Dome Projection using a Vertex Shader

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Dome Projection – Becoming more Common

I believe that it’s only a matter of time until it becomes a routine visualization tool.
Programming a Dome display is easier when only a single projector is used

A fisheye lens in the projector distorts the image so that it spreads out across the dome.

The trick is pre-distorting the image in the other direction so that it looks correct after being projected.
One Night at the Reuben H. Fleet Science Center in San Diego…
Move the teapot so it surrounds the audience

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Dome Projection

Viewing Volume = (-1,-1) to (1,1)

The edge of the circle represents the edge of the dome projection = your left, right, bottom, top as you are sitting in the theater.
Dome Vertex Shader:

God’s-eye View:

As the eye sees it:

From the side:

const float PI = 3.14159265;

void main()
{
    vec4 pos = gl_ModelViewMatrix * gl_Vertex;
    float lenxy = length(pos.xy);

    float phi = atan(lenxy, -pos.z);
    pos.xy = (phi / (PI/2.0)) * (pos.xy / lenxy);

    gl_Position = gl_ProjectionMatrix * pos;
}

Note: \((pos.xy / lenxy) = (\cos\Theta, \sin\Theta)\)
Dome Vertex Shader:

Undistorted

Distorted
Dome Vertex Shader:

Distorted
Flow Visualization in the Dome

Distorted

Projected
Mars Panoram in the Dome
Large Lines and Polygons Need to be Tessellated

Note: This edge does not pass through the flow vectors!

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Bounding Box edges were *not* tessellated. Straight lines on the monitor produced curved lines on the dome.

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