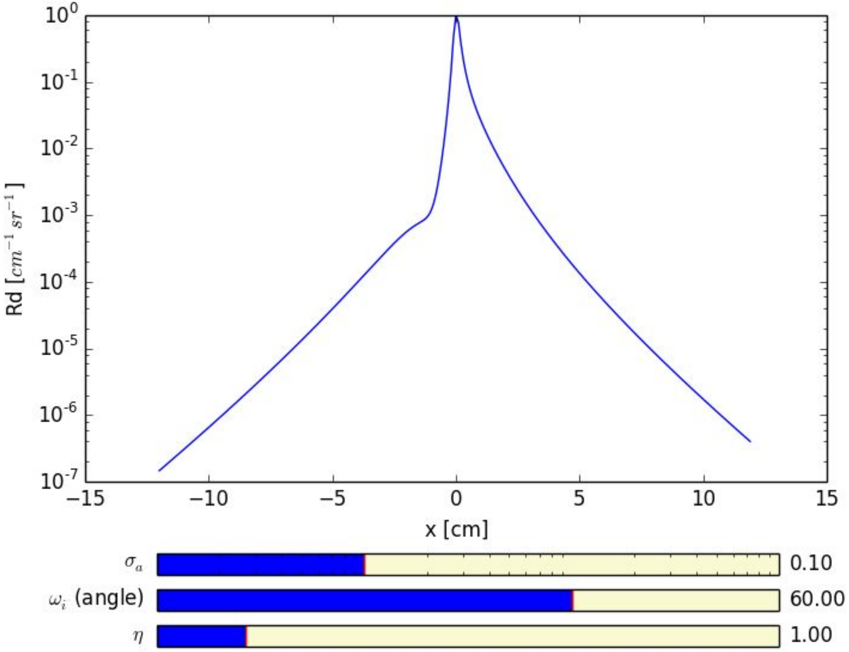
Directional Methods

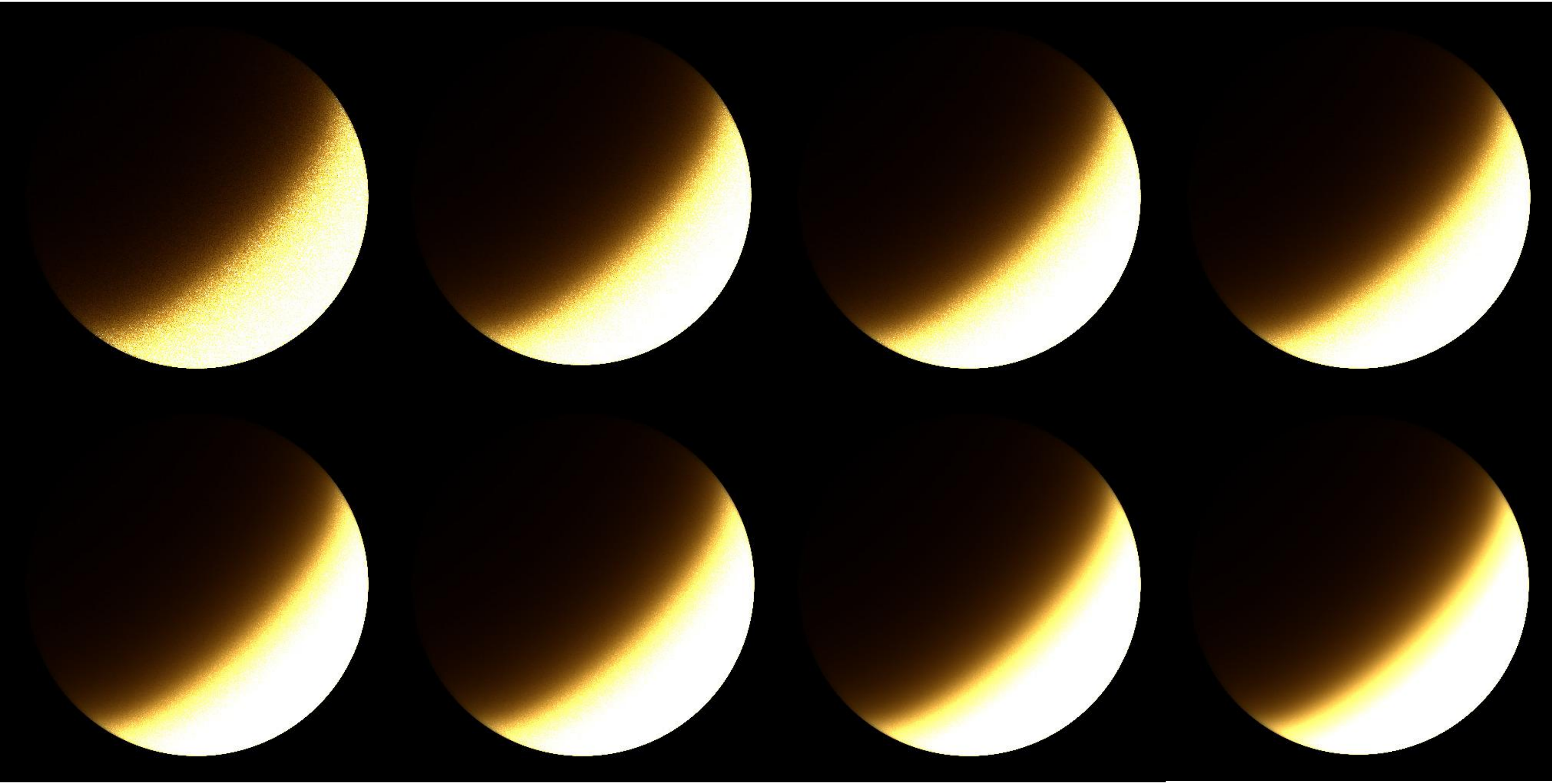




Directional Methods

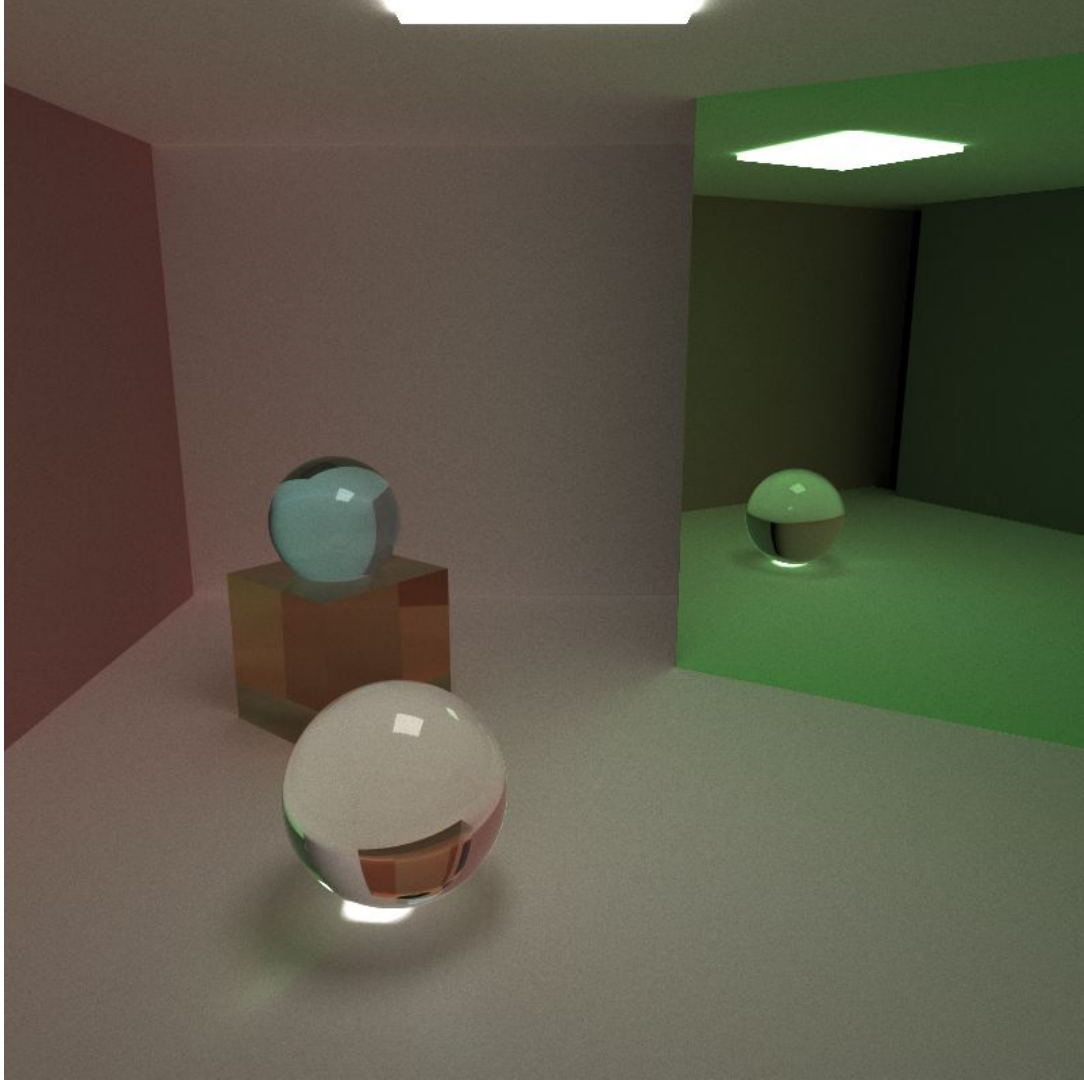






Basic Raytracer

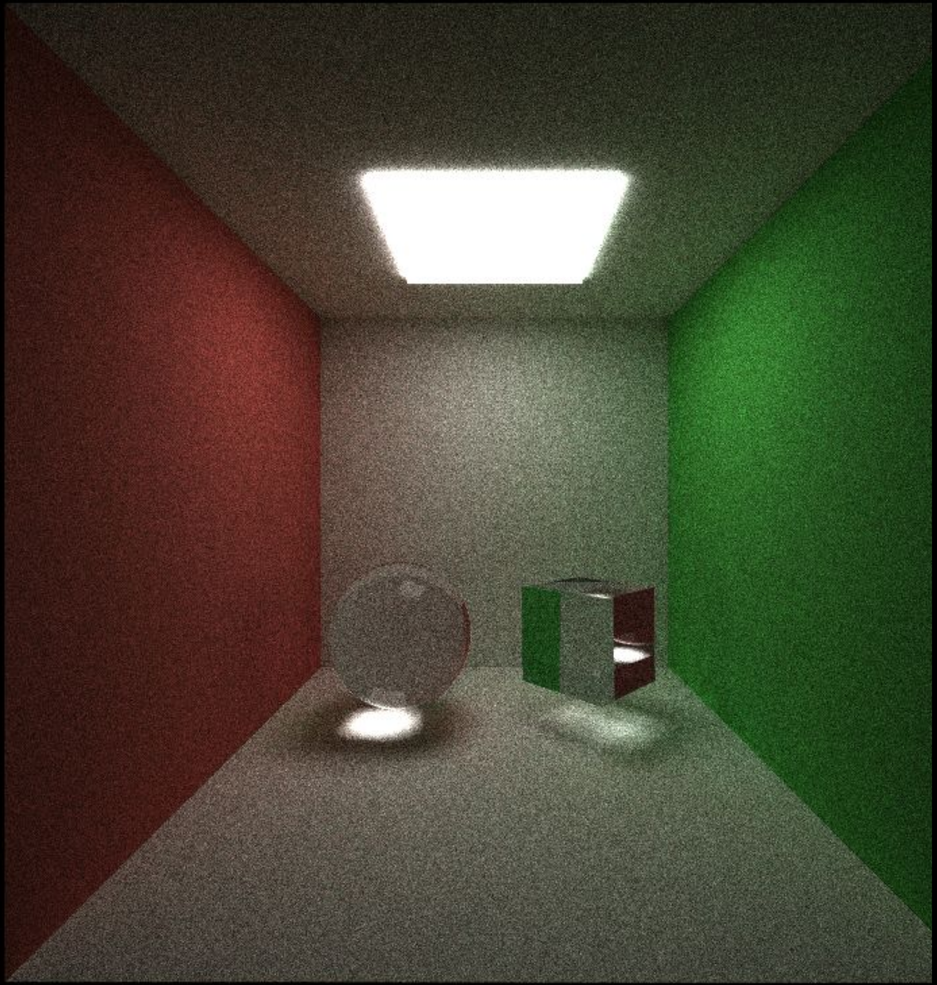
- Diffuse
- Specular
  - Perfect
  - Non-Perfect
- Transparent
- Subsurface Scattering
- Directional Dipole
- Additional:
  - DoF

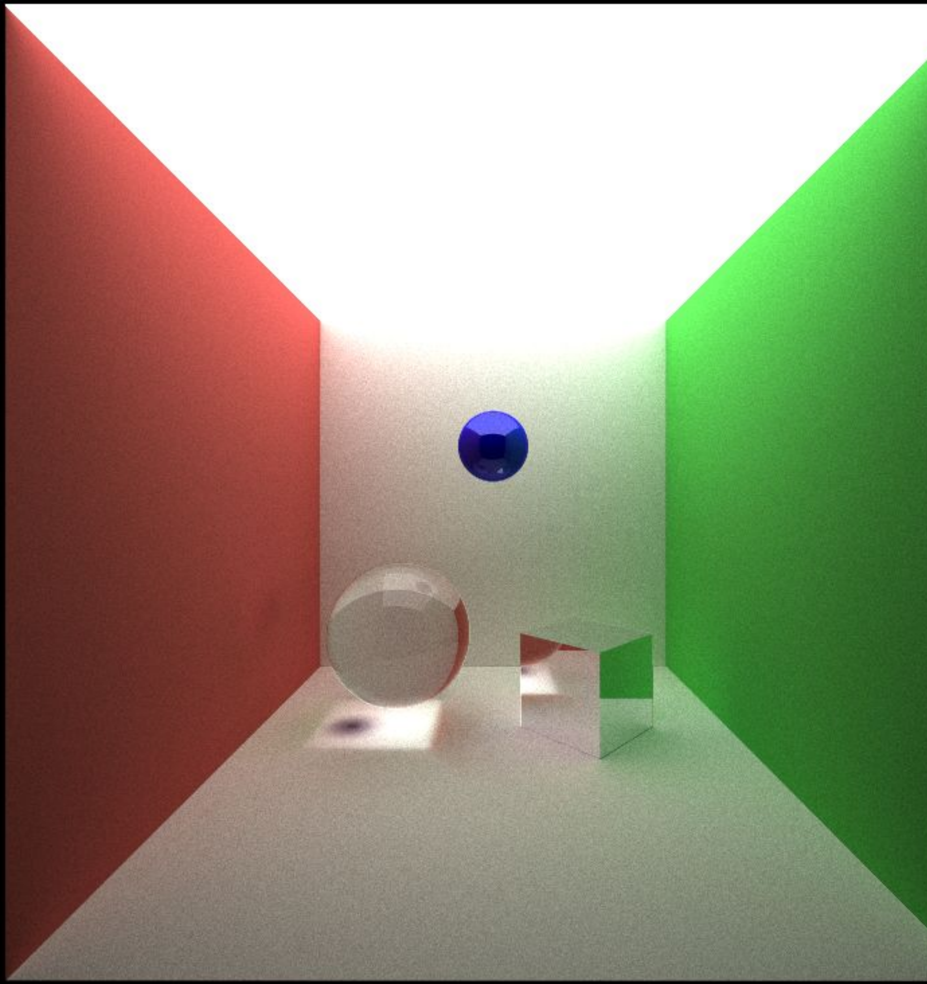


Platform

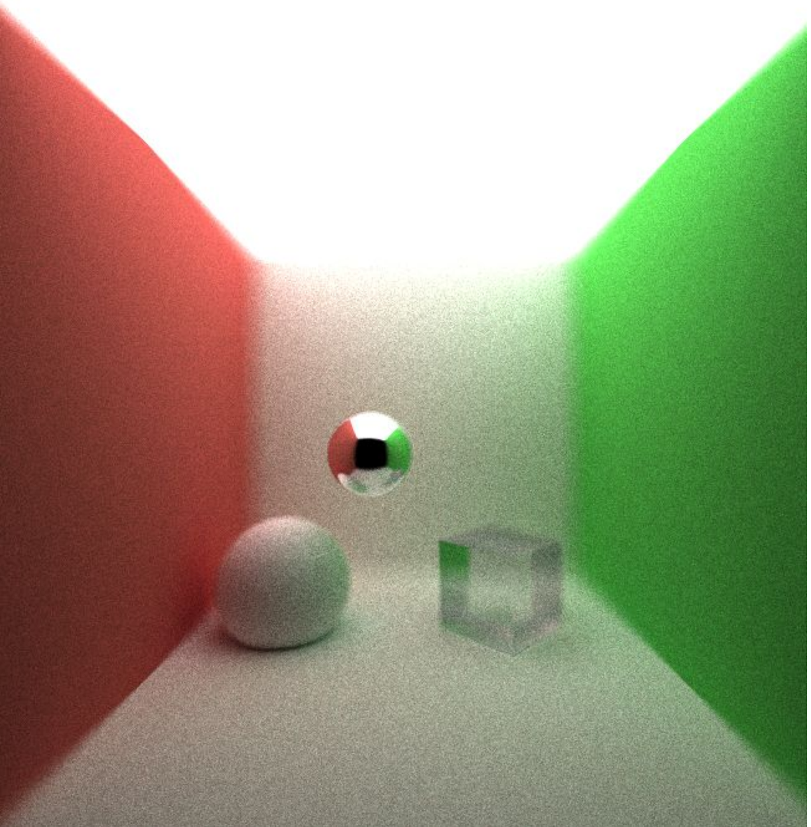
- i7 - 4700MQ
- NVIDIA GeForce GTX 780m
  - DRAM: 3GB
  - Calc Power: 3.0
- RAM 16GB
- Windows 7

- CIS 565 Path Tracer
- C++, Python
- A little lisp but later omitted

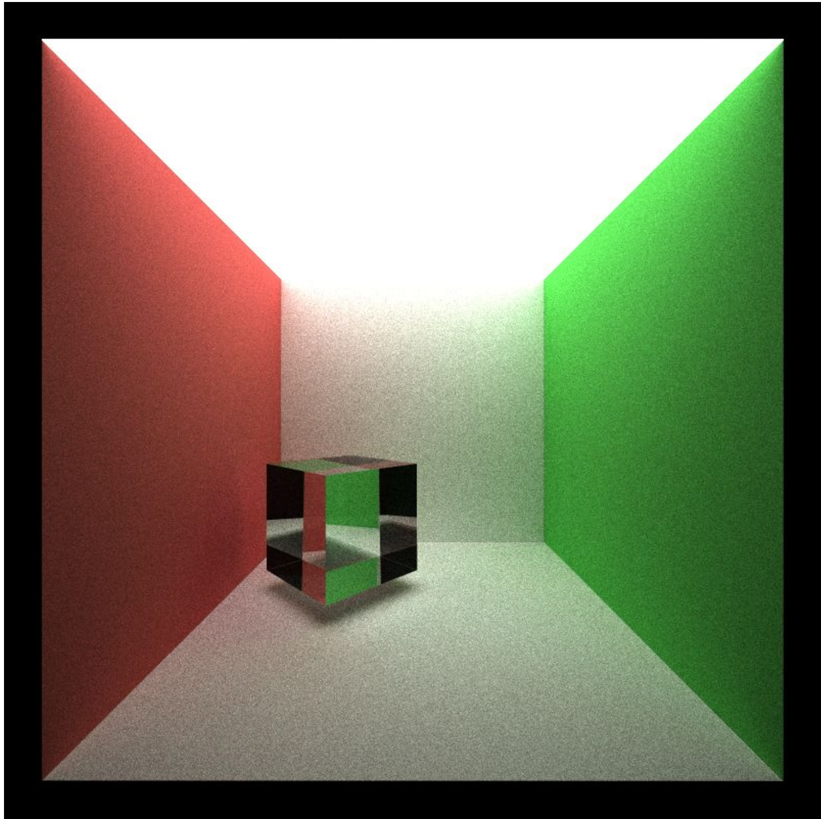




How Matt Damon Came back from Marz



To



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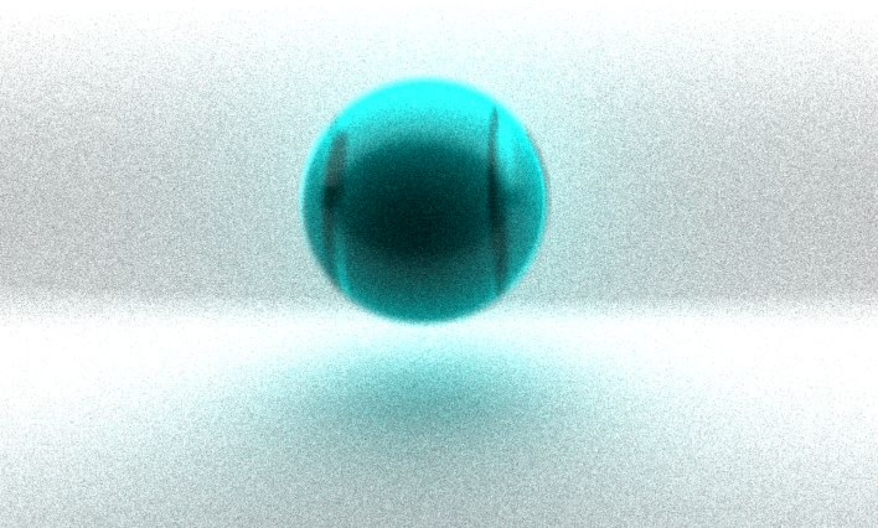

To

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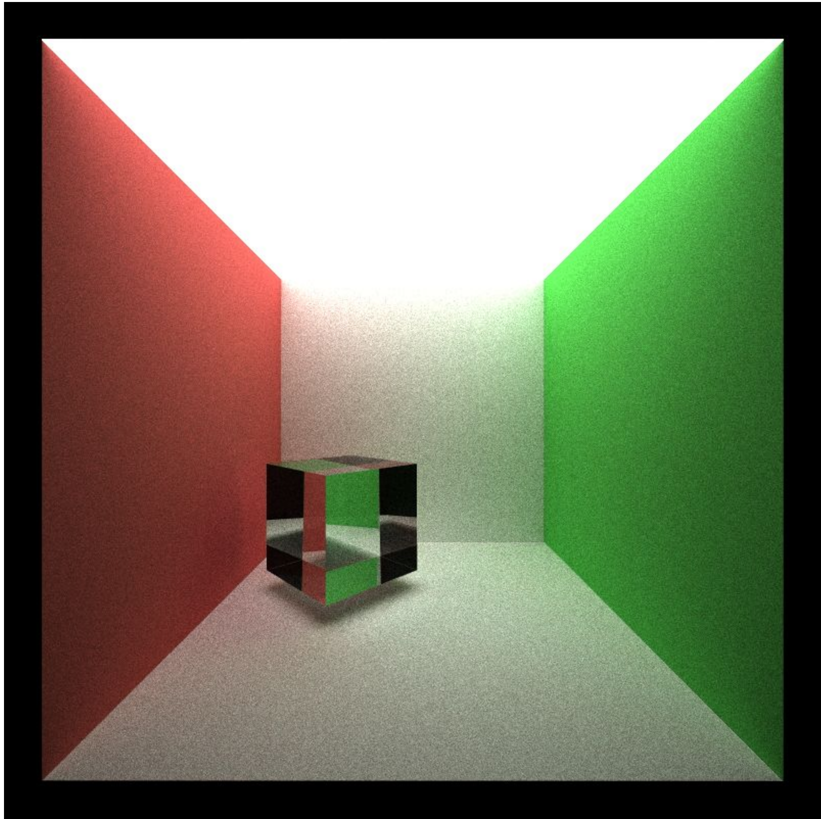

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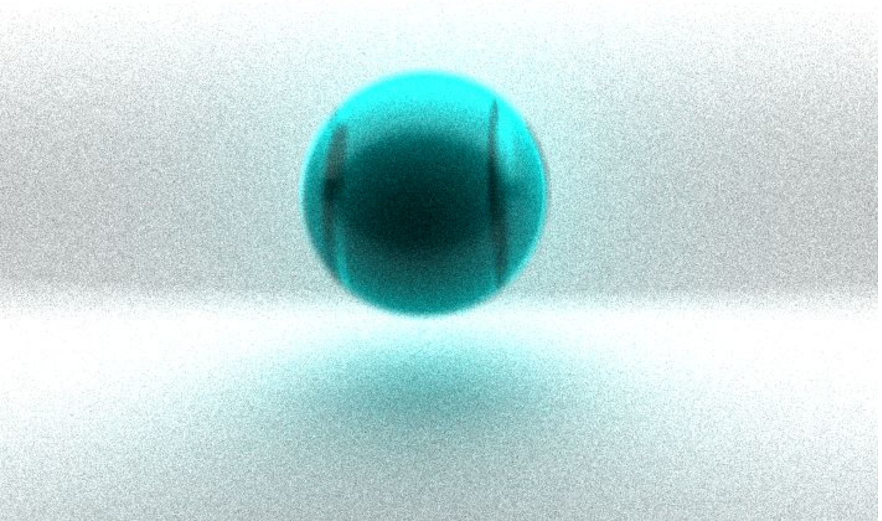

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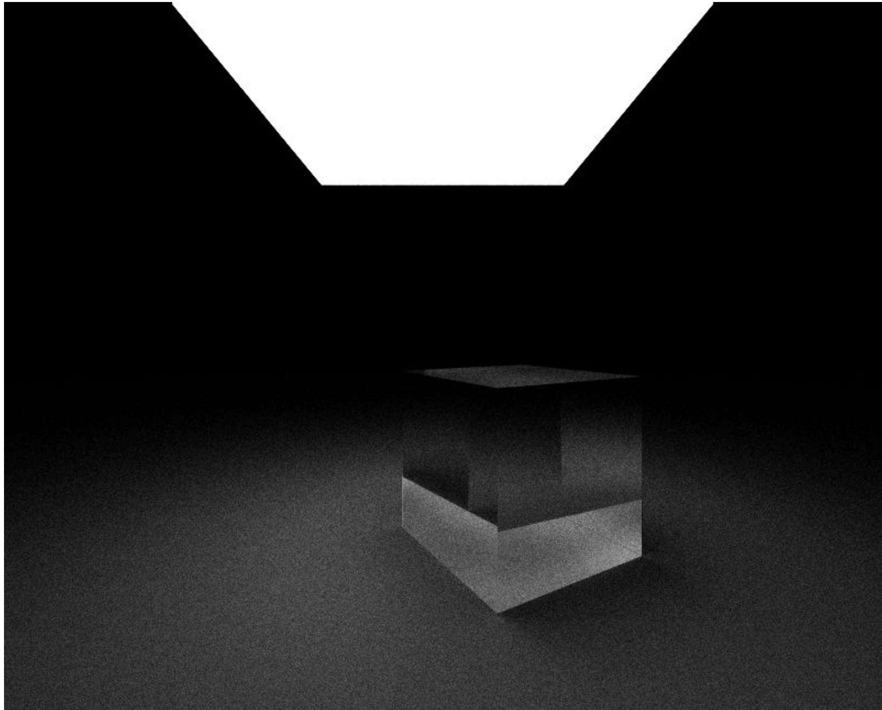

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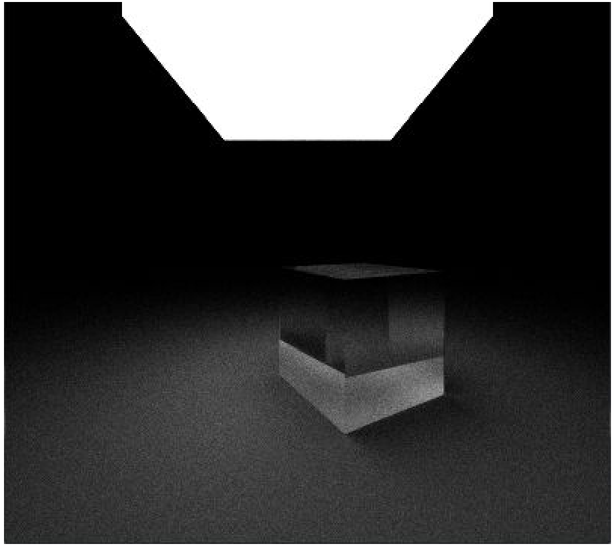

400 X 400

To

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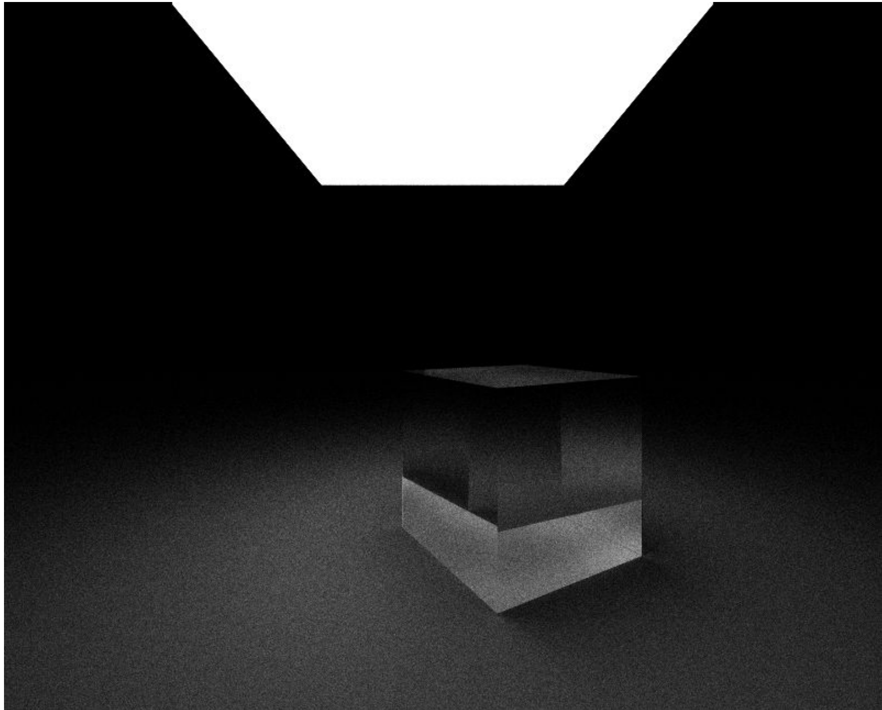

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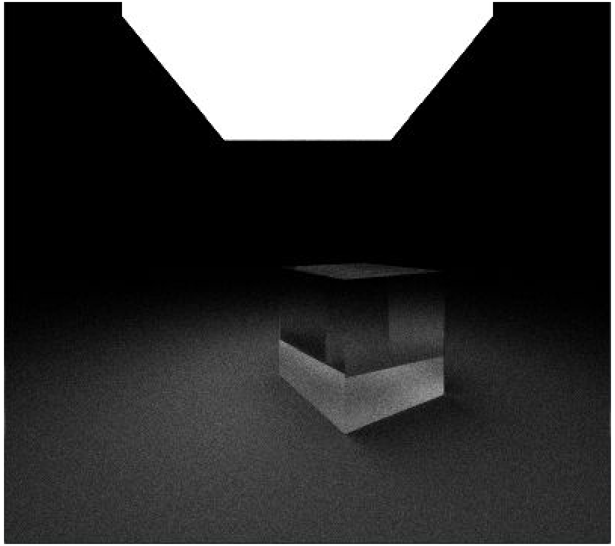
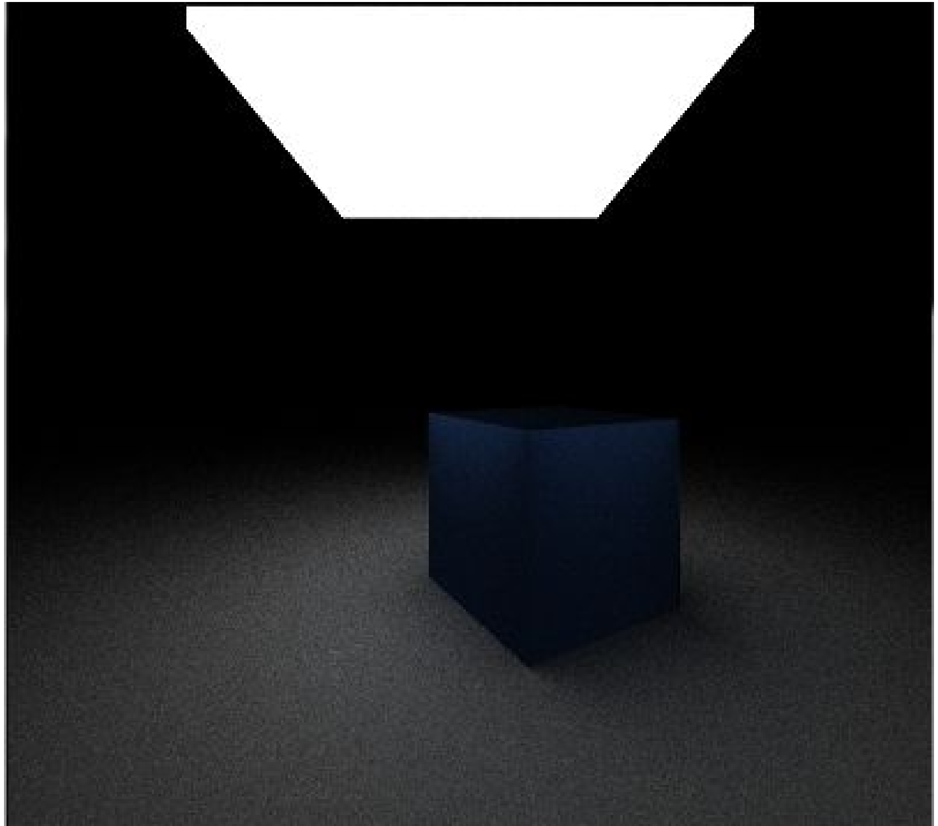


400 X 400

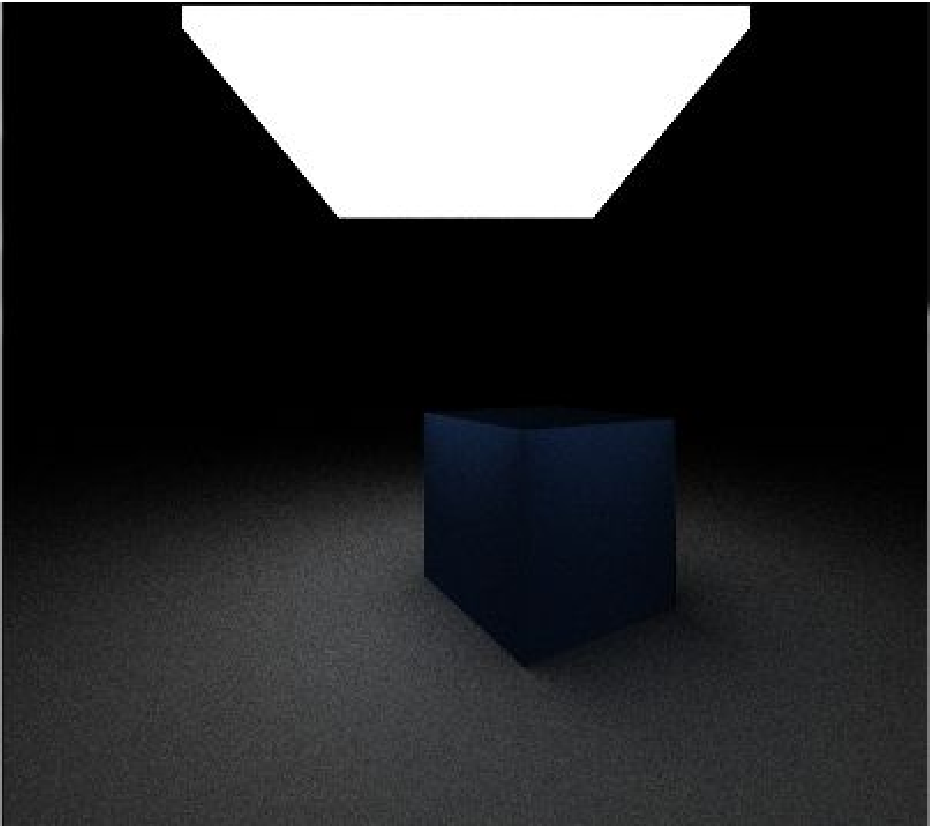
2.63 Iterations Per Second

:(

Basic BSSRDF

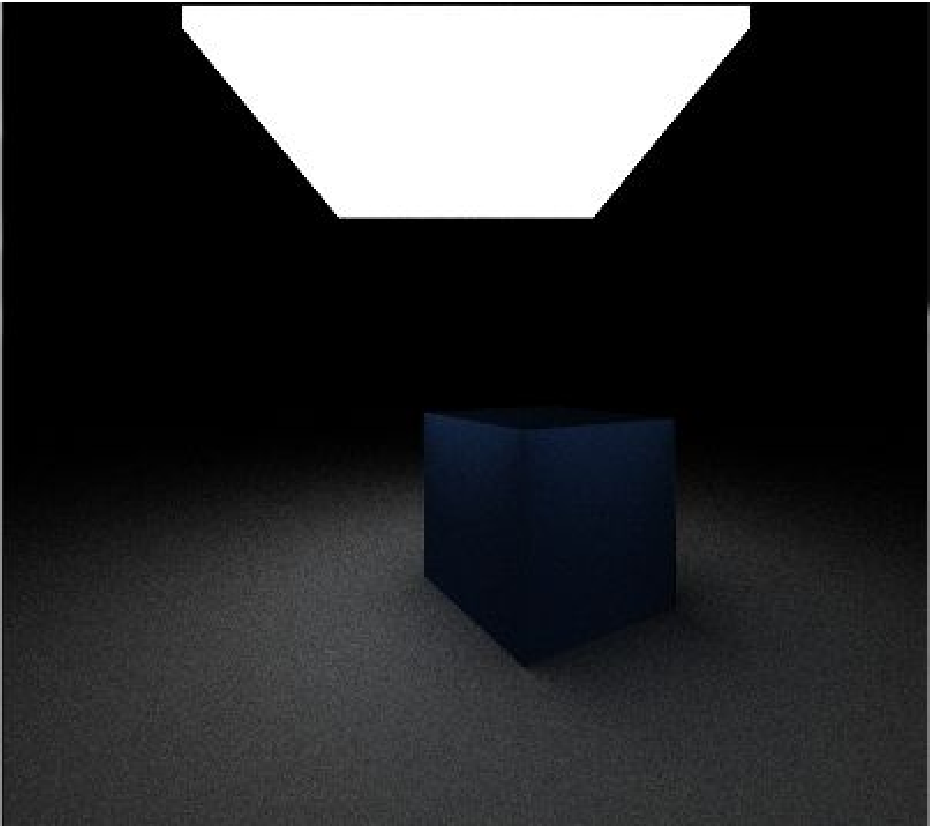


Basic BSSRDF



- Simple Logarithmic Sampling :

Basic BSSRDF



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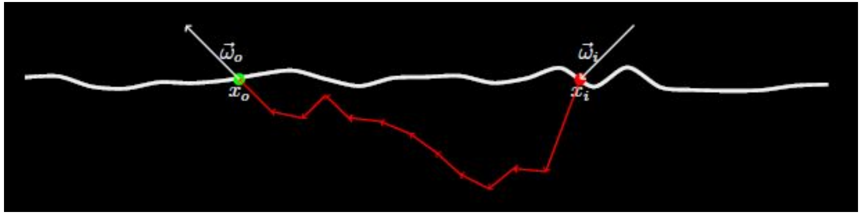
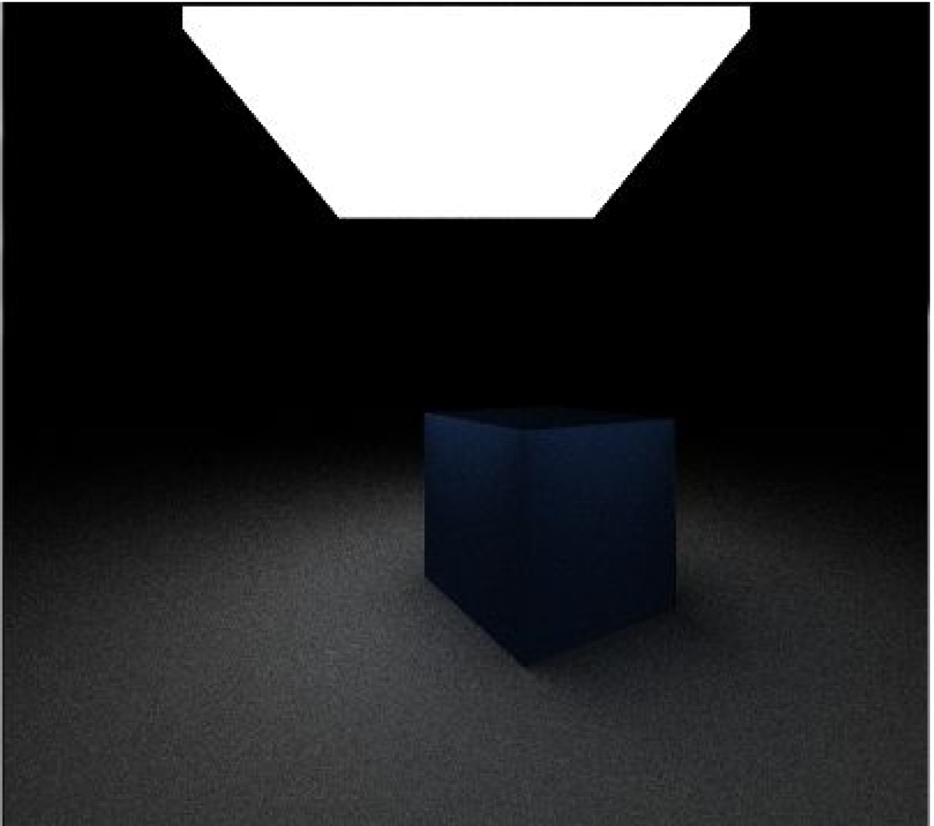


Basic BSSRDF



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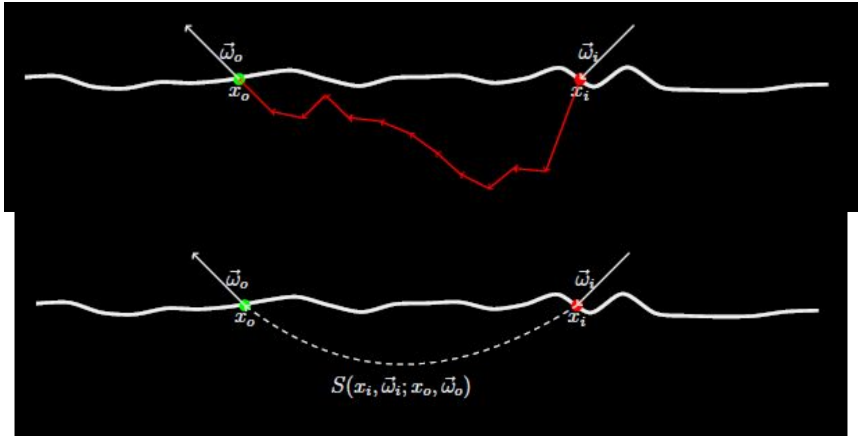

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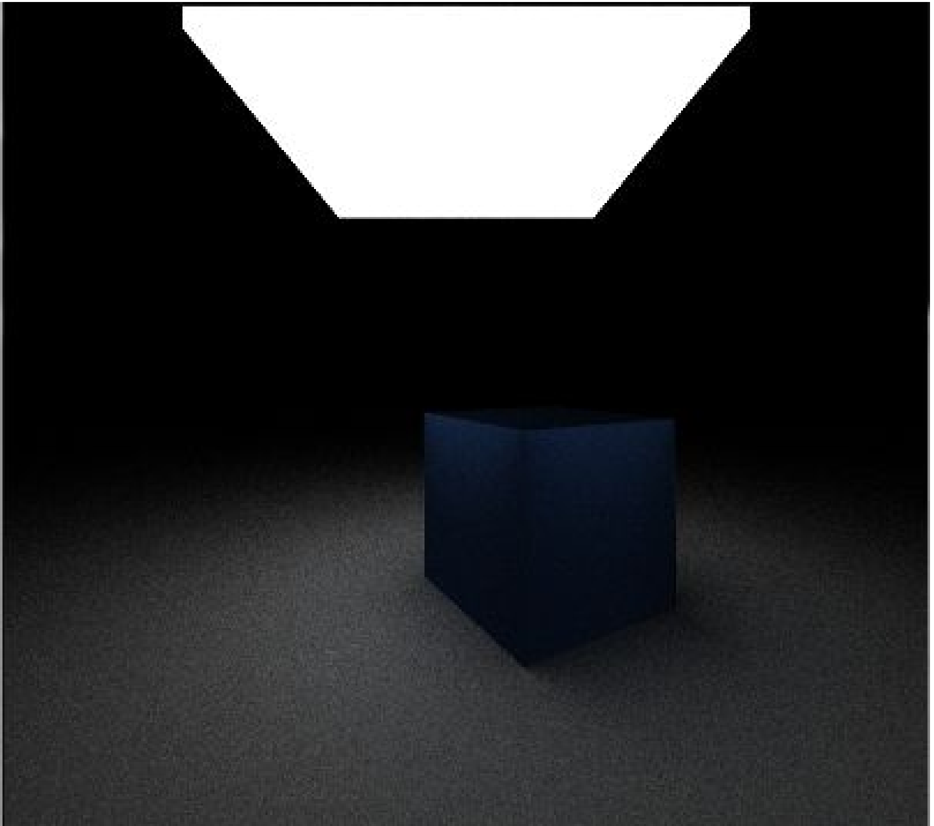

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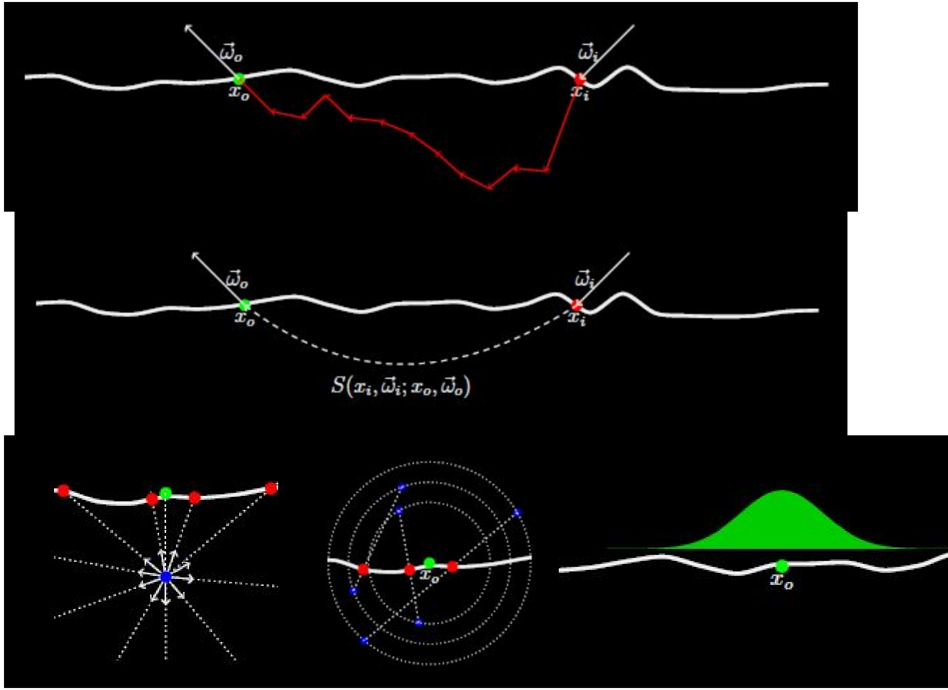
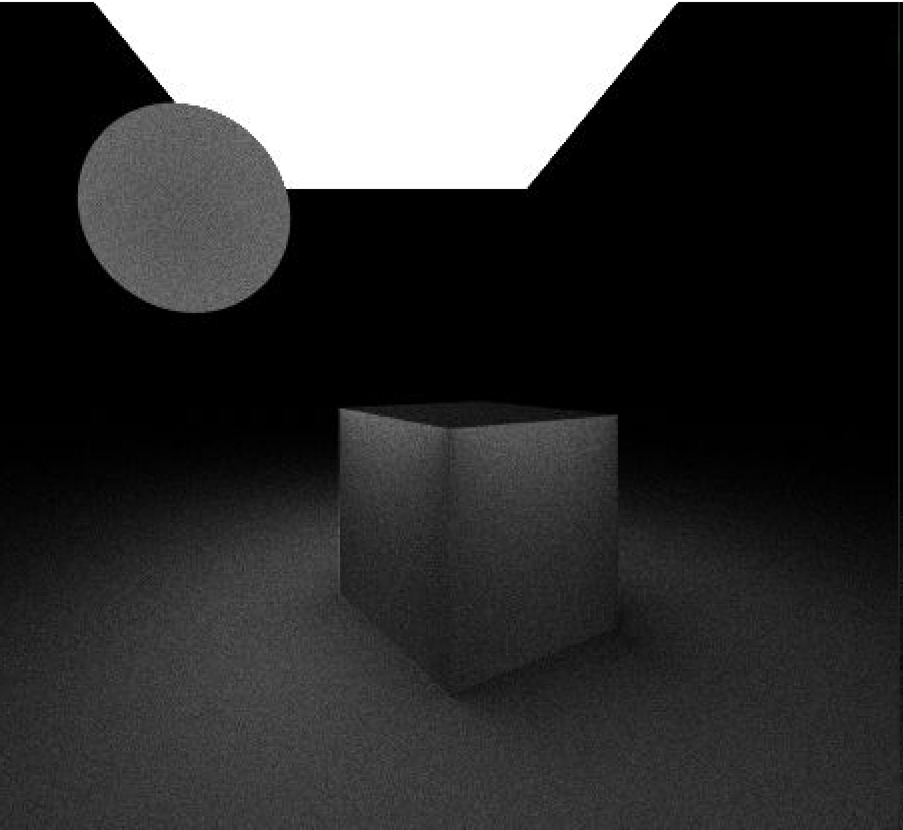
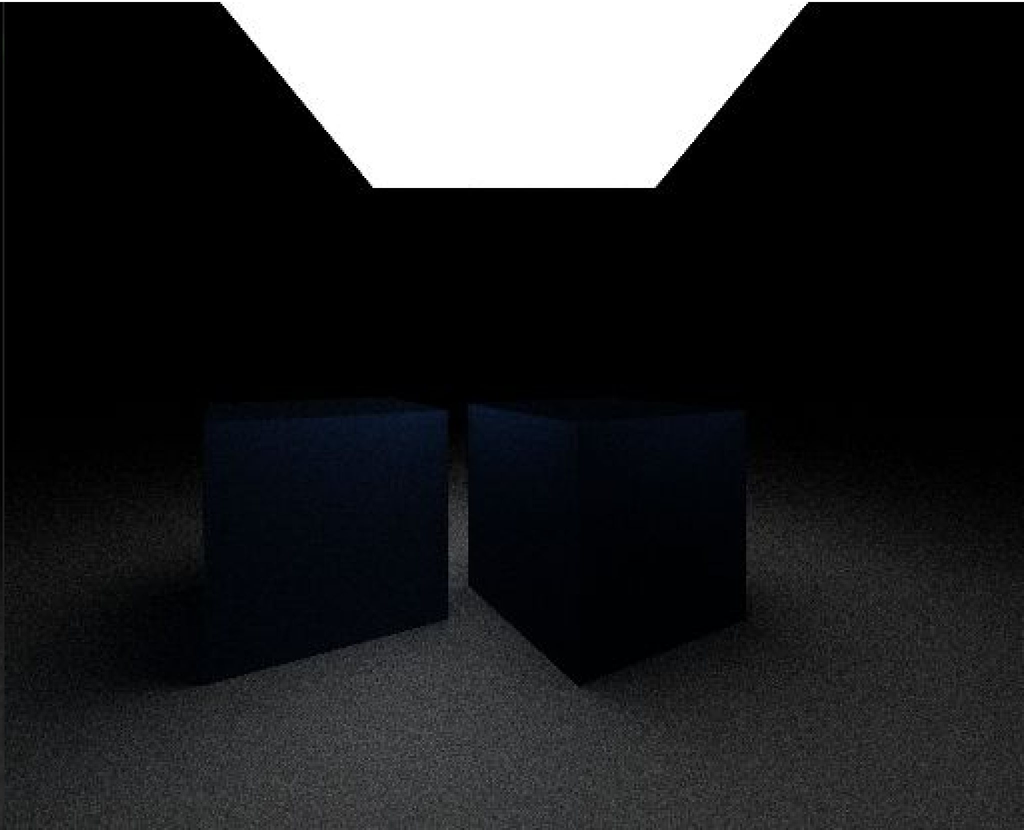


Directional Dipole





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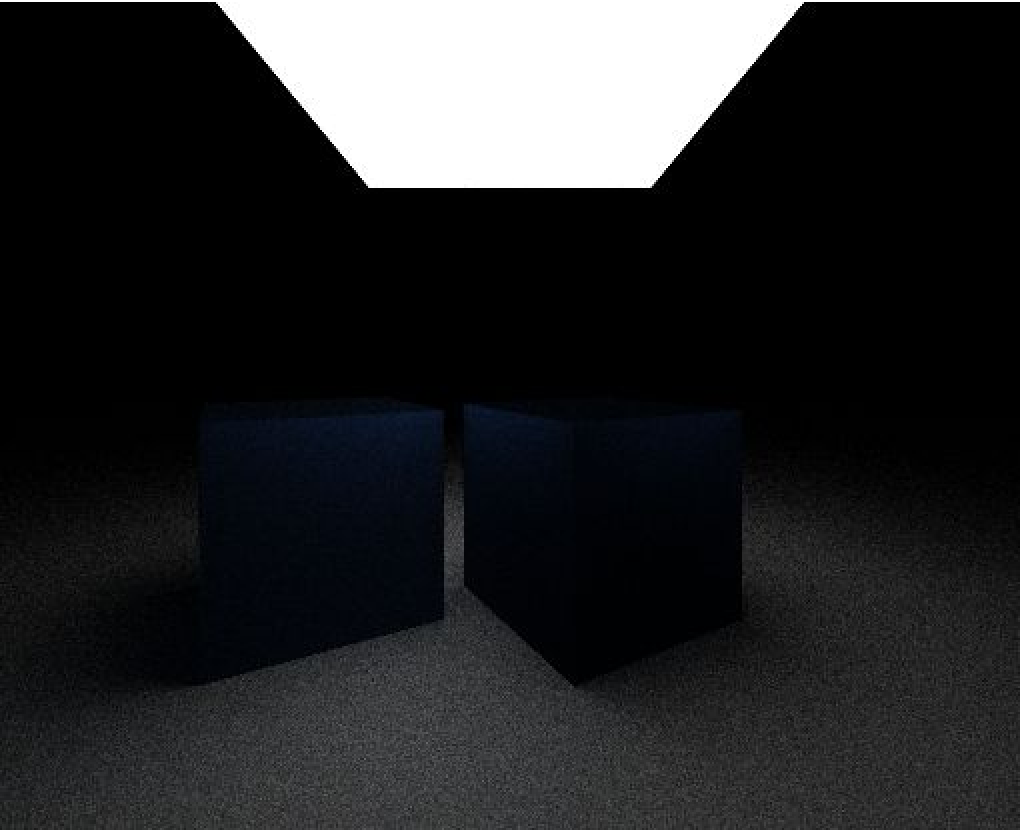

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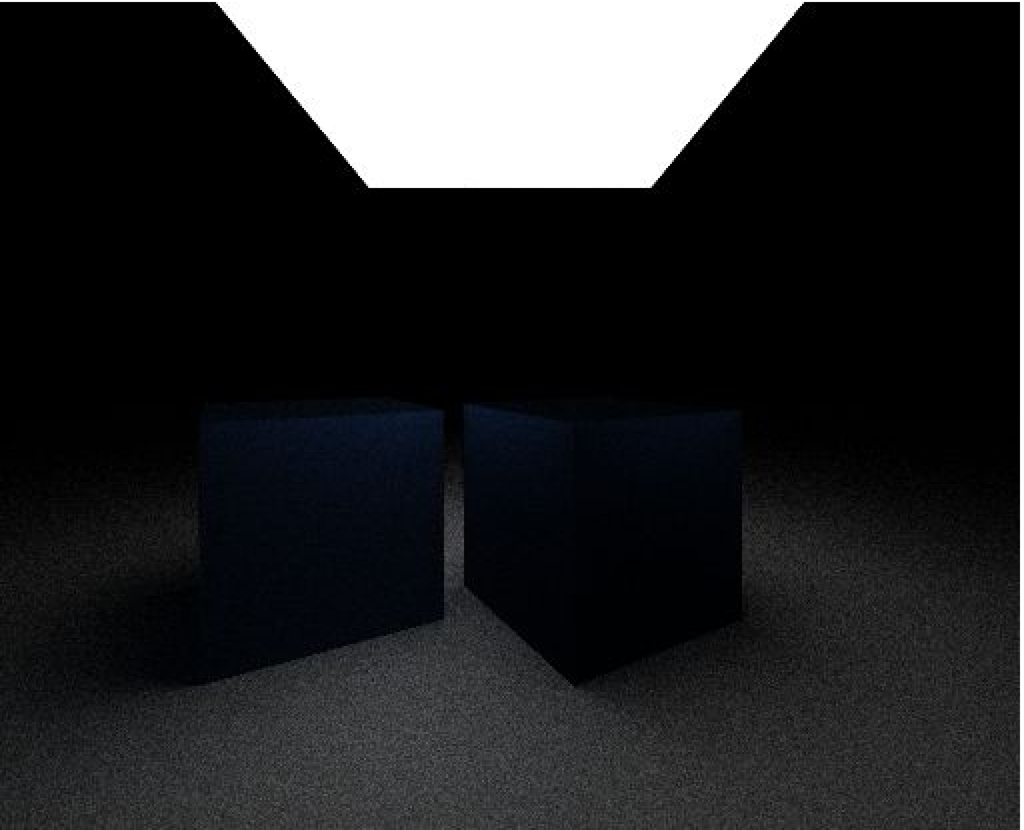
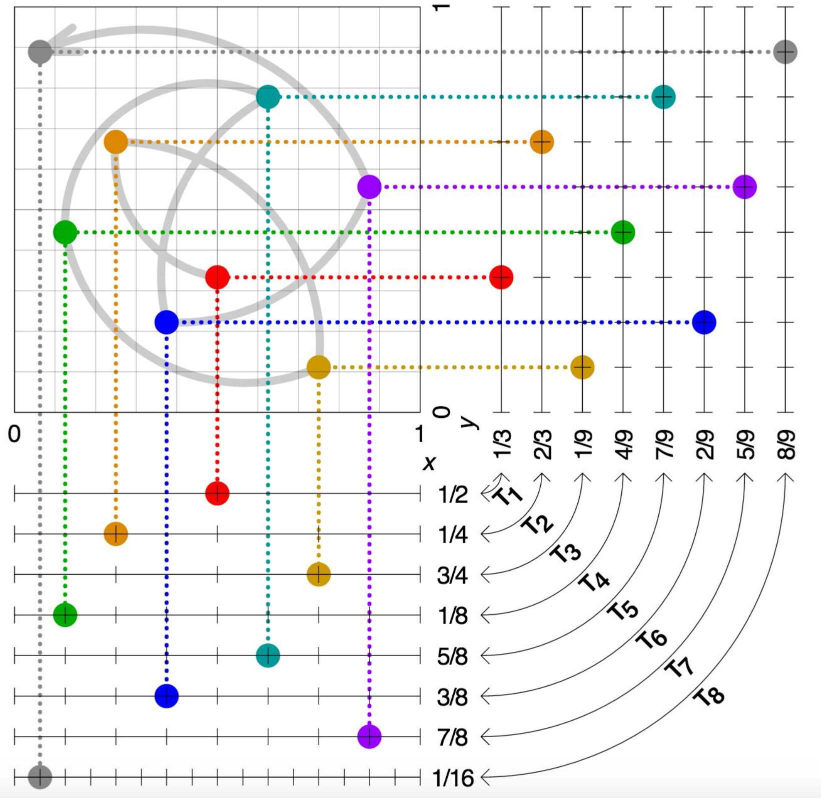
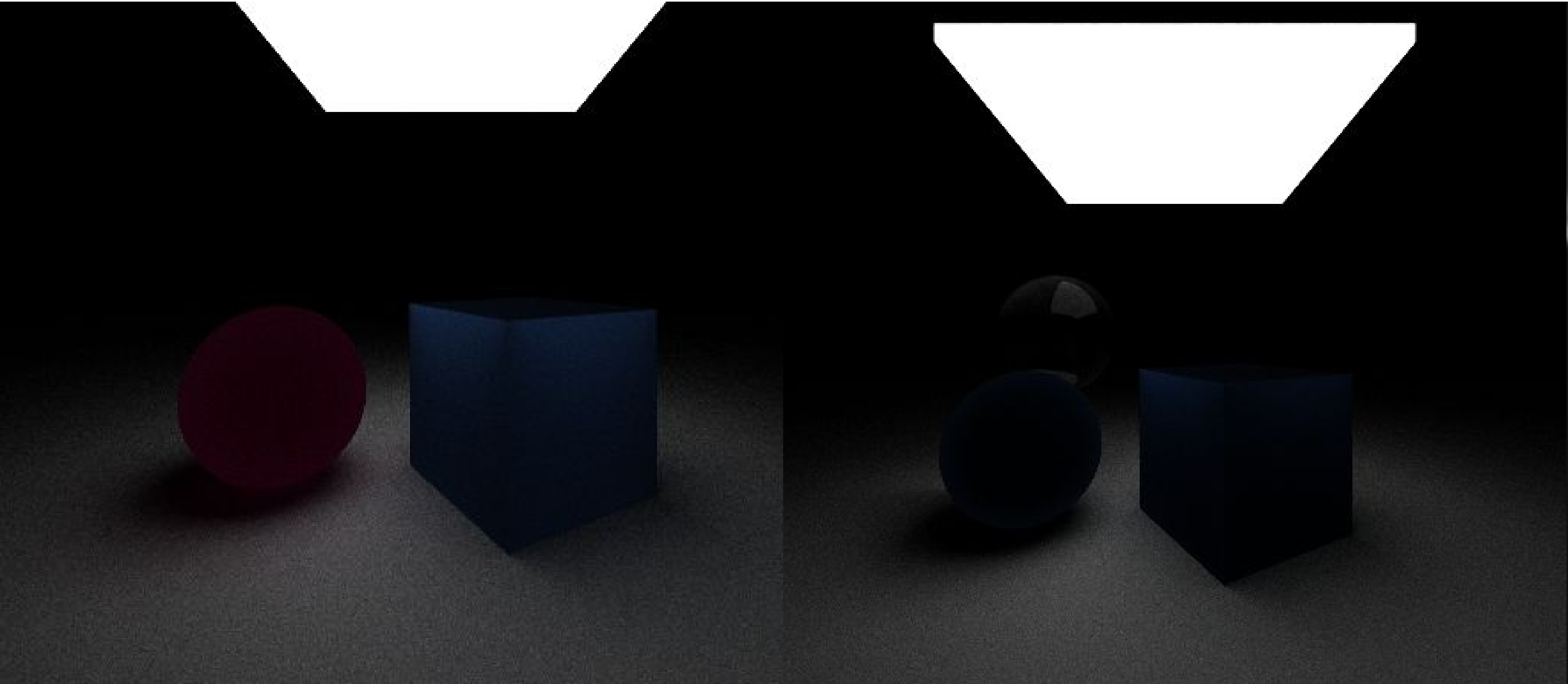
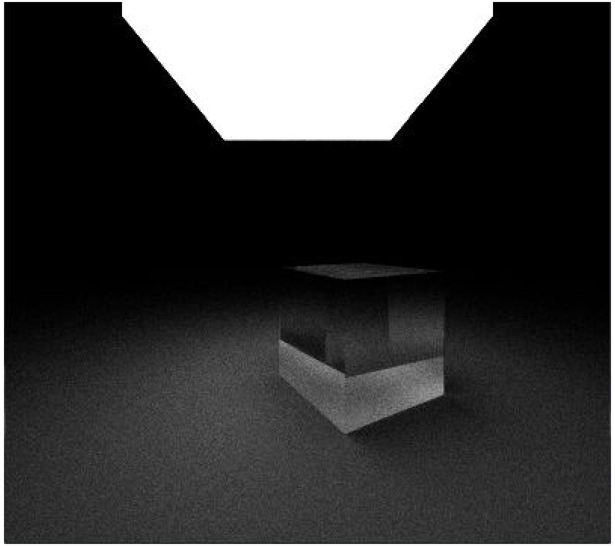




BSRDF vs Directional Dipole



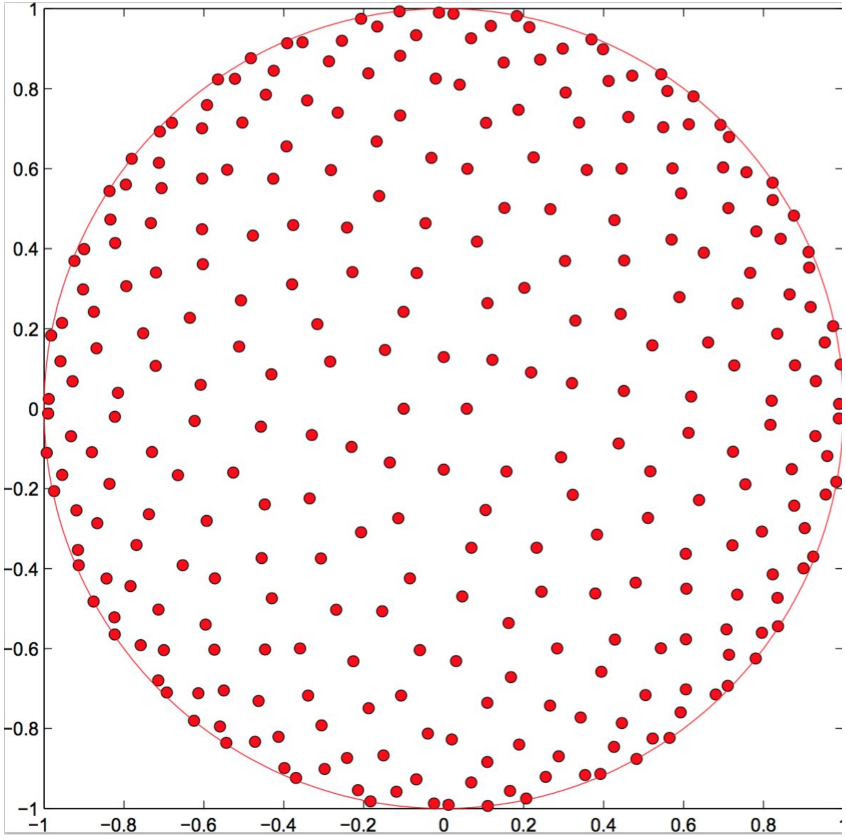
Now About the Time

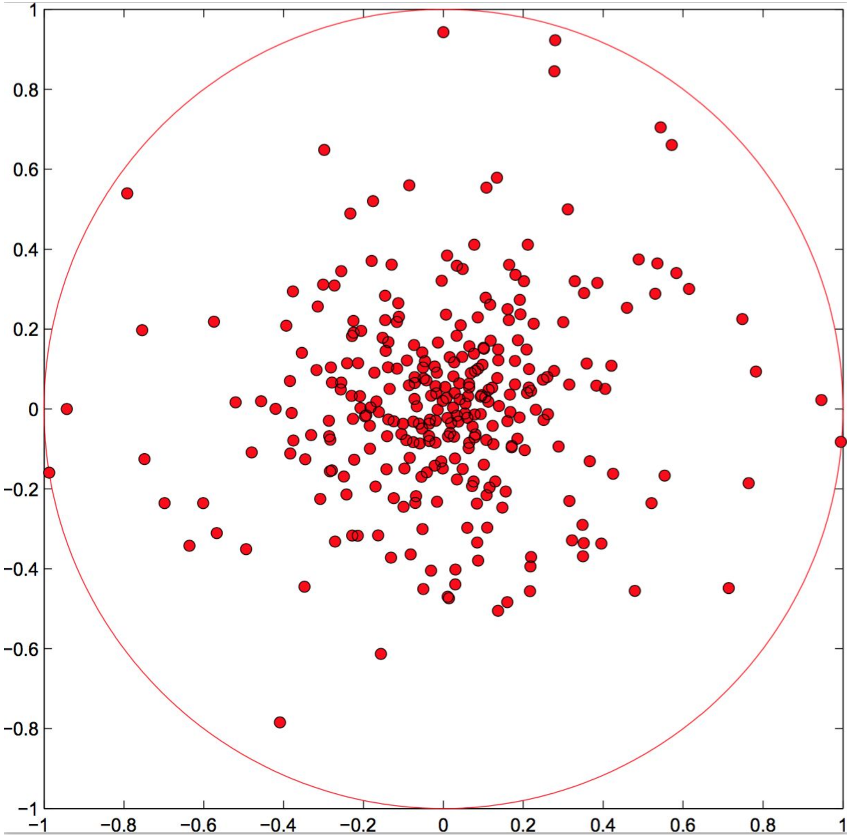


400 X 400

- BSSRDF : Monte Carlo
- Directional: Holson Sequence

Directional Dipole - Sampling





Directional Dipole - Sampling

- Holsen Sequence is not O(1)
- Better efficiency can be achieved by improving the sampling

Directional Dipole - Sampling

- Definitions:
  - U : random variable uniformly distributed on [0, 1];
  - U': approximated variable of U;
  - $R^{O(1)}$: random number generated with constant time(and bits);

Directional Dipole - Sampling

Method – Exponentially Distributed Random Variable:

$R^{O(1)}$: random number generated with constant time (and bits)

A1. Choose an integer $M = R^{O(1)}$

A2. Select an integer N from [1, M] using $O(\log R)$ random bits

A3. $U' = \frac{N}{M'}$, ; U' is then the approximation of U

A4. Compute $\mathrm{X} = -\frac{\ln \mathrm{U}'}{\mathrm{w}}$ where we use the first $O(\log R)$ terms of the Taylor expansion of $\ln \mathrm{U}'$;

Thanks

Andy Pan