

Subsurface Scattering in Organic Media

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Problem Statement

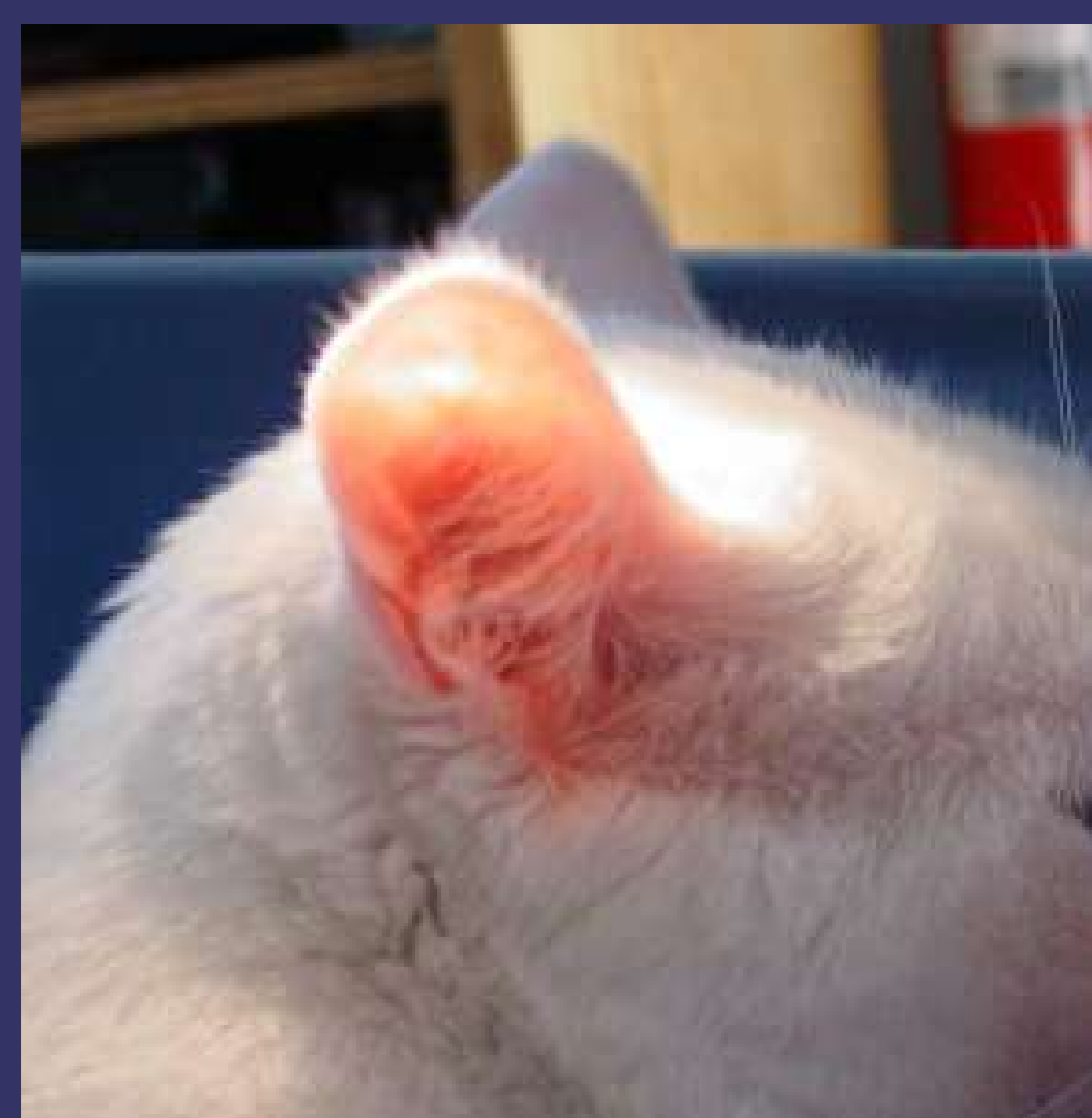
- Rendering of subsurface scattering effects is critical for photo realistic image synthesis
 - The "glow" associated with light shining through a marble statue, or the visual softness of skin
- The physics are understood, however direct numerical solutions are too complex to solve
- Thus, approximations are used
 - Local models
 - Diffusion Approximation
 - Forward Scattering Approximation

Current Work

- Finite Element Simulations using Diffusion Approximation
- Implicit Hardware Accelerated Subsurface Scattering Models
- Acquisition of scattering properties at visible-light wavelengths

Real-World Examples

- White light scattered red through cat ear
- Grapes "glow" due to light exiting in shadowed area



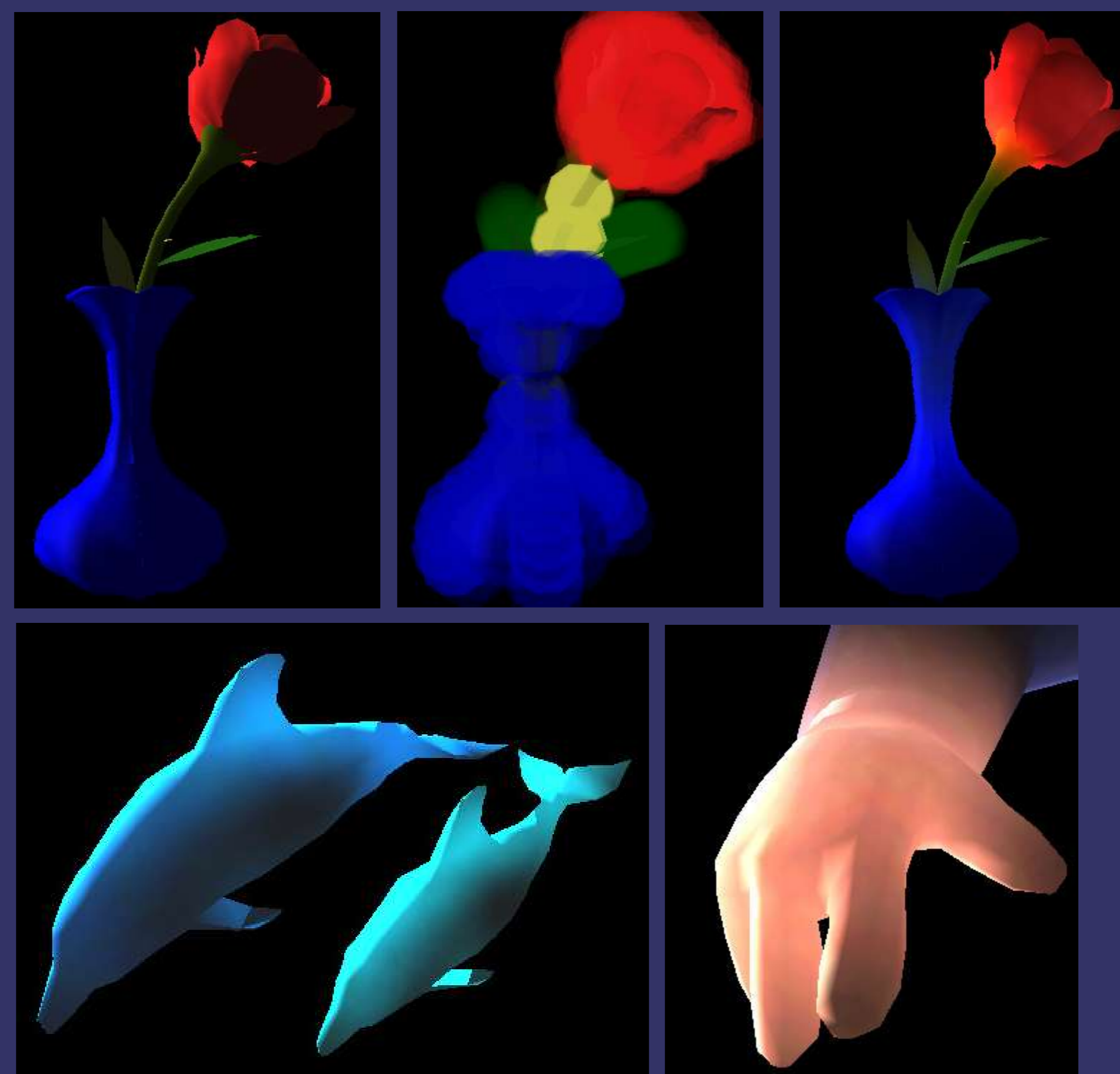
Impedance Network

- Assumes the scattering media is a resistive network
- Intensity is voltage
- Scattering properties are impedances
- Absorption is "ground"
- An unconventional conceptual approach



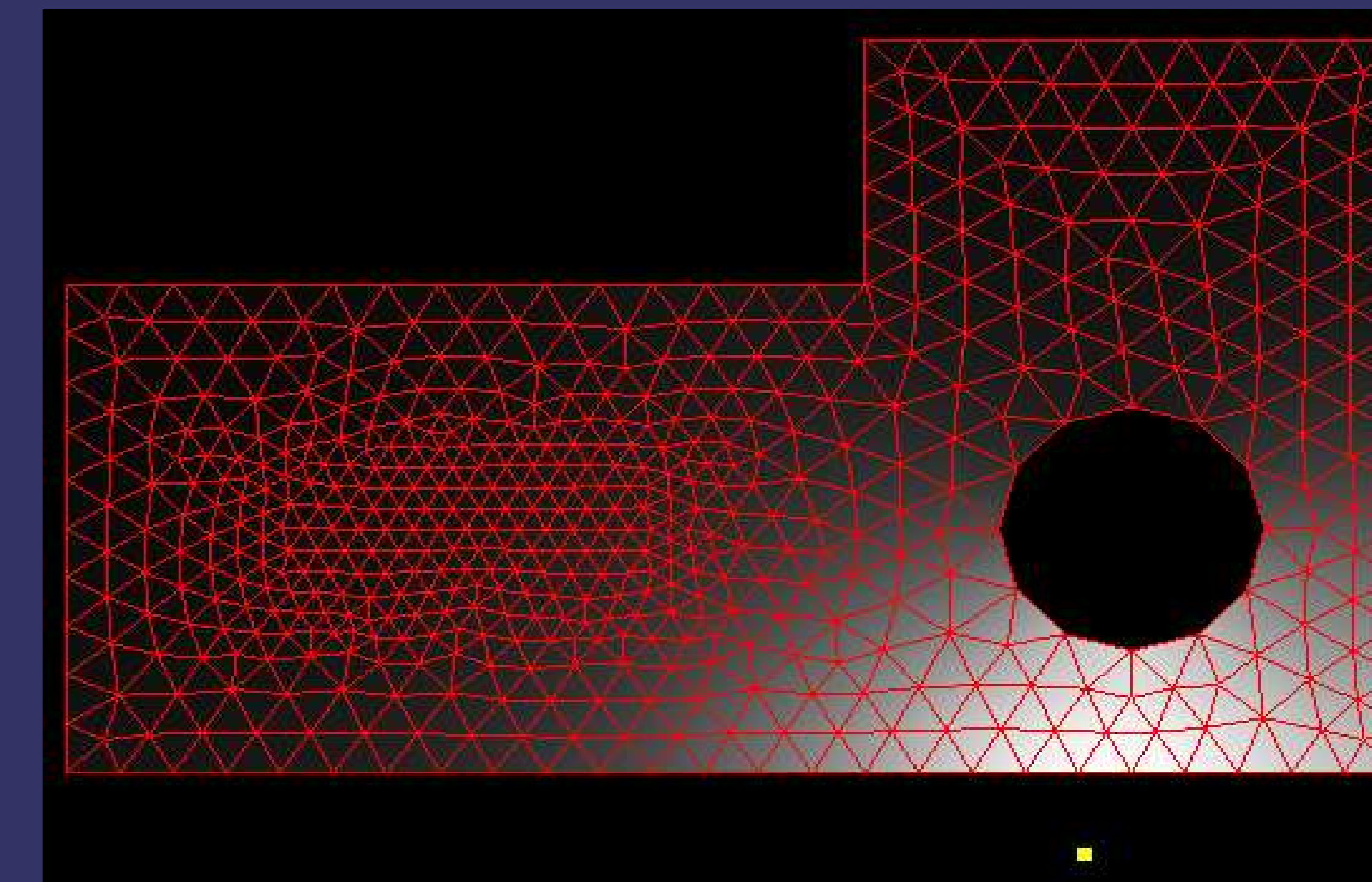
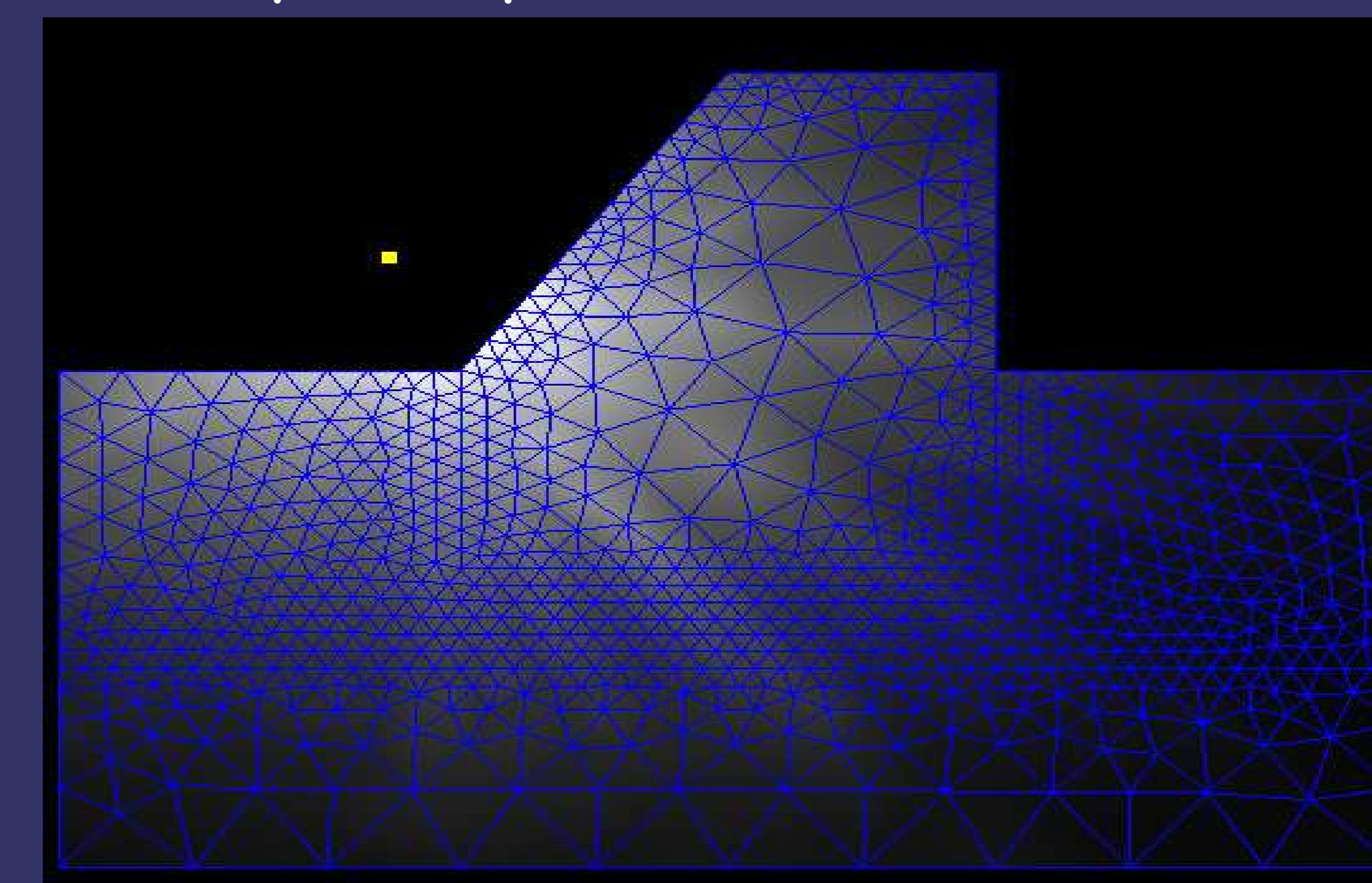
Results - Hardware Acceleration

- Uses fragment shaders to add subsurface effect from vertices
- Shaders triggered by "scatterlobes" to simulate maximum scattering contribution



Finite Element Approach

- Here we solve the diffusion equation via a FE formulation.
- Initial 2D results look promising in terms of accuracy and speed.



Summary

- Variety of approaches to subsurface scattering
 - Monte Carlo
 - Numerical
 - Hardware Accelerated
 - Others?
- Need accurate measurements of physical properties
- Besides image synthesis, looking for applications to real world problems