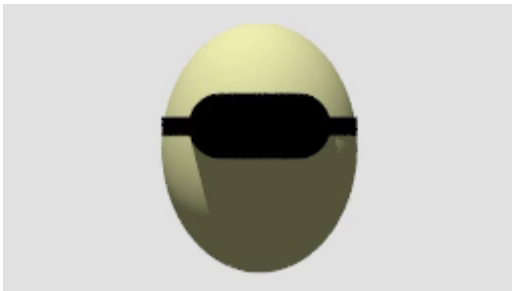


360 Video Animations and Simple Virtual Reality for Introductory Physics

Mike Gallis

Penn State Schuylkill

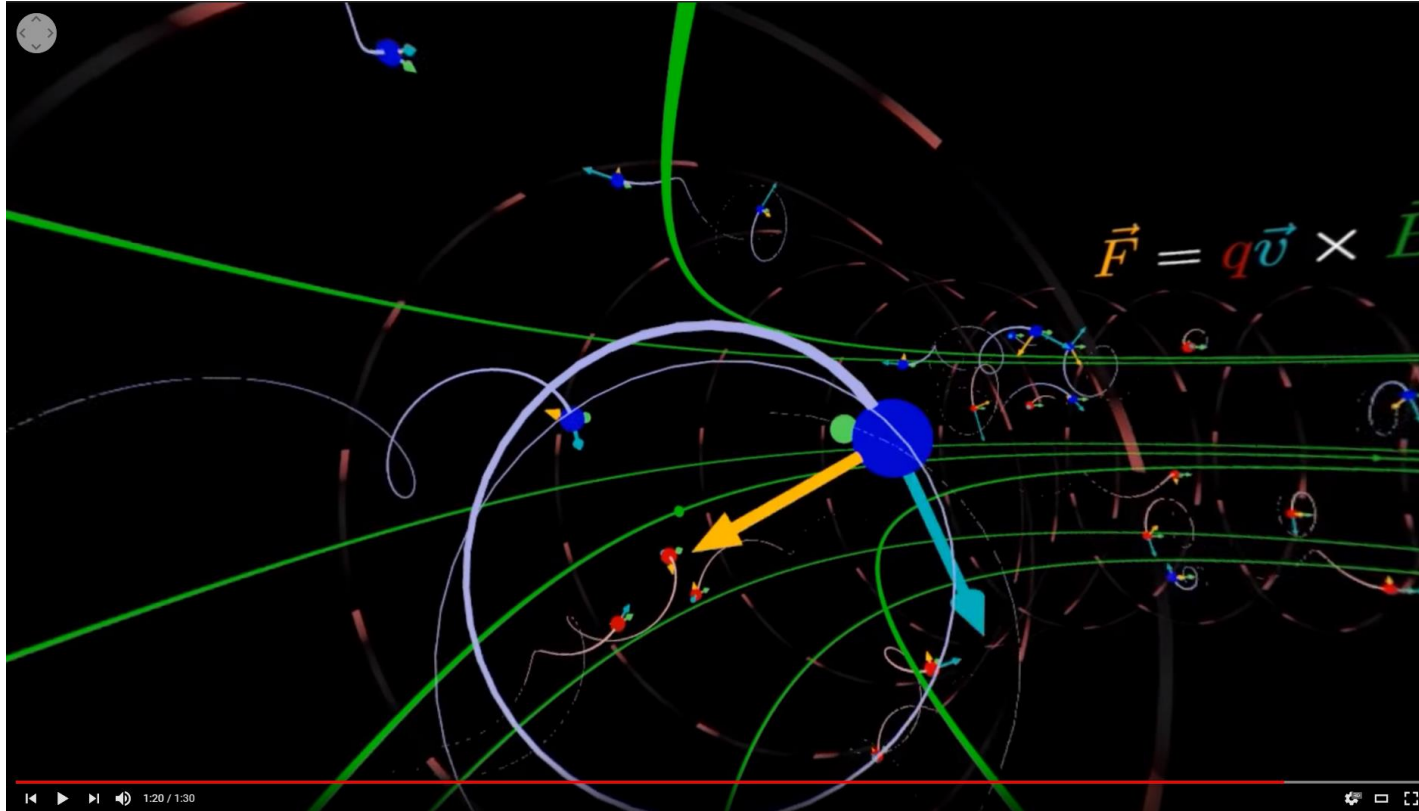
mrg3@psu.edu



Video: <https://www.youtube.com/mrg3>

WebVR: <http://personal.psu.edu/mrg3/VirtualWorlds/>

360 Animation Example



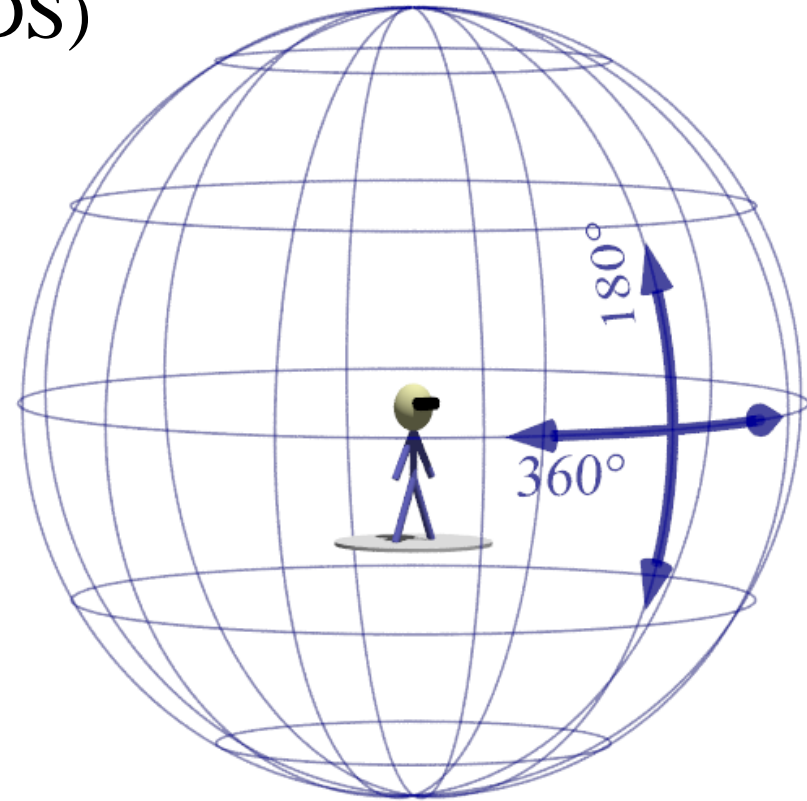
Electric Charges magnetically confined with a toroidal magnetic field, ala Tokamak.

<https://youtu.be/t5GmfQKfw9U>

<https://vimeo.com/222892681>

360 Imagery

- 360 videos, immersive videos, spherical videos
 - possibly Omnidirectional Stereo (ODS)
- 360° horizontal by 180° vertical



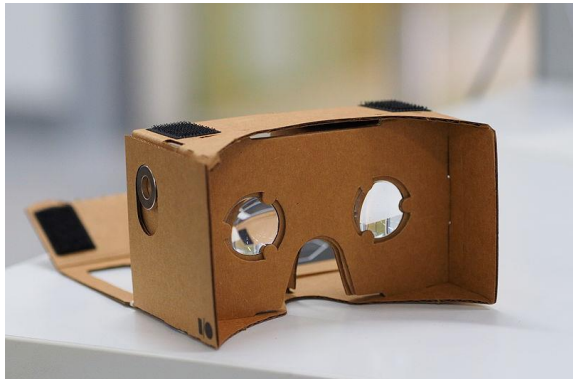
Why 360 Imagery?

- Immersive experience
- Helpful for some geometric concepts
- Entry level Virtual Reality
 - *The Art and Science of Virtual Worlds*, a new linked general education course (GA-GN)
- The “Wow!” factor
- Opportunities for creativity
 - Group projects with student creative and technical team

Technical Aspects of Dissemination

Playback Hardware

- PC, mobile devices: click and drag panning
- Smart mobile devices: windowing controlled through device internal gyroscope
- Smart Phones and viewers: Google Cardboard, View-Master VR, etc.
- HTC Vive



“Playback”

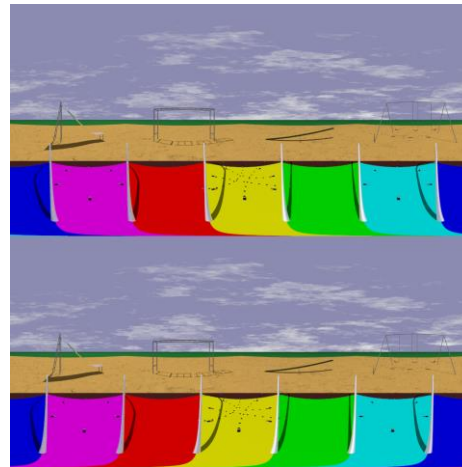
- Web Browsers
 - 360 Images in web pages: PhotoSphereViewer by Jérémy Heleine.
 - A-Frame Web VR
- Smart Devices
- “VR” apps with Google Cardboard mode
 - YouTube, Vimeo, Veer, etc.
 - Mobile VRStation
 - VRPlayer

Creating 360 Imagery with POV-Ray



- Mono with spherical camera
- Stereo:
 - Custom camera (only available in recent beta/alpha versions 3.71, 3.8.0)
 - Custom OmniDirectional Stereo (ODS) camera specification
 - <http://wiki.povray.org/content/HowTo:ODS>
 - Follows Google ODS specs: <https://developers.google.com/vr/jump/rendering-ods-content.pdf>

Top-Bottom stereoscopic image. Images for frames of animation rendered at 4096x4096



YouTube Playlist

<https://www.youtube.com/playlist?list=PLqESchaAtRL656WwQv53pbaTUVBU1nsVK>

360 Video from Imagery & Delivery

- Audio recorded and edited with Audacity
- Image and Audio stream compressed into .mp4 format with ffmpeg⁶
- Set video file internal information with Spatial Media Metadata Injector
 - <https://github.com/google/spatial-media>
- Upload to favorite web based media repository (YouTube, Vimeo, Veer, etc)

Imagery and Video with 360 Camera

- GoPro Fusion
- Examples with A-Frame:
- Single 360 Image
 - <http://personal.psu.edu/mrg3/VirtualWorlds/360RoomExamples/example1/room360.html>
- Video (warning, violent motion)
 - <http://personal.psu.edu/mrg3/VirtualWorlds/360RoomExamples/videosphereExample/firstPersonWaiterTray.html>

Entry level web based VR: A-Frame

- Javascript library
- Examples remix-able on Glitch:
 - <https://glitch.com/edit/#!/aframe?path=index.html:1:0>
 - Physics Library (kinematics, friction, impact physics)
- Charges in a uniform field
 - <http://personal.psu.edu/mrg3/VirtualWorlds/animation/ChargeInSolenoid.html>
- Coming Soon: Student Project “Pinball Model of Conduction”
 - A-Frame VR, A-Frame Physics engine

Thanks

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- 360 Video Vectors Student Team: Lauren Gober and Kyanna Gonzalez.
- A-Frame E&M Student Team: Lauren Gober, Jennie Li, Travis Barrow and Jesse Foran.
- Virtual Worlds colleagues Nicole Andel, Jeffrey Stone, Daniel Jackson, Michelle Kaschak