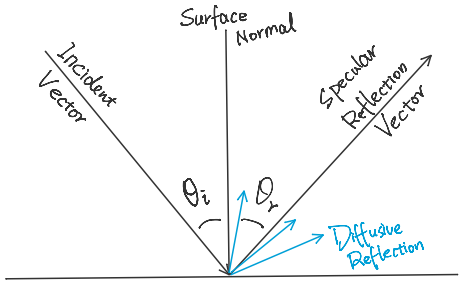
Reflection - MCFPM Notes

Tuesday, September 22, 2020 4:35 PM

A^+ + SURF --> $A^\#$	Ion striking surface, neutralizing and returning to plasma as a hot neutral.
A + SURF --> A + B	Particle A reflects from the surface while producing a gas phase thermal particle B.



For high energy particles, the A particle in these examples will reflect with both specular and diffusive components.
The B particle will be emitted from the surface with essentially thermal energies and diffusive reflection angle.

Specular vs. diffusive

- The specular component of the outgoing/reflection particle results in a trajectory along the mirror reflection of the incoming trajectory. The magnitude of the reflected velocity/speed is a function of incident angle, incident energy, particle type, etc.
- The diffusive/thermal component of reflectance is given by a modified Phong distribution, which scales as $\cos^n(\theta)$, where θ is either the angle w.r.t. the normal of the surface.
- The distribution of reflected velocity/speed is composed of the sum of statistically sampled specular and diffusive velocity/speed.
- The thermal component of the reflected velocity/speed is a Lambertian distribution, scaling as $\cos(\theta)$, where is θ the angle relative to the surface normal. The Lambertian distribution can be replaced by Phong distribution, as $\cos^n(\theta)$, where $n > 1$. The Phong distribution narrows to align with the surface model.
- A maximum angle θ_{max} can be used to limit the emitting angle, which can alleviate the problem of a sputtered particle hitting a neighboring cell when the source cell is further cut into the surface.

Grazing Incident

- The angle of emission of a thermal particle may not always be aligned with the normal to the surface. For example, if an energetic A particle strikes the surface at a grazing angle, the B particle may be emitted tilted in the direction of the mirror reflection of the A particle.
- Grazing incident angle, $\theta_{grazing}$. When $\theta > \theta_{grazing}$, the emitting B particle uses surface normal as the center vector; when , the emitting B particle uses the mirror reflection vector as the center vector.
- When reflecting angle (w.r.t. surface normal) > 90, the particle is eliminated.
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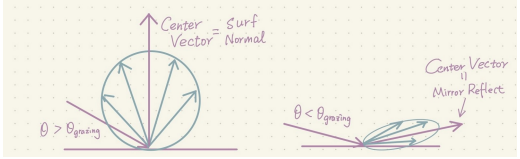
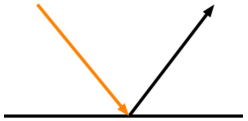


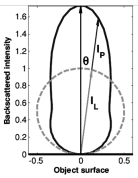


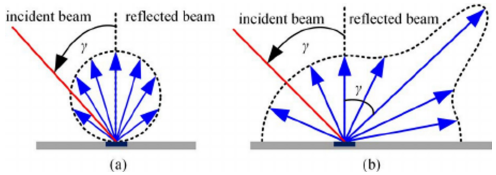
mirror reflection

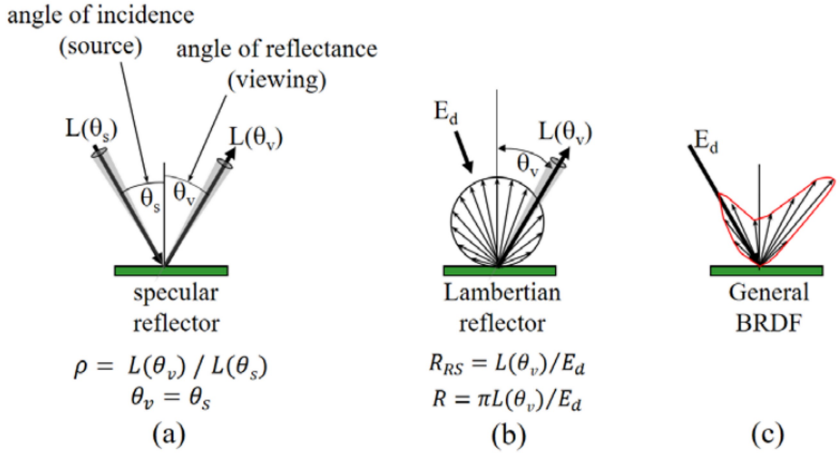
specular reflection

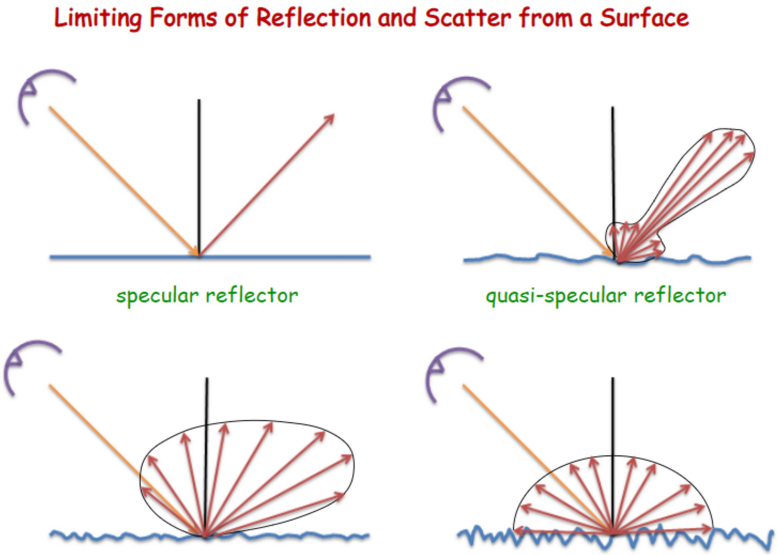
difuse reflection

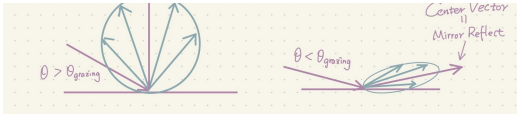
diffuse + specular

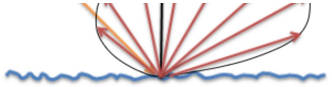




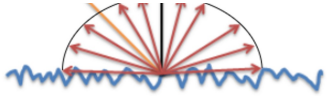




- 



quasi-Lambert reflector



Lambert reflector