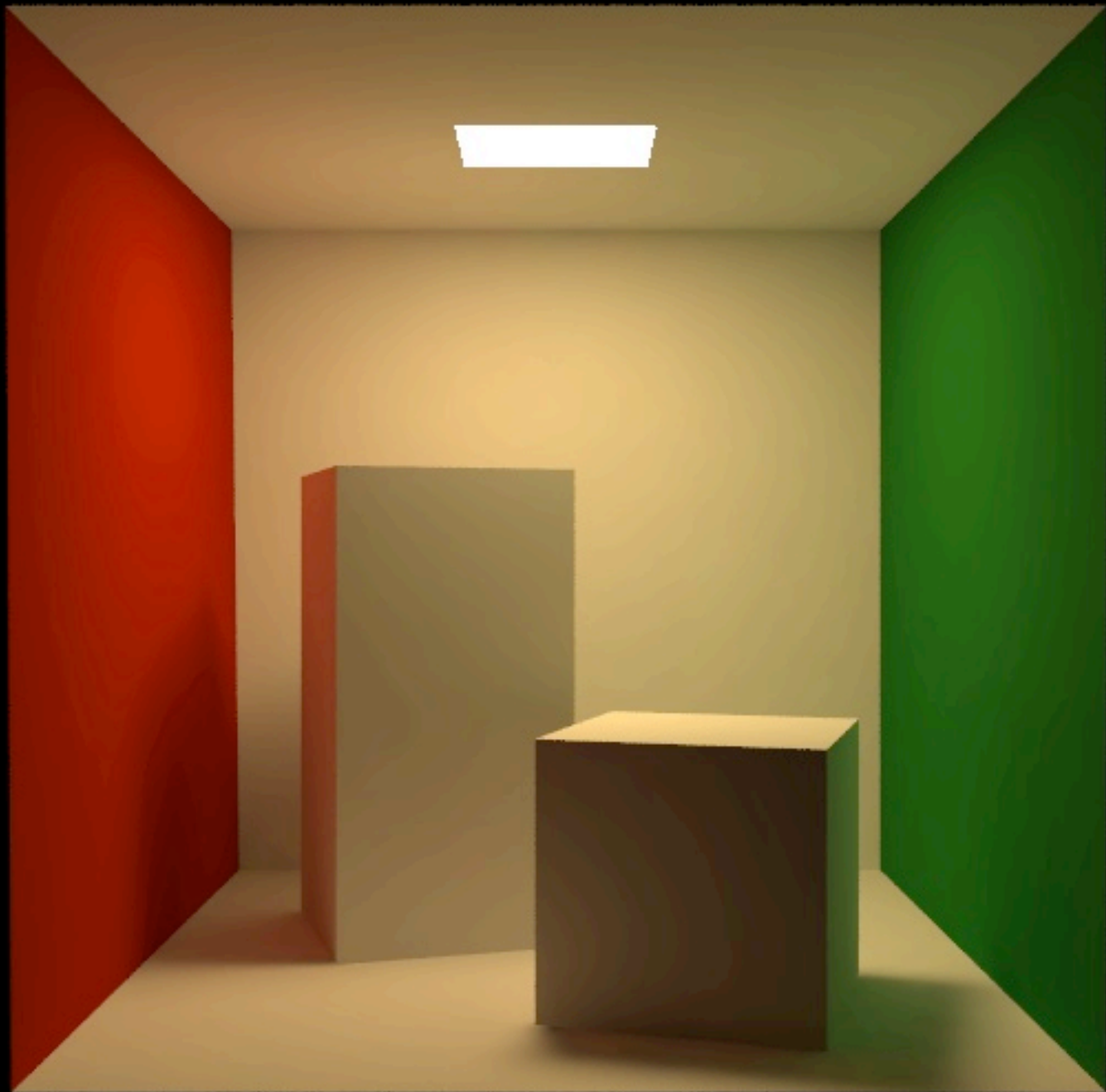
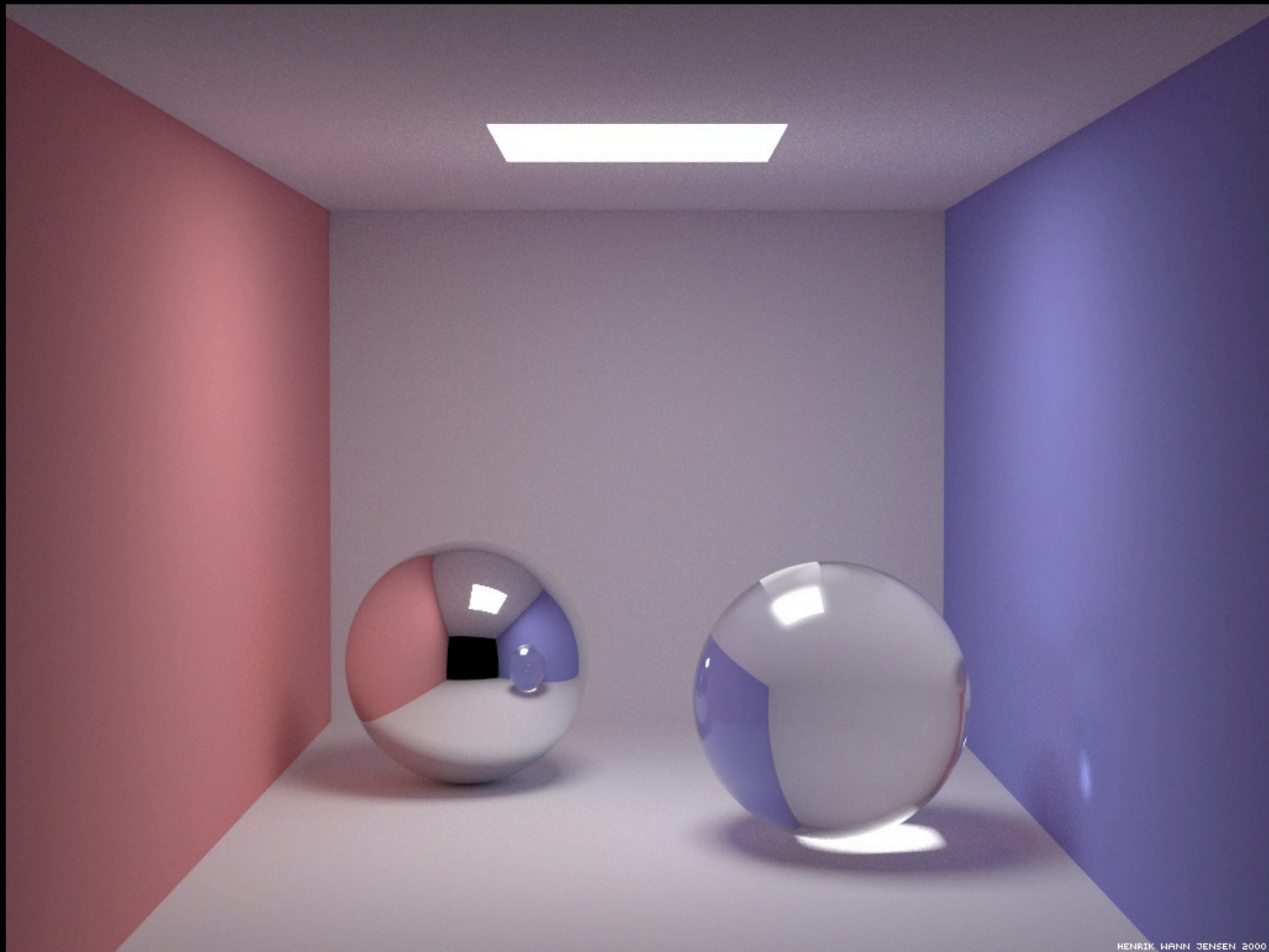


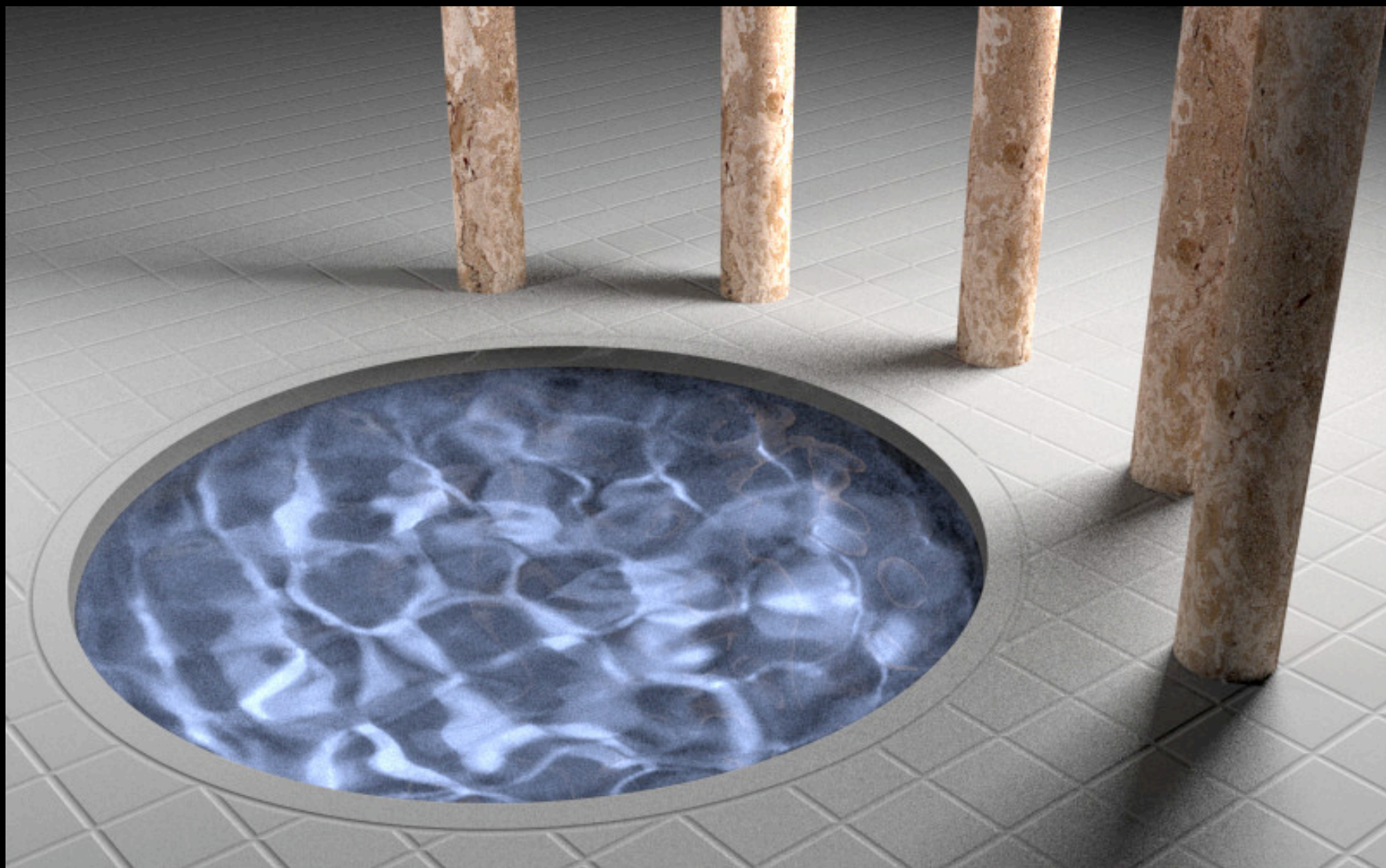
# Path Tracing

Images for CS667 lecture











Kajiya-style path tracing, version 0:

**rayRadianceEst**( $x, \omega$ ):

$y = \text{traceRay}(x, \omega)$

return  $\text{emittedRadiance}(y, -\omega) + \text{reflectedRadianceEst}(y, -\omega)$

**reflectedRadianceEst**( $x, \omega_r$ ):

$\omega_i = \text{uniformRandomPSA}(n(x))$

return  $\pi * \text{brdf}(x, \omega_i, \omega_r) * \text{rayRadianceEst}(x, \omega_i)$

Kajiya-style path tracing, version 0.5:

**rayRadianceEst**( $x, \omega$ ):

$y = \text{traceRay}(x, \omega)$

    return  $\text{emittedRadiance}(y, -\omega) + \text{reflectedRadianceEst}(y, -\omega)$

**reflectedRadianceEst**( $x, \omega_r$ ):

    if  $\text{random}() < \text{survivalProbability}$ :

$\omega_i = \text{uniformRandomPSA}(n(x))$

        return  $\pi * \text{brdf}(x, \omega_i, \omega_r) * \text{rayRadianceEst}(x, \omega_i) / \text{survivalProbability}$

    else

        return 0

Kajiya-style path tracing, version 0.75:

**rayRadianceEst**( $x$ ,  $\omega$ ):

$y = \text{traceRay}(x, \omega)$

return  $\text{emittedRadiance}(y, -\omega) + \text{reflectedRadianceEst}(y, -\omega)$

**reflectedRadianceEst**( $x$ ,  $\omega_r$ ):

if  $\text{random}() < \text{survivalProbability}$ :

$\omega_i, \text{pdf} = \text{brdfSample}(x, n(x))$

return  $\pi * \text{brdf}(x, \omega_i, \omega_r) * \text{rayRadianceEst}(x, \omega_i) / (\text{pdf} * \text{survivalProbability})$

else

return 0

## Kajiya-style path tracing, version 1.0:

**rayRadianceEst**( $x, \omega$ ):

```
y = traceRay(x,  $\omega$ )  
return emittedRadiance(y,  $-\omega$ )  
    + reflectedRadianceEst(y,  $-\omega$ )
```

**directRadianceEst**( $x, \omega_r$ ):

```
 $\omega_i, pdf = \text{luminaireSample}(x, n(x))$   
y = traceRay(x,  $\omega_i$ )  
return brdf(x,  $\omega_i, \omega_r$ )  
    * emittedRadiance(y,  $-\omega_i$ ) / pdf
```

**reflectedRadianceEst**( $x, \omega_r$ ):

```
return directRadianceEst(x,  $\omega_r$ )  
    + indirectRadianceEst(x,  $\omega_r$ )
```

**indirectRadianceEst**( $x, \omega_r$ ):

```
if random() < survivalProbability:  
     $\omega_i, pdf = \text{brdfSample}(x, n(x))$   
    y = traceRay(x,  $\omega_i$ )  
    return  $\pi * \text{brdf}(x, \omega_i, \omega_r)$   
        * reflectedRadianceEst(y,  $-\omega_i$ )  
        / (pdf * survivalProbability)  
else:  
    return 0
```

## Kajiya-style path tracing, version 1.0m:

### **directRadianceEst**(x, $\omega_r$ ):

```
 $\omega_l$ , pll = luminaireSample(x, n(x))
pbl = brdfPDF( $\omega_l$ )
 $\omega_b$ , pbb = brdfSample(x, n(x))
plb = luminairePDF( $\omega_b$ )
yl = traceRay(x,  $\omega_l$ )
yb = traceRay(x,  $\omega_b$ )
fl = brdf(x,  $\omega_l$ ,  $\omega_r$ )
    * emittedRadiance(yl,  $-\omega_l$ )
fb = brdf(x,  $\omega_b$ ,  $\omega_r$ )
    * emittedRadiance(yb,  $-\omega_b$ )
return fl / (pll + pbl) + fb / (plb + pbb)
```

### **reflectedRadianceEst**(x, $\omega_r$ ):

```
return directRadianceEst(x,  $\omega_r$ )
    + indirectRadianceEst(x,  $\omega_r$ )
```

### **indirectRadianceEst**(x, $\omega_r$ ):

```
if random() < survivalProbability:
     $\omega_i$ , pdf = brdfSample(x, n(x))
    y = traceRay(x,  $\omega_i$ )
    return  $\pi$  * brdf(x,  $\omega_i$ ,  $\omega_r$ )
        * reflectedRadianceEst(y,  $-\omega_i$ )
        / (pdf * survivalProbability)
else:
    return 0
```

## Kajiya-style path tracing, version 1.1:

**reflectedRadianceEst**( $x, \omega_r$ ):

```
 $\omega_l, p_{ll} = \text{luminaireSample}(x, n(x))$   
 $p_{bl} = \text{brdfPDF}(\omega_l)$   
 $\omega_b, p_{bb} = \text{brdfSample}(x, n(x))$   
 $p_{lb} = \text{luminairePDF}(\omega_b)$   
 $y_l = \text{traceRay}(x, \omega_l)$   
 $y_b = \text{traceRay}(x, \omega_b)$   
 $f_l = \text{brdf}(x, \omega_l, \omega_r)$   
    *  $\text{emittedRadiance}(y_l, -\omega_l)$   
 $f_b = \text{brdf}(x, \omega_b, \omega_r)$   
    *  $\text{emittedRadiance}(y_b, -\omega_b)$   
 $\text{reflRad} = f_l / (p_{ll} + p_{bl}) + f_b / (p_{lb} + p_{bb})$   
if  $\text{random}() < \text{survivalProbability}$ :  
     $\text{reflRad} += \text{brdf}(x, \omega_b, \omega_r) / p_{bb}$   
        *  $\text{reflectedRadianceEst}(y_b, -\omega_b)$   
        /  $\text{survivalProbability}$   
return  $\text{reflRad}$ 
```