Scattering

# The Radiative Transfer Equation:

The RTE is an equation that describes the propagation and scattering of light in space; it’s a generalization of the rendering equation by accounting for all types of light interaction.

# The transmittance function:

It gives the fraction of light that starts from point x and reaches point y.

# Scattering events:

## Absorption:

Light gets attenuated by moving through a medium, it is due to the collision of photons with suspended particles, actually besides absorption, light gets out-scattered hence the extinction coefficient.

## In-Scattering:

This accounts for light that is added along the photons’ trajectory due to scattering from other particles.

## Emission:

Photons get emitted from particles and lighten the scene (e.g. flames).

# Putting it all together:

# Sampling the transmittance function:

## Normalizing the pdf:

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## Calculating the cumulative distribution function:

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# Scattering estimator:

# Emission Integrator:

# Single Scattering Integrator:

In single scattering, light gets scattered **at most once** before reaching the camera or any other surface.

By increasing the absorption coefficient, photons fade out quicker as they travel longer; increasing the scattering coefficient illuminates space and makes nearby objects appear more visible.

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# Multiple Scattering:

In relatively dense media like milk or clouds, light get scattered many times before exiting the medium, which lighten particles not directly visible to the light source, just like in a traditional global illumination system where dim regions are indirectly lit by light coming from nearby surfaces.

# Sampling the Schlick phase function:

The variable k controls the shape of the function. If k is strictly positive, we get forward scattering, if k is strictly negative, we obtain backward scattering. Else if k equals 0, the function will be completely isotropic .

Now, we proceed to calculating the cumulative distribution function for the above pdf:

Unfortunately wolfram alpha refuses to calculate this integral, and my math skills is quite rusty, so I’m going to switch to the Henyey-Greenstein function (I have a paper where the calculations are already done).