

CSC 240

Computer Graphics

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Outline: 11/9

- Handout 5 last problem, recap Lab 8
 - Introduction to Lighting
 - Lab 9: Phases of the moon
 - Midterm questions
- **HW 7**: posted tonight, due next Wed
 - **Office Hours**: Mon/Tues 4-5pm
 - can also come Thurs 4-5pm

Lab 8: Robotic Arm

```
// set up the cube for the lower arm
lowerCube = new THREE.Mesh(cubeGeom, cubeFaceMaterial);
lowerCube.position.x = 1; // move the lowerCube over
lowerCube.scale.set(2,0.5,0.5);

// add it to the lower arm object
lowerArm.add(lowerCube);
lowerArm.position.x = 2; // move the "origin" of the lowerCube over

// set up the cube for the upper arm (exactly the same transformations)
upperCube = new THREE.Mesh(cubeGeom, cubeFaceMaterial);
upperCube.position.x = 1;
upperCube.scale.set(2,0.5,0.5);

// add the lowerArm and upperCube to the full arm
arm.add(upperCube);
arm.add(lowerArm);
arm.rotation.set(0.2,-0.4,0); // just to get a better view
```

Lab 8: Robotic Arm

```
// Render the scene. This is called for each frame of the animation.  
function render() {  
    requestAnimationFrame( render );  
  
    // update the rotation angle here  
    arm.rotation.z += 0.03;  
    lowerArm.rotation.z += 0.06;  
  
    renderer.render(scene, camera);  
}
```

Types of Lighting

- Ambient
- Diffuse
- Specular
- Emitted

Ambient

- General Light levels
- Constant



Ambient



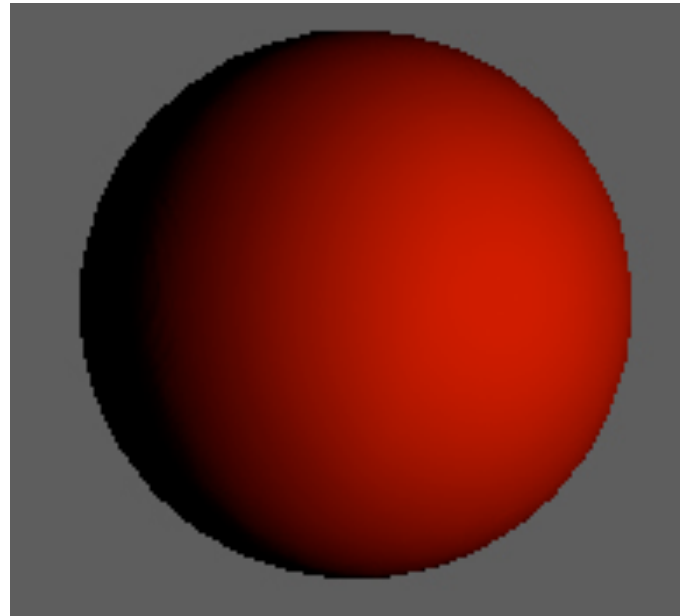
- pixel color =
material color * ambient light color

Ambient Light

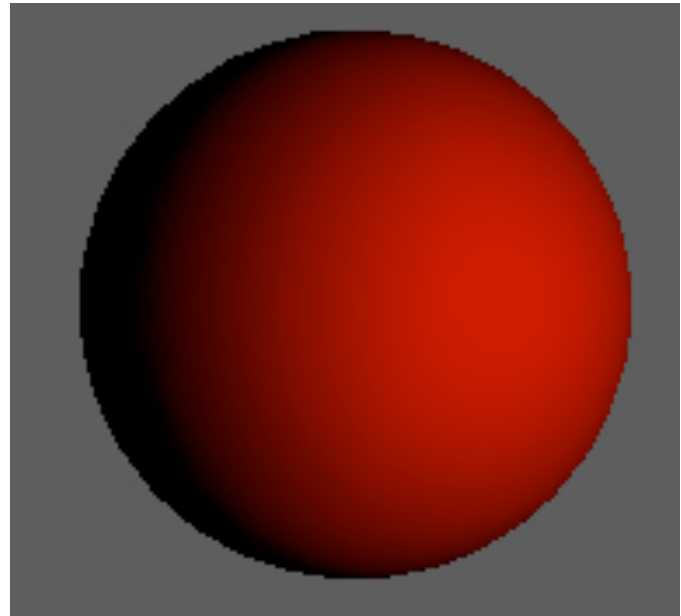
- Ambient light doesn't make shapes look 3D!
- So scattered you can't tell it's original direction

Diffuse

- Light from a source
- scattered by an object



Diffuse

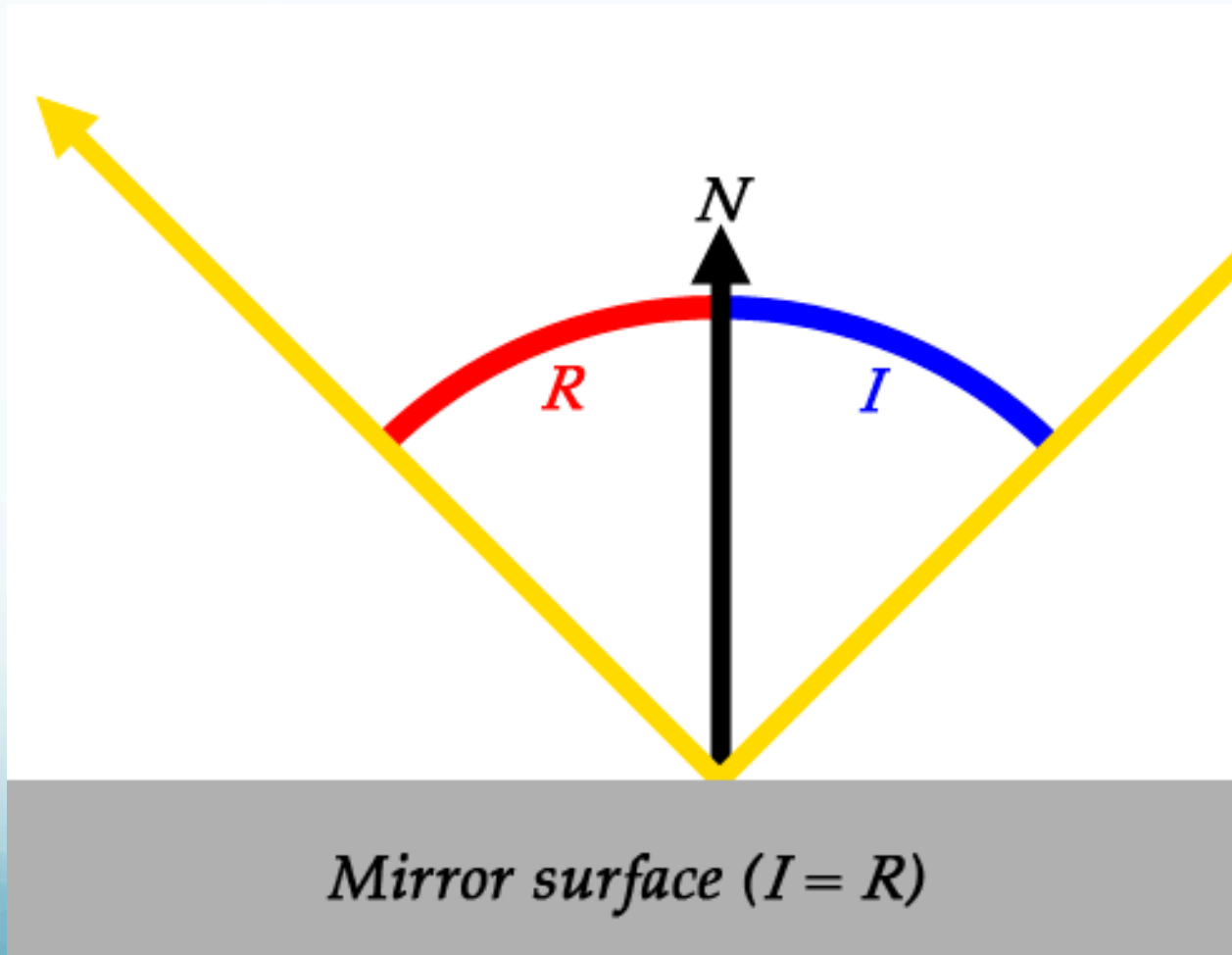


- pixel color =
material color * lightColor * (lightDirection • normal)



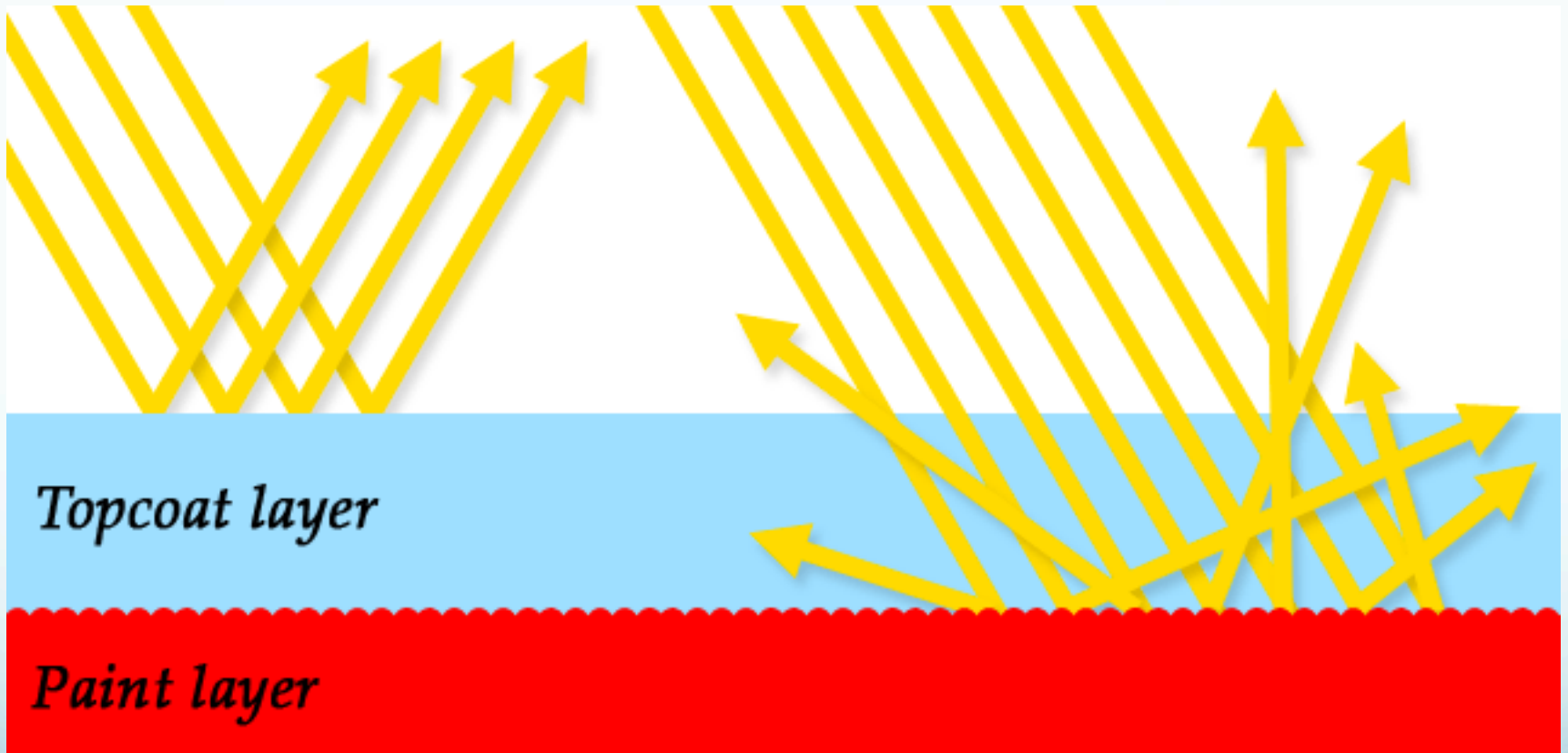
- What about non-diffuse (shiny, specular) surfaces?

Specular Light

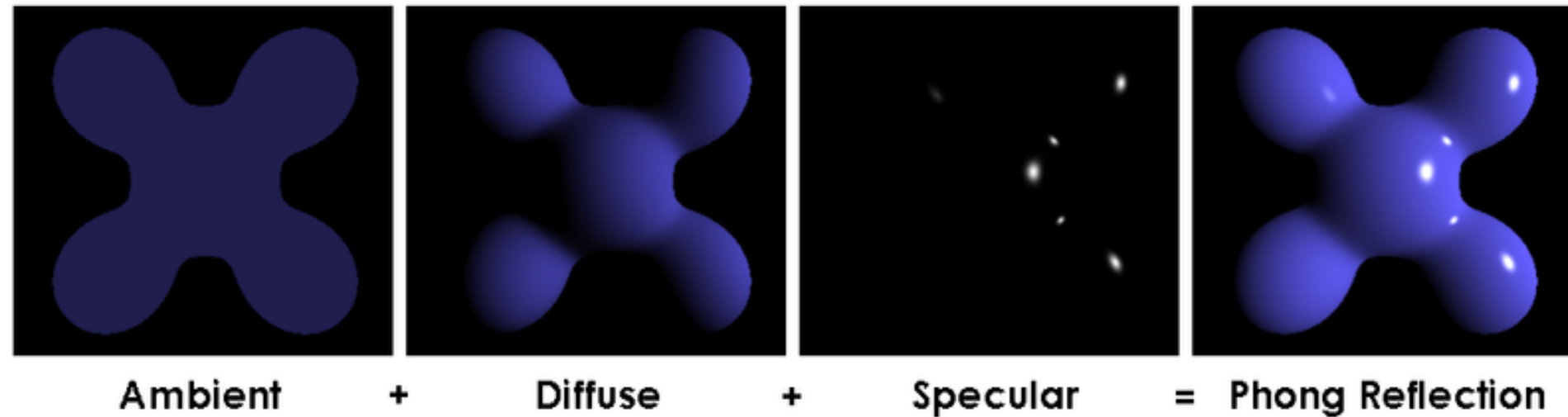


- Mirror-like
- “shiny”

Specular and Diffuse lighting



Adding up lighting types



Add it up

- pixel color = ambient + diffuse + specular

Phong Model

- no basis in physics!
- most common model
 - (but there are many others)

Emitted

- Light source is “inside” object
- Looks like it’s glowing

Demo Lab 9

Midterm

- Average: 85
- Median: 88
- $90 \leq g \leq 100$: some type of A
- $80 \leq g < 90$: some type of B
- $65 \leq g < 80$: some type of C
- Below 60: not passing