Dome Projection using a Vertex Shader

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Computer Graphics
Dome Projection – Becoming more Common

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 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.
Dome Distortion

Move the teapot so it surrounds the audience
Dome Projection:

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

Edge of the circle represents the edge of the dome projection = your left, right, bottom, top as you are sitting in the theater.
const float PI = 3.14159265;

void main( )
{
    vec4 pos = uModelViewMatrix * aVertex;
    float lenxy = length(pos.xy);

    float phi = atan(lenxy, -pos.z);
    pos.xy = (phi / (PI/2.)) * (pos.xy / lenxy);

    gl_Position = uProjectionMatrix * pos;
}

Note: \( \frac{\text{pos.xy}}{\text{lenxy}} = (\cos\Theta, \sin\Theta) \)
Cartesian:

Dome:
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Flow Visualization in the Dome
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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