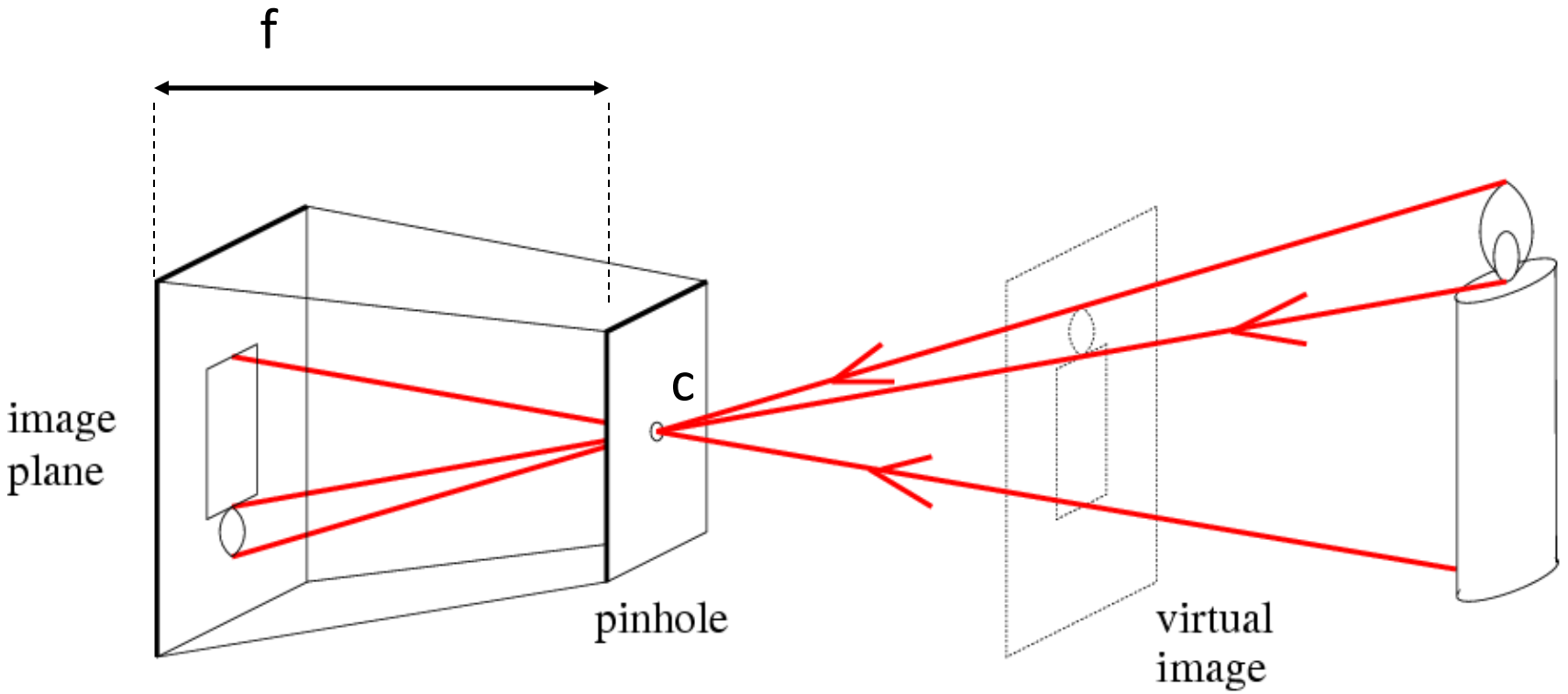
Project 2
Helpful Notes

CS 3630

Pinhole camera model



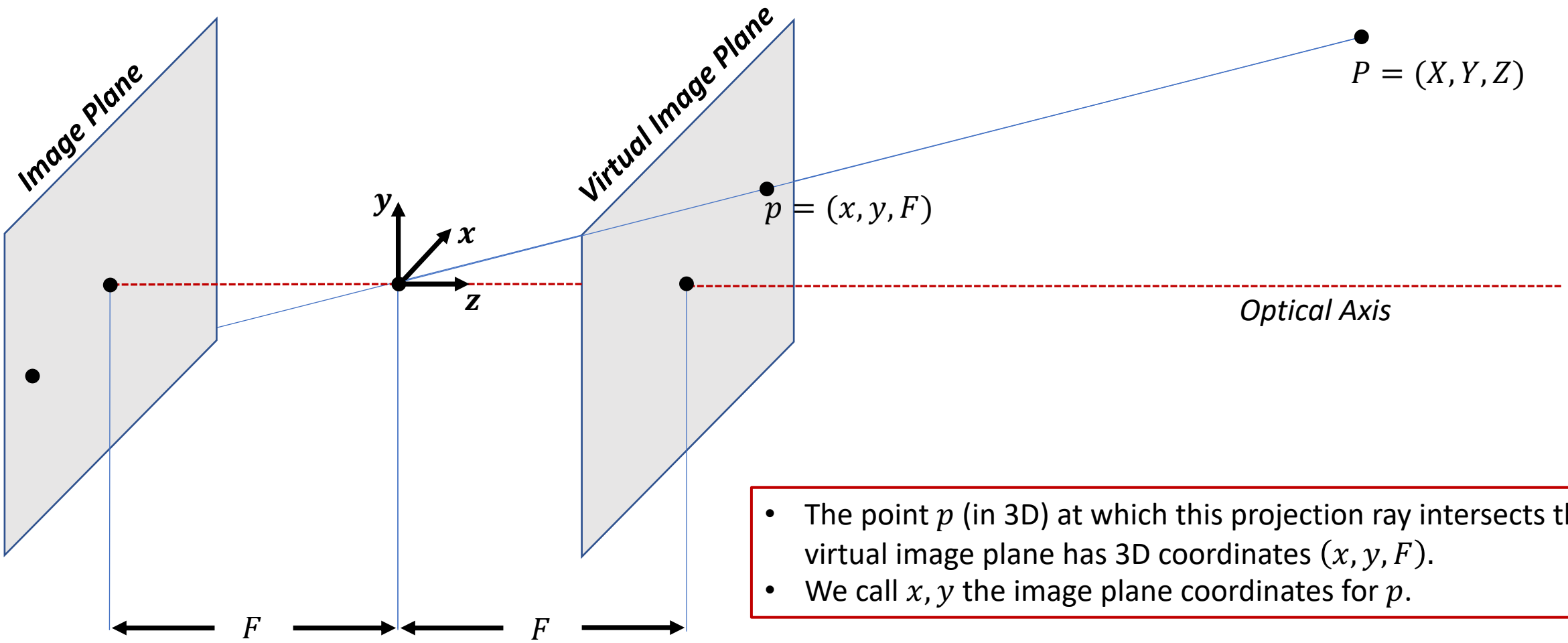
f = focal length

c = center of the camera

Figure from Forsyth

Pinhole Camera

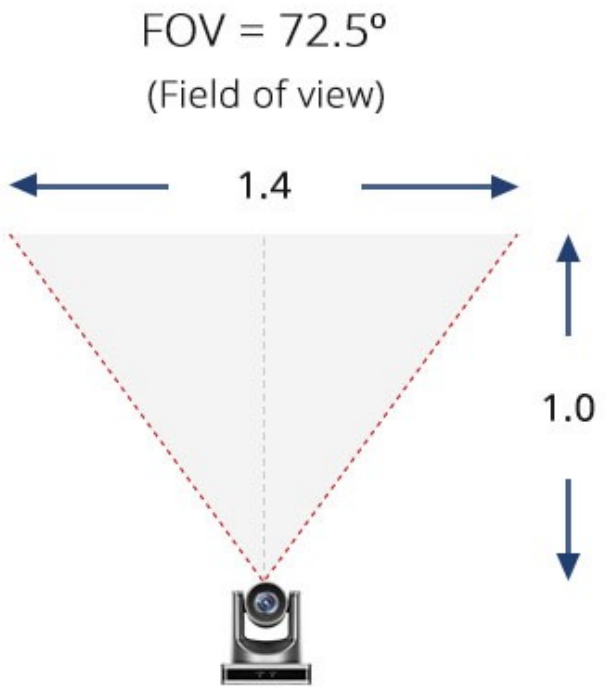
The point $P = (X, Y, Z)$ lies on a projection ray that passes through P and the focal center, and that intersects both the image plane and the virtual image plane.



- The point p (in 3D) at which this projection ray intersects the virtual image plane has 3D coordinates (x, y, F).
- We call x, y the image plane coordinates for p.

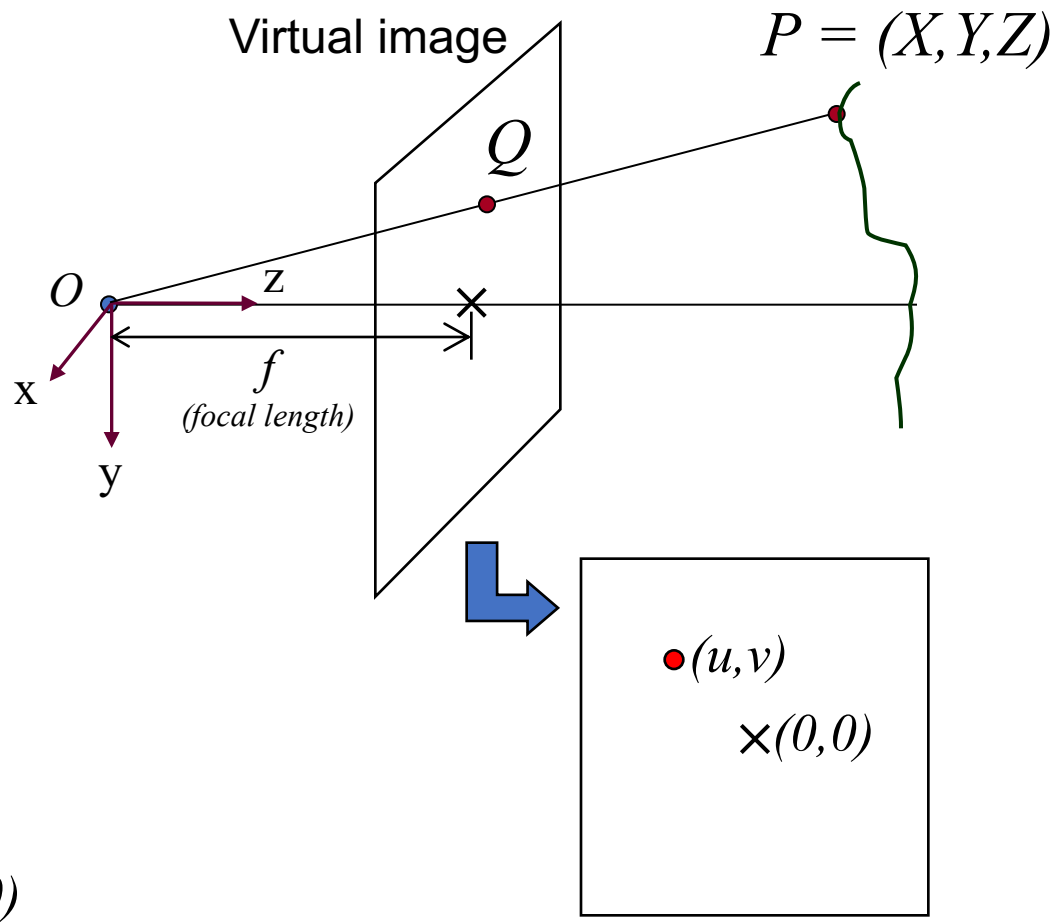
Field of view (FOV)

- the angle of camera view
- the wider the FOV, the more we can see of the observable world



Review: Pinhole Camera Model

3D scene point P is projected to a 2D point Q in the virtual image plane

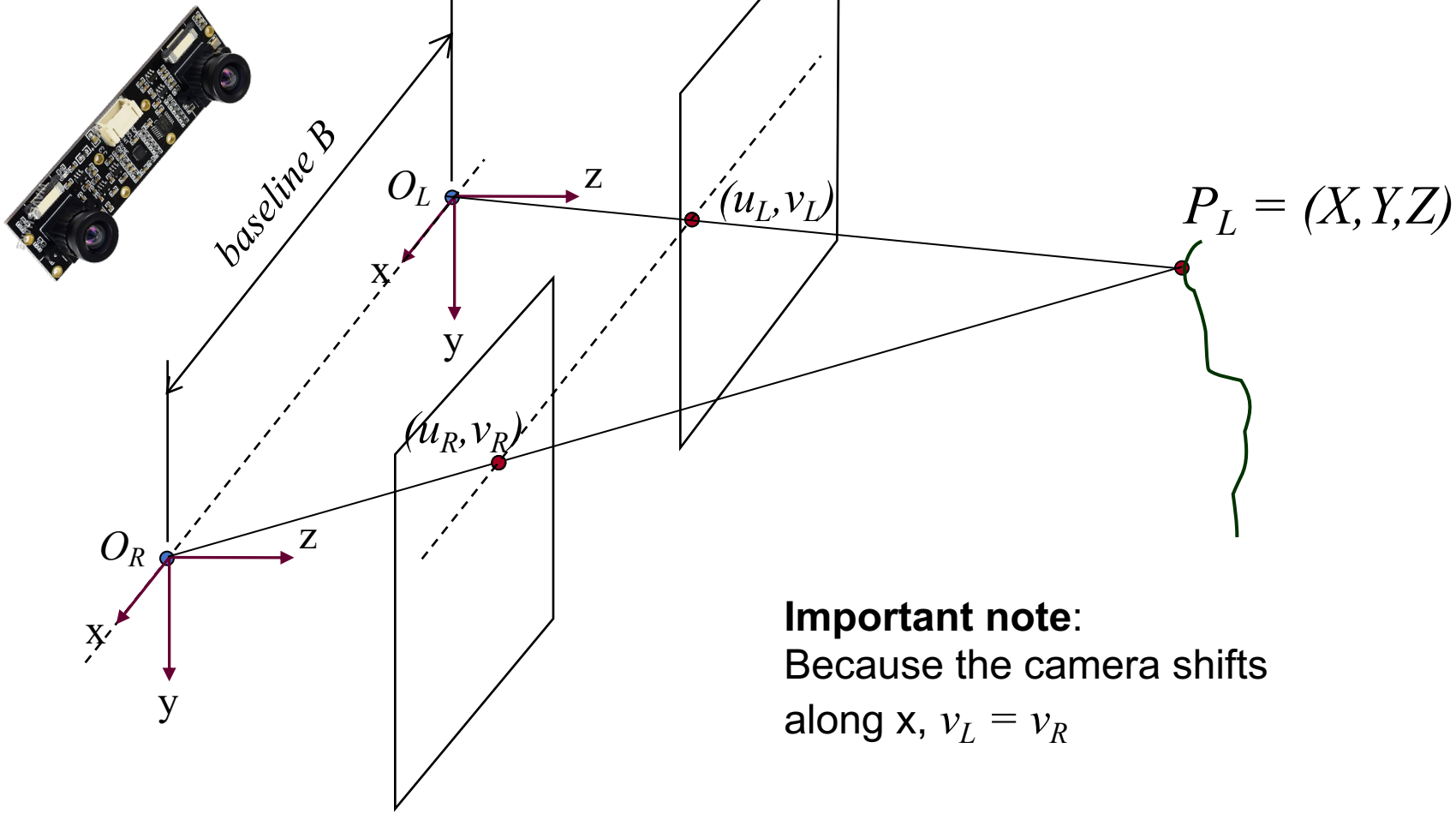


The 2D coordinates in the image are given by

$$(u, v) = \left(f\frac{X}{Z}, f\frac{Y}{Z} \right)$$

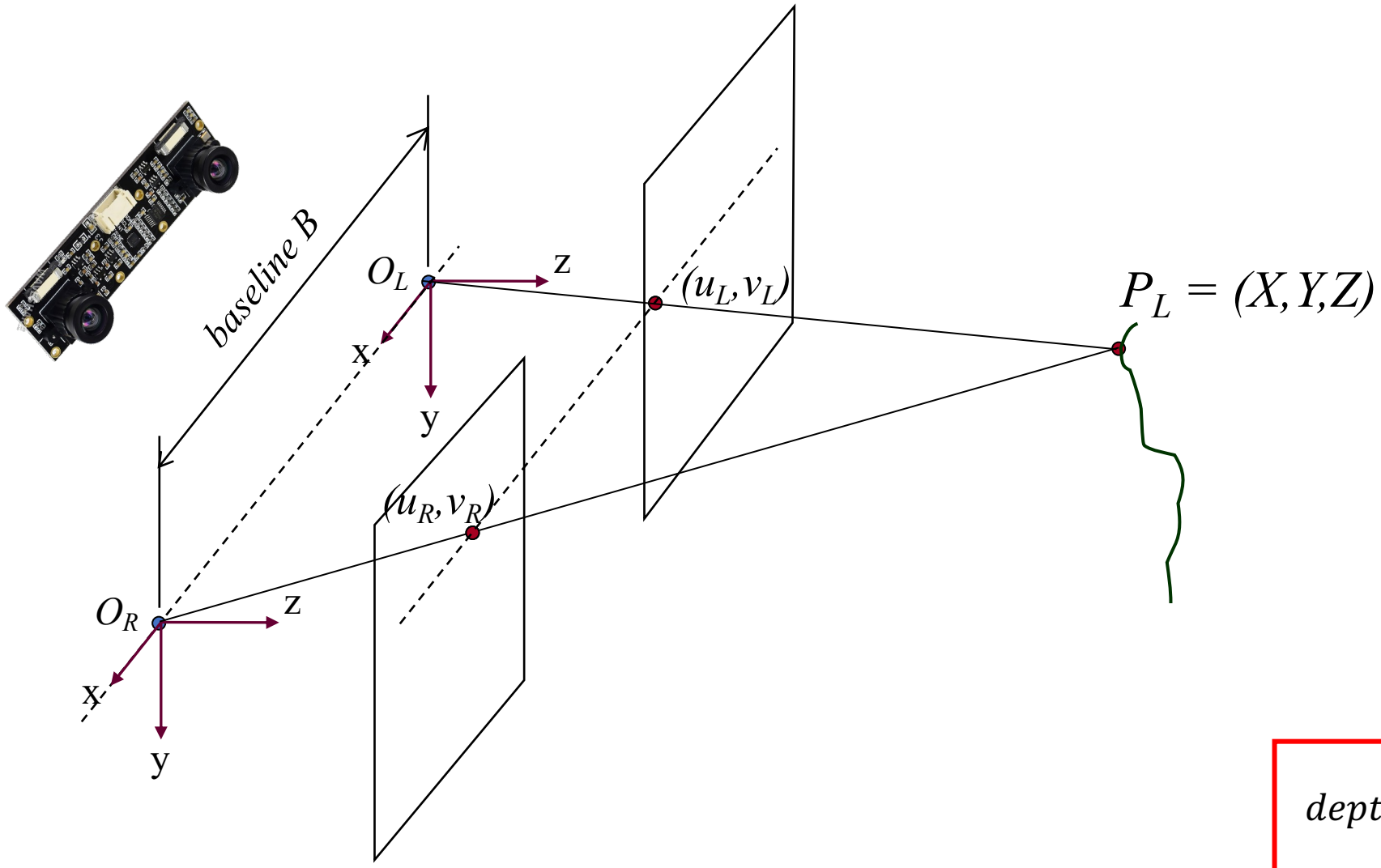
Note: image center is *(0,0)*

Basic Stereo Derivations



Important note:
Because the camera shifts along x, $v_L = v_R$

Basic Stereo Formula



$$(u_L, v_L) = \left(f\frac{X}{Z}, f\frac{Y}{Z}\right)$$

$$(u_R, v_R) = \left(f\frac{X-B}{Z}, f\frac{Y}{Z}\right)$$

Disparity:

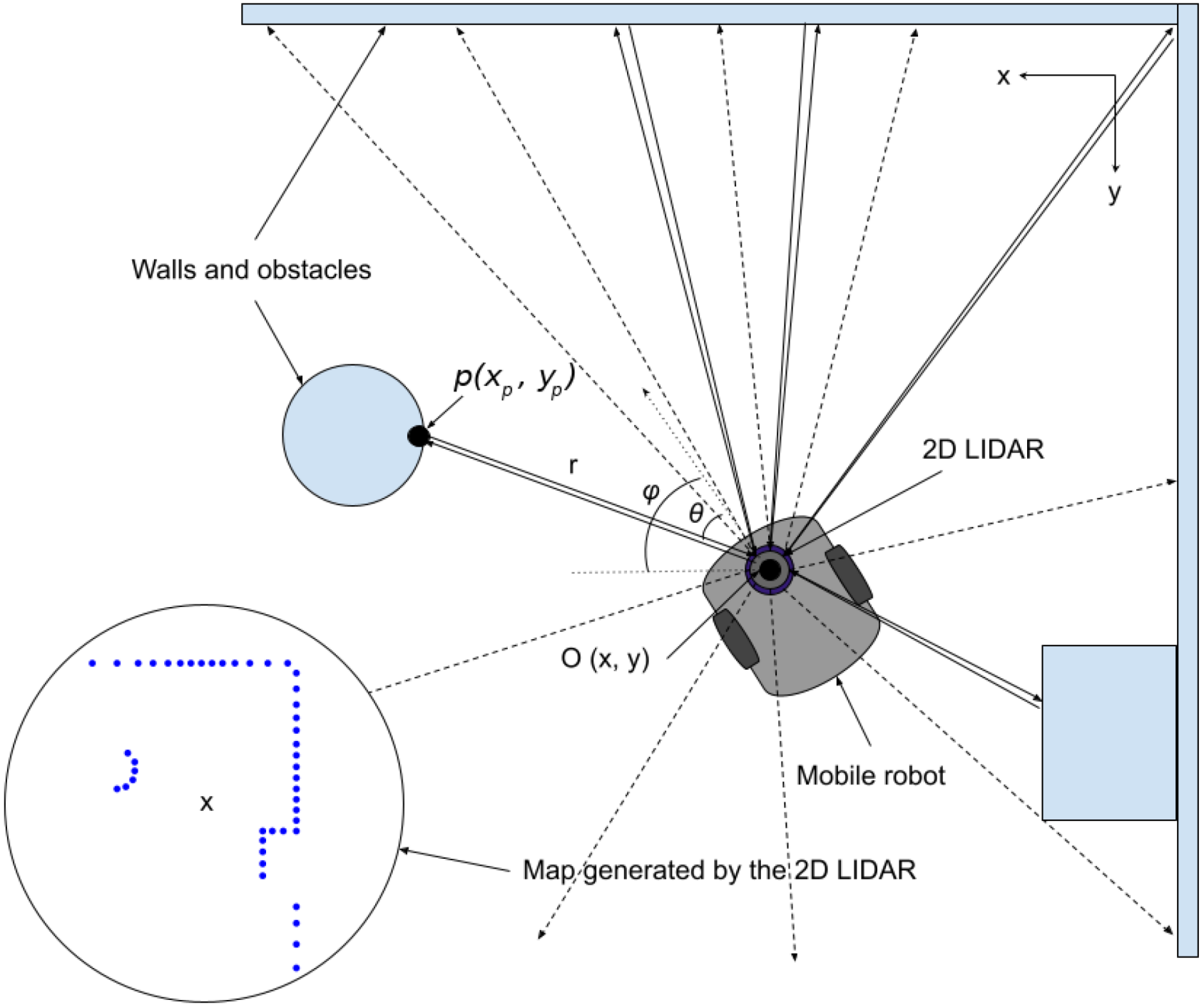
$$d = u_L - u_R = f\frac{B}{Z}$$

Depth:

$$\Rightarrow \boxed{Z = f\frac{B}{d}}$$

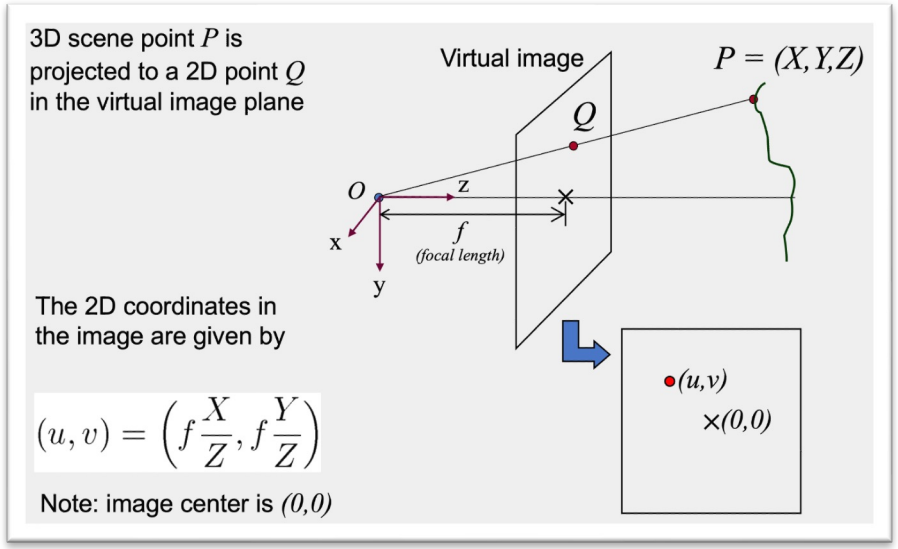
$$\boxed{depth = focallength\ \frac{baseline}{disparity}}$$

How do we identify the point of interest in a lidar scan?

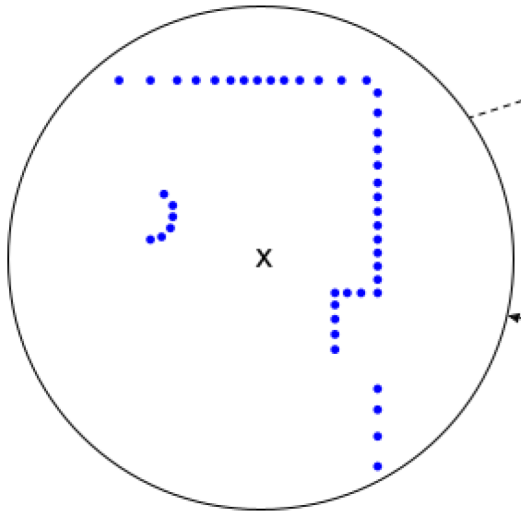


How do we identify the point of interest in a lidar scan?

Use all this:



To find the angle of the lidar reading you care about.



General notes

- Disparity is always a positive number (take absolute value to be safe)
- Make sure your calculations are correct for objects on both the right and left side of the image (positive theta and negative theta, respectively). As well as for the corner case where theta is 0.
- Check your units, a lot of the variables are in radians, function definition asks for answer in degrees

Avoid mistakes of the Mars Climate Orbiter