## CSE 190: Virtual Reality Technologies

LECTURE #8: VR DISPLAY ISSUES

### Upcoming Deadlines

Sunday, April 25: Project 1 late deadline

Monday, April 26: Discussion Project 2

Sunday, May 2: Project 2 due

Monday, May 3: Discussion Project 3

Sunday, May 9: Project 2 late deadline

#### App Presentations

Baichuan Wu

• VR Movie "Myth"

#### Jonathan Barnes

• Echo VR

#### David Cruz

• Poker Stars VR

# VR Display Issues

### VR Display Issues: Projectors

Vignetting, caused by hotspot effect

- Brightness falloff
- Viewpoint dependent
- Hotspot at intersection of eye point and projector lens

#### Polarization falloff

- Viewpoint dependent
- Polarization deteriorates towards more oblique angles



### VR Display Issues: Passive LCD

Frame synchronization (simultaneous buffer swaps)

Off-axis viewing along vertical axis causes ghosting

 Caused by distance between pixels and polarization layer (image below does not show polarization layer)



#### VR Display Issues: Passive OLED

Frame synchronization (simultaneous buffer swaps)

Off-axis viewing less bad than with LCDs

Polarization layer closer to pixels

Brightness falloff

Image retention

Burn-in

- Automatic Brightness Limiter (ABL)
  - Limits overall screen brightness



#### VR Display Issues: Active Stereo

Synchronization between screens:

- Frame synchronization (simultaneous buffer swaps)
- Image generation ("electron beam"): needs to be in sync between screens and shutter glasses: infrared light or Bluetooth signal
- IR easily gets blocked by objects or people, Bluetooth can be finicky

