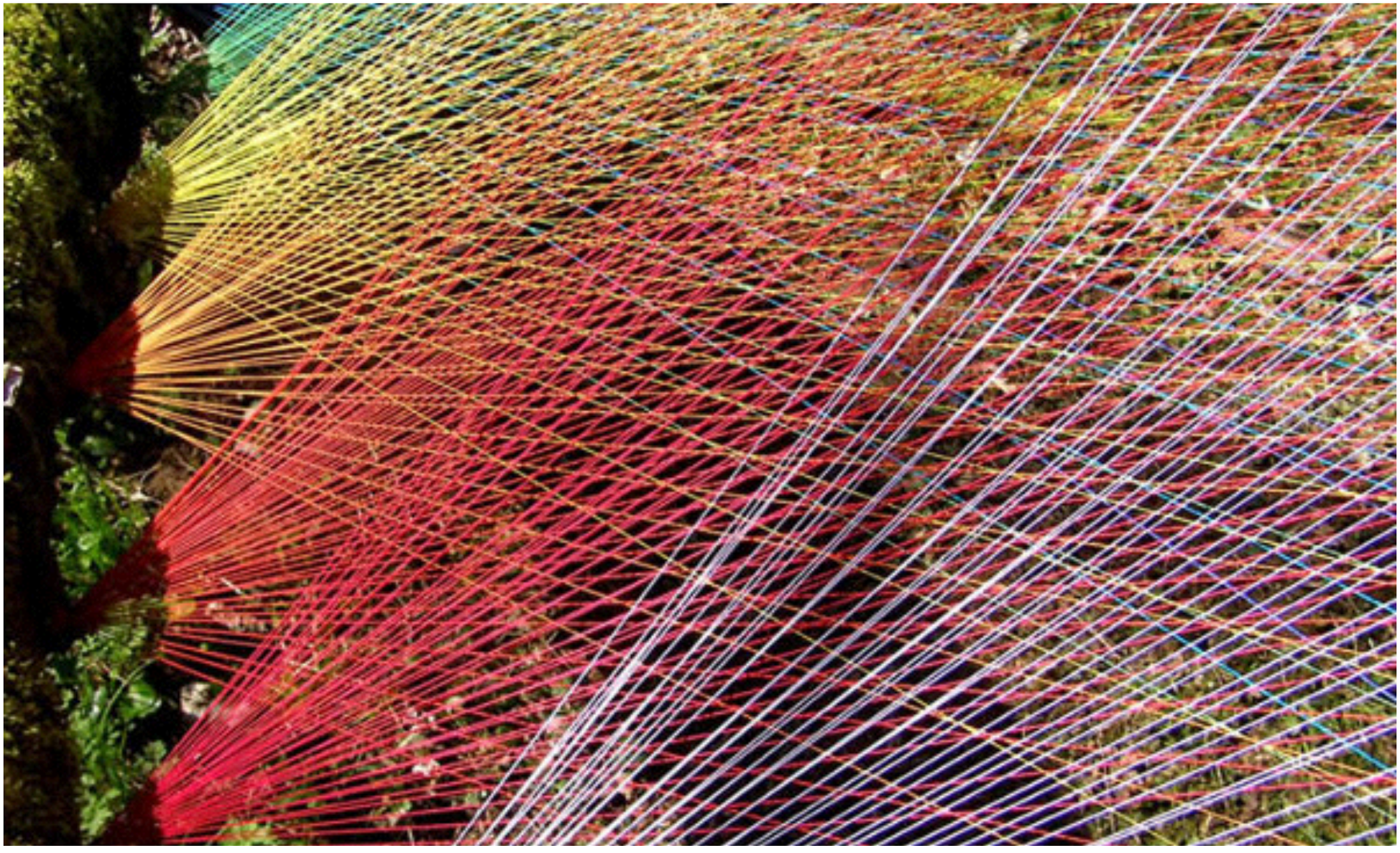
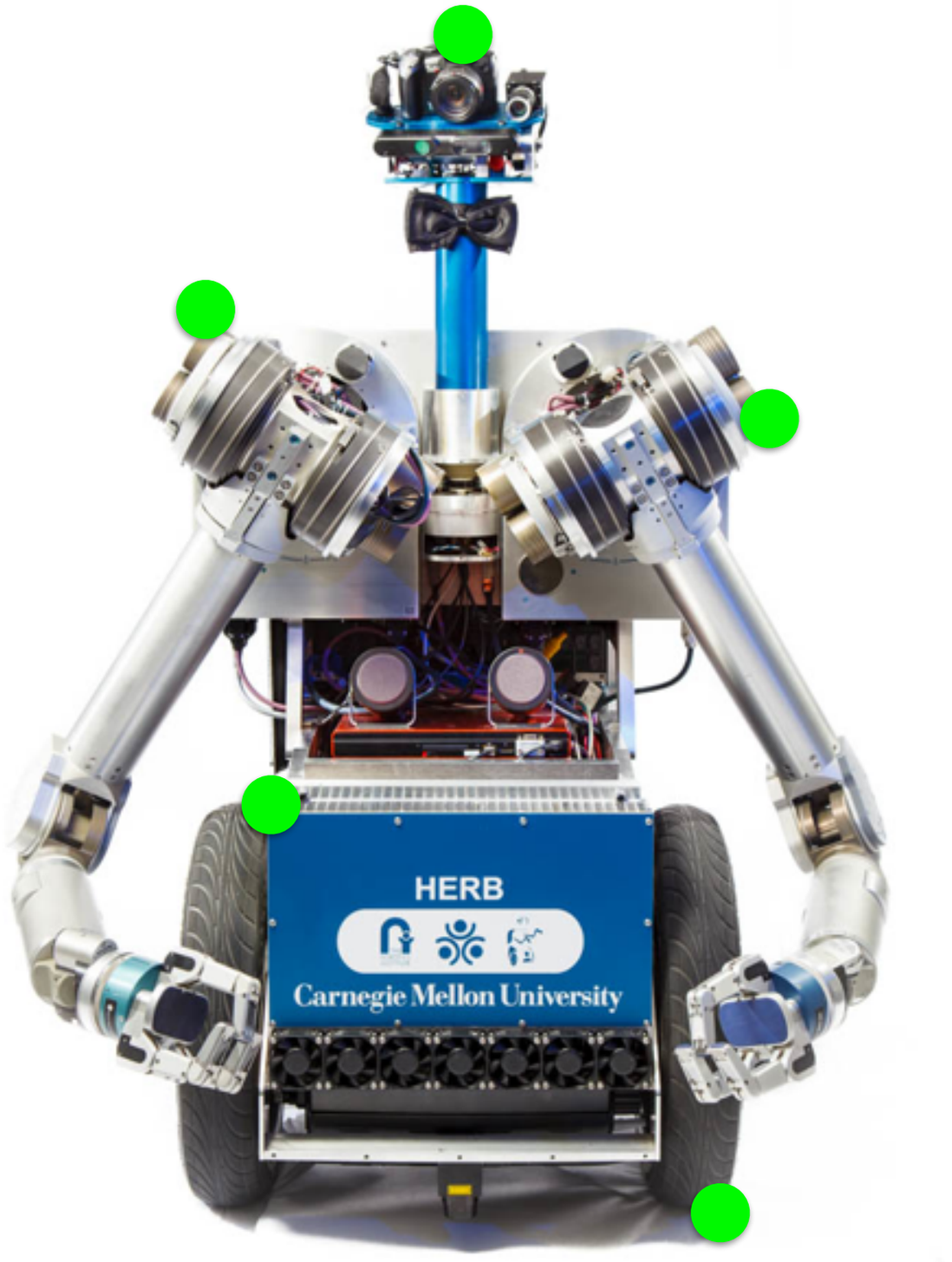


Epipolar Geometry

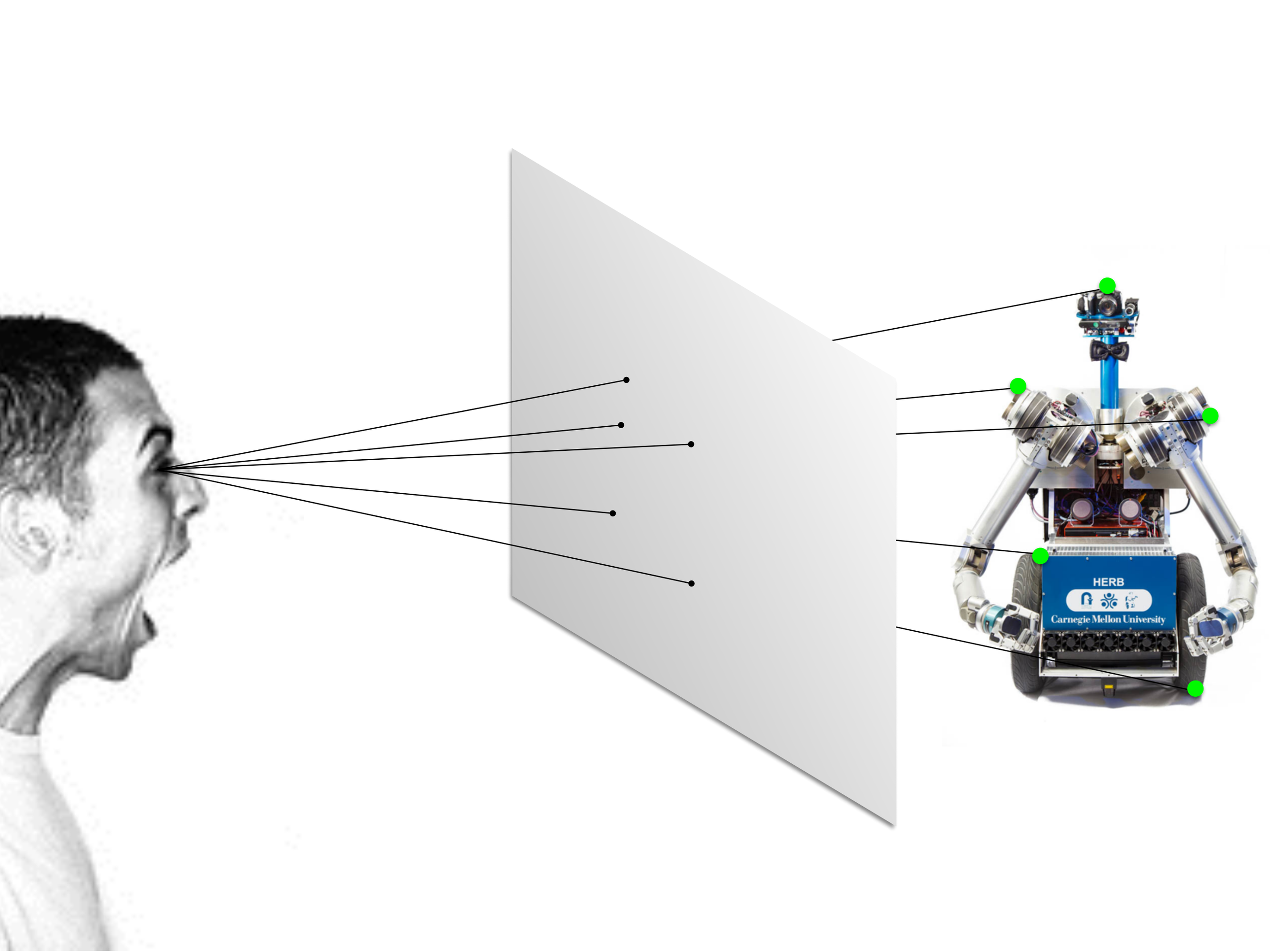
16-385 Computer Vision (Kris Kitani)

Carnegie Mellon University

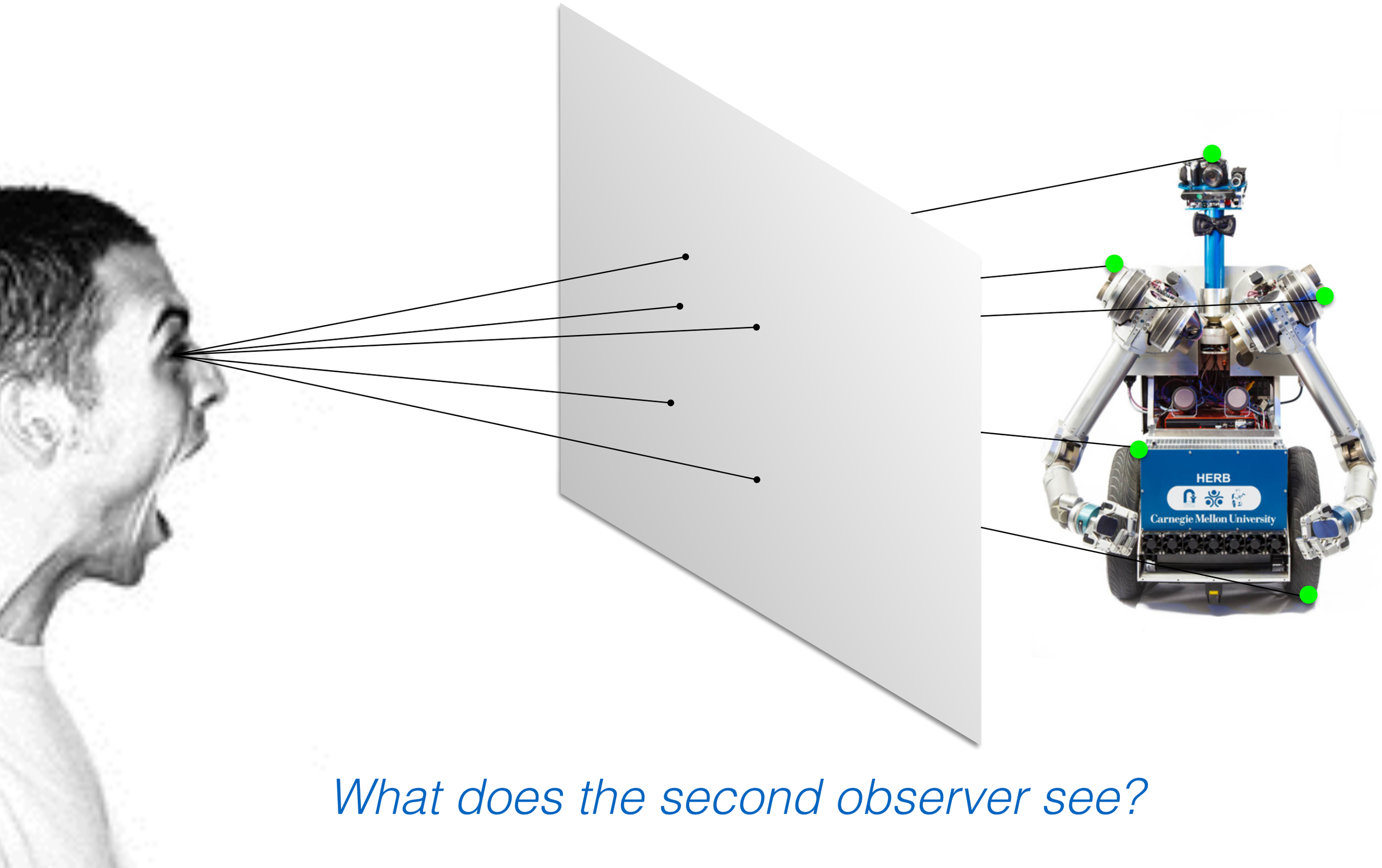


Tie tiny threads on HERB and pin them to your eyeball

What would it look like?

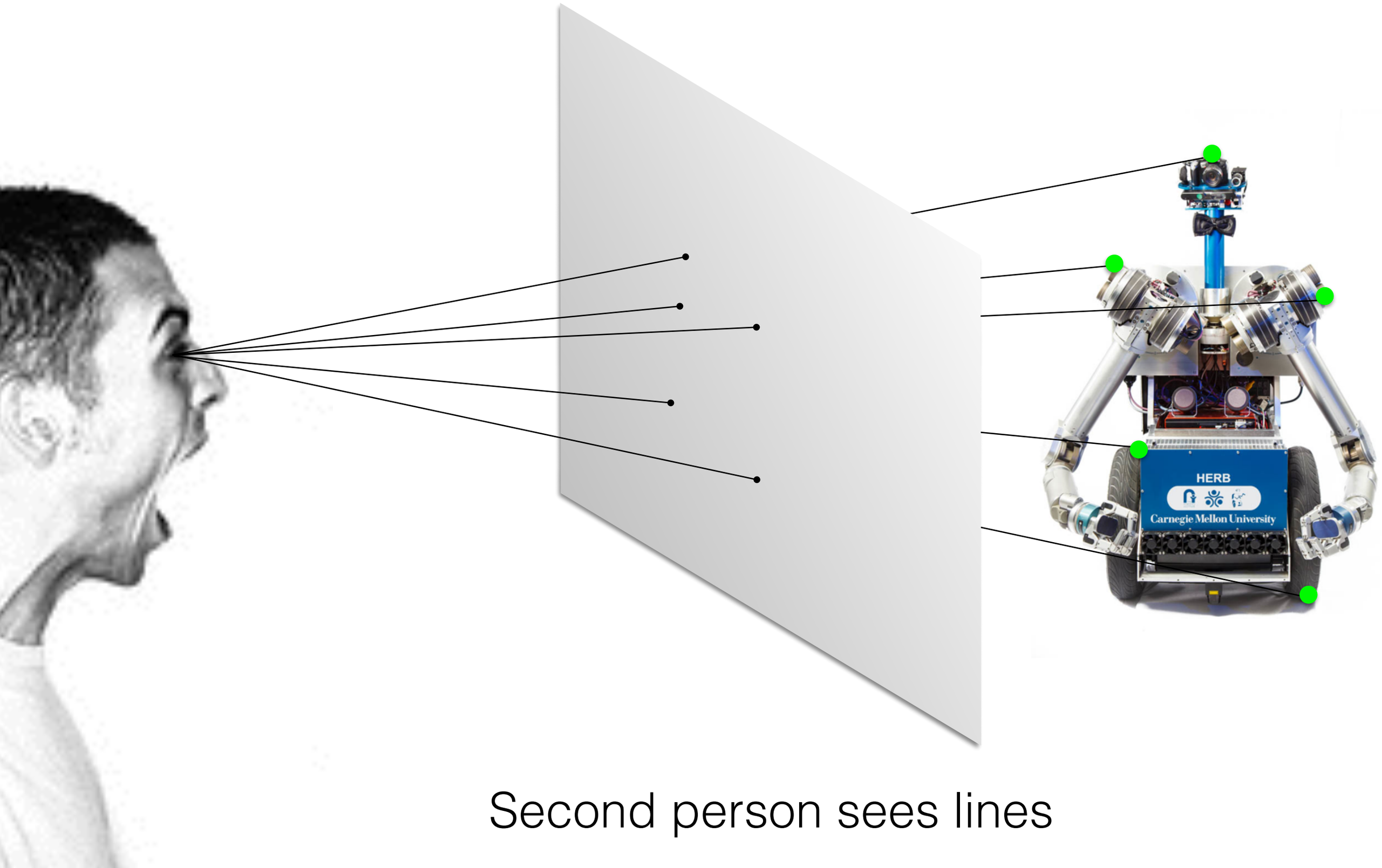

HERB
Carnegie Mellon University

You see points on HERB



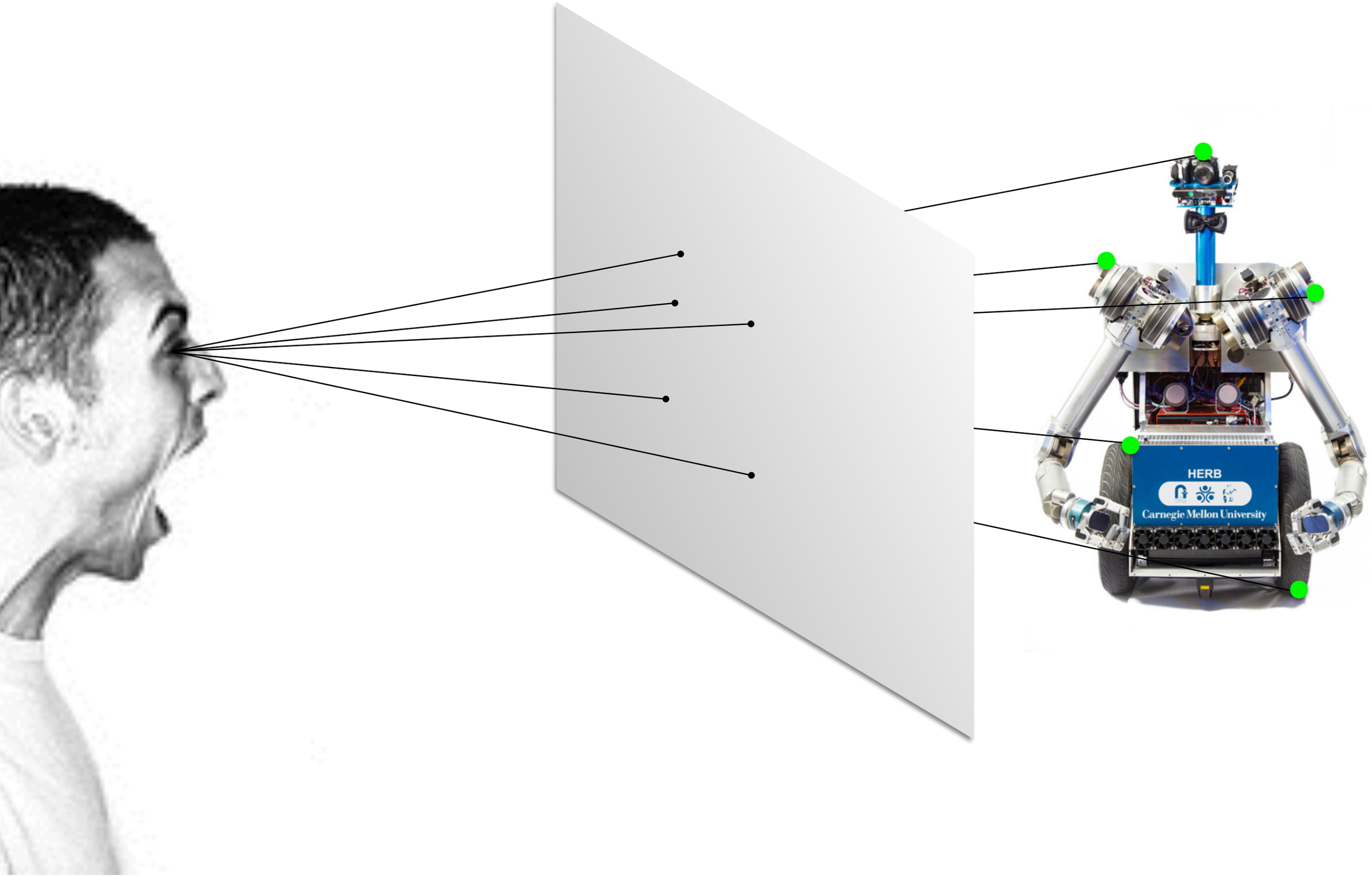
What does the second observer see?

You see points on HERB

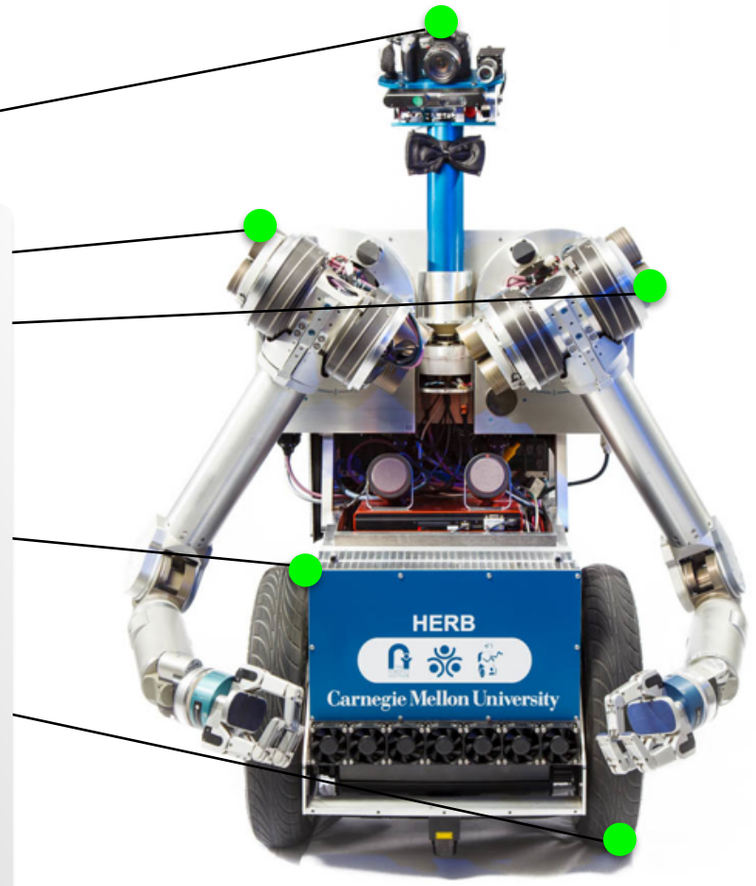


Second person sees lines

This is Epipolar Geometry

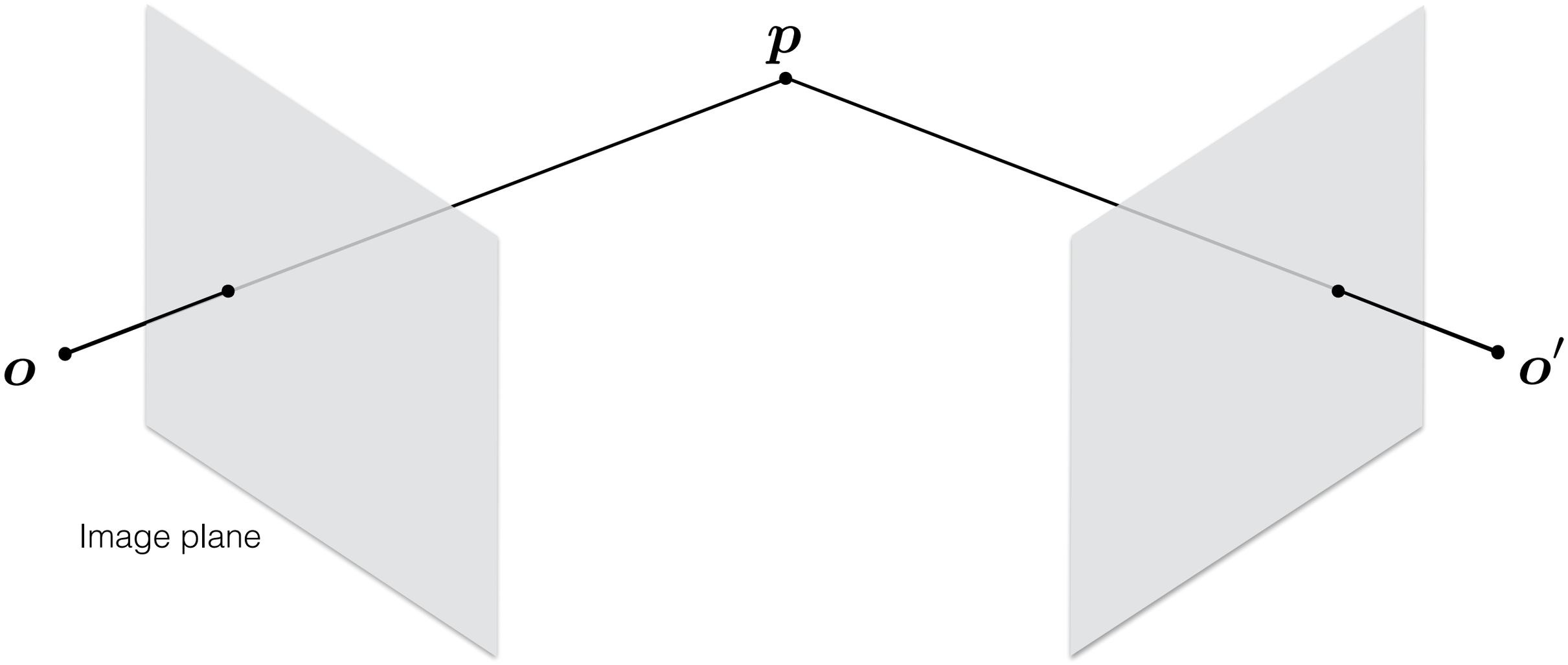


Epipole

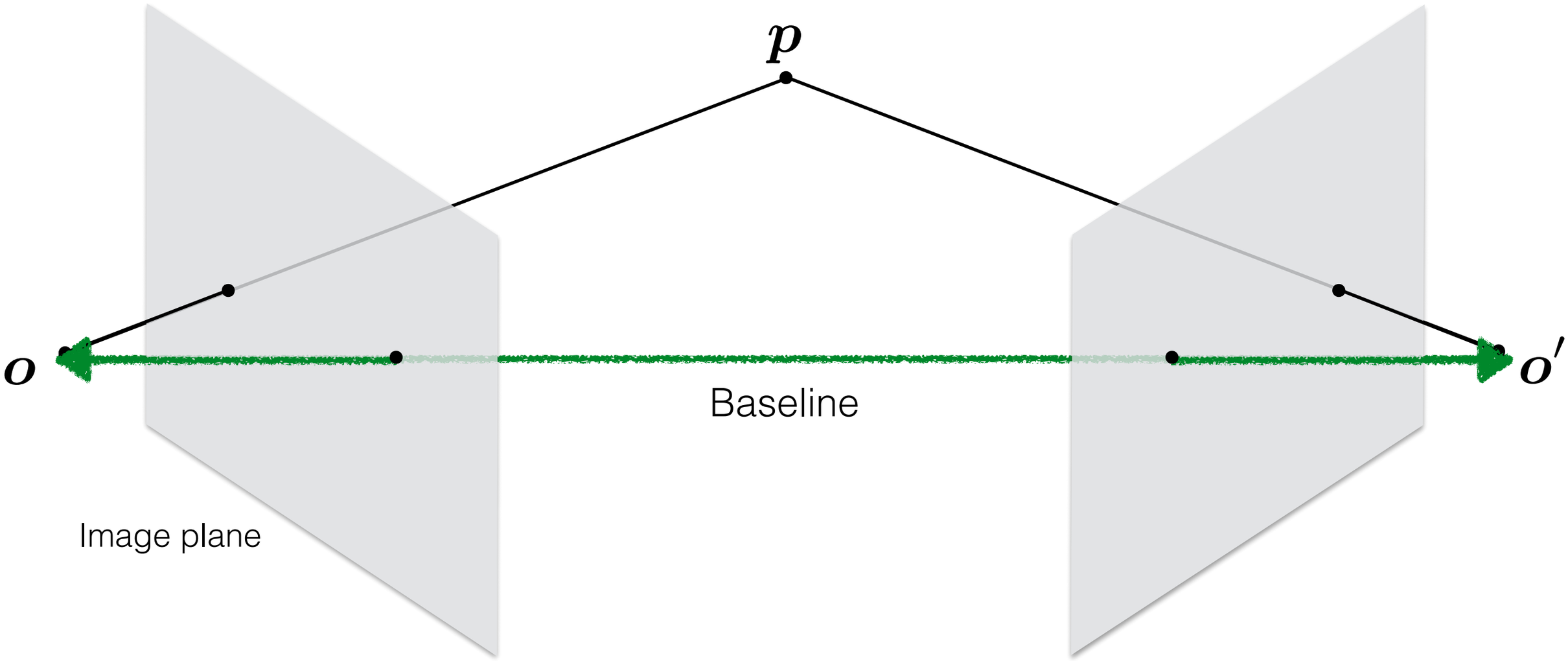


Epipolar lines

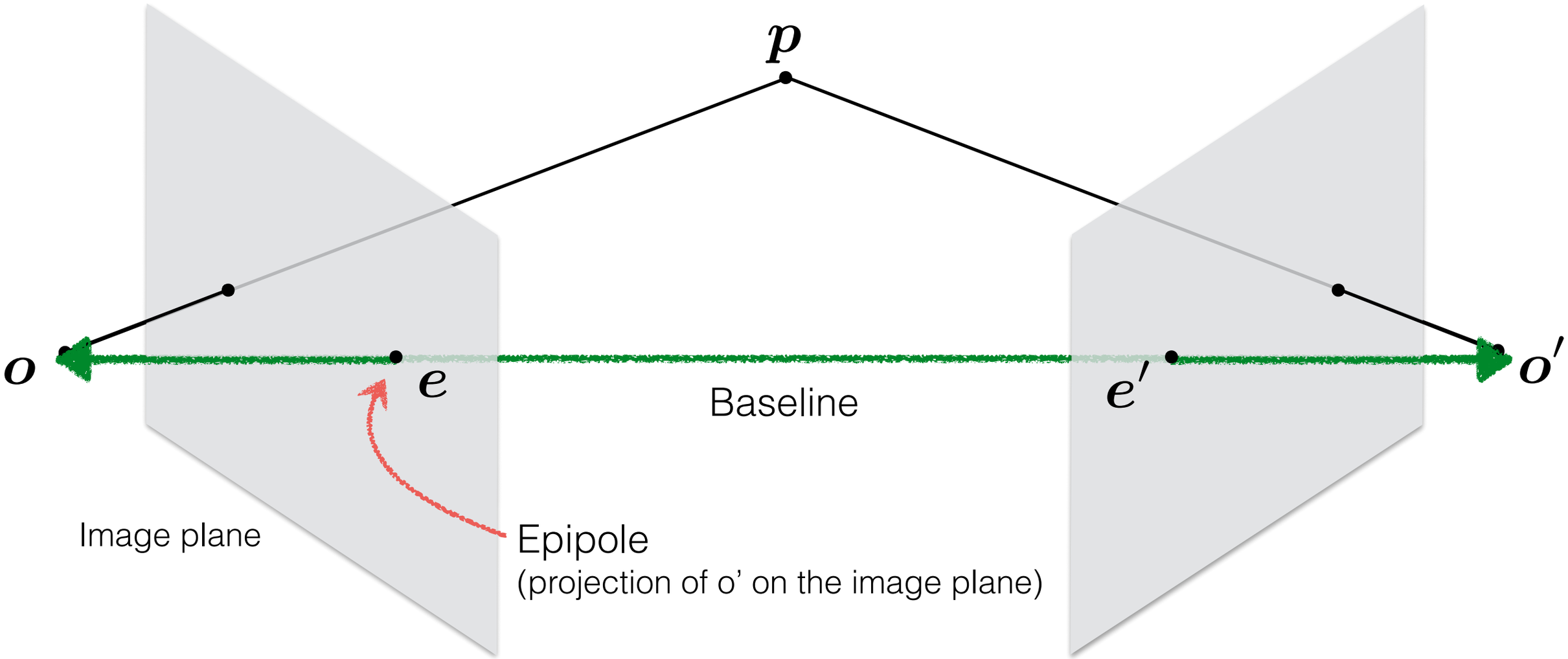
Epipolar geometry



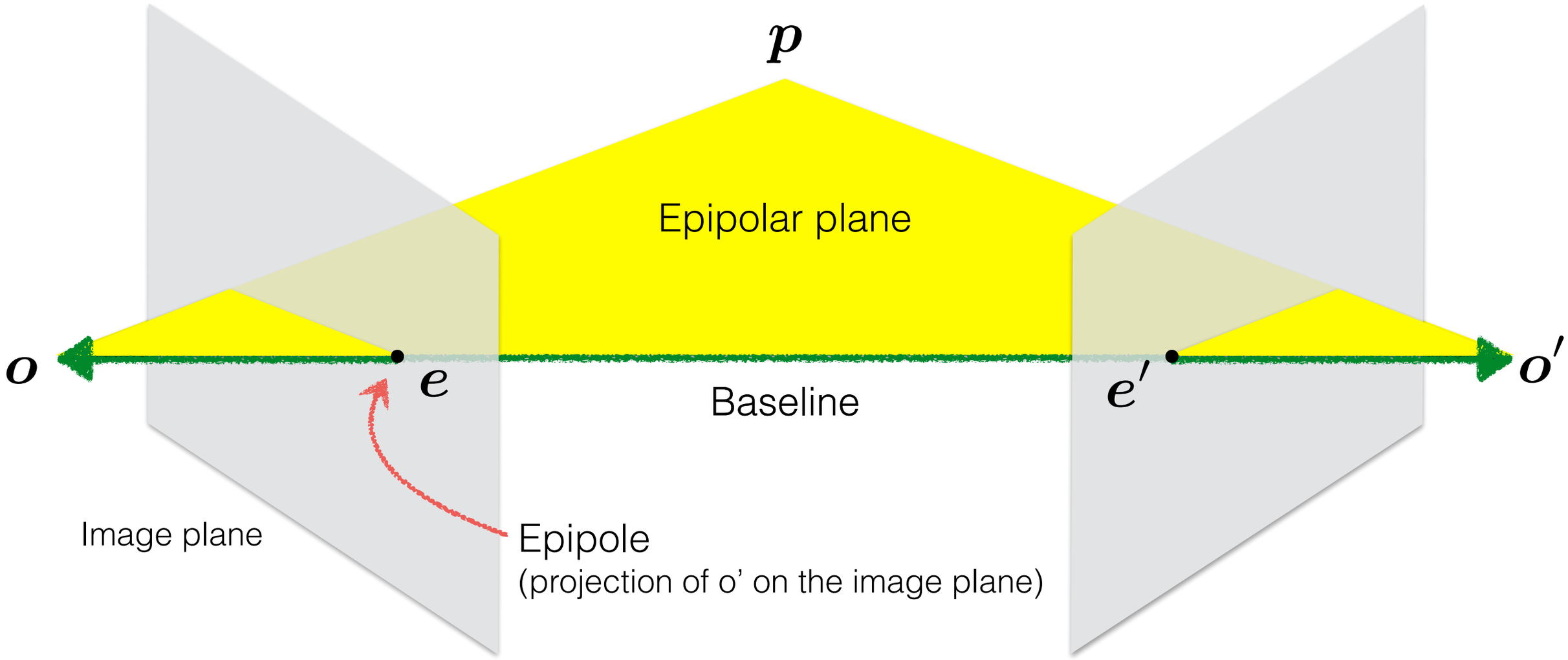
Epipolar geometry



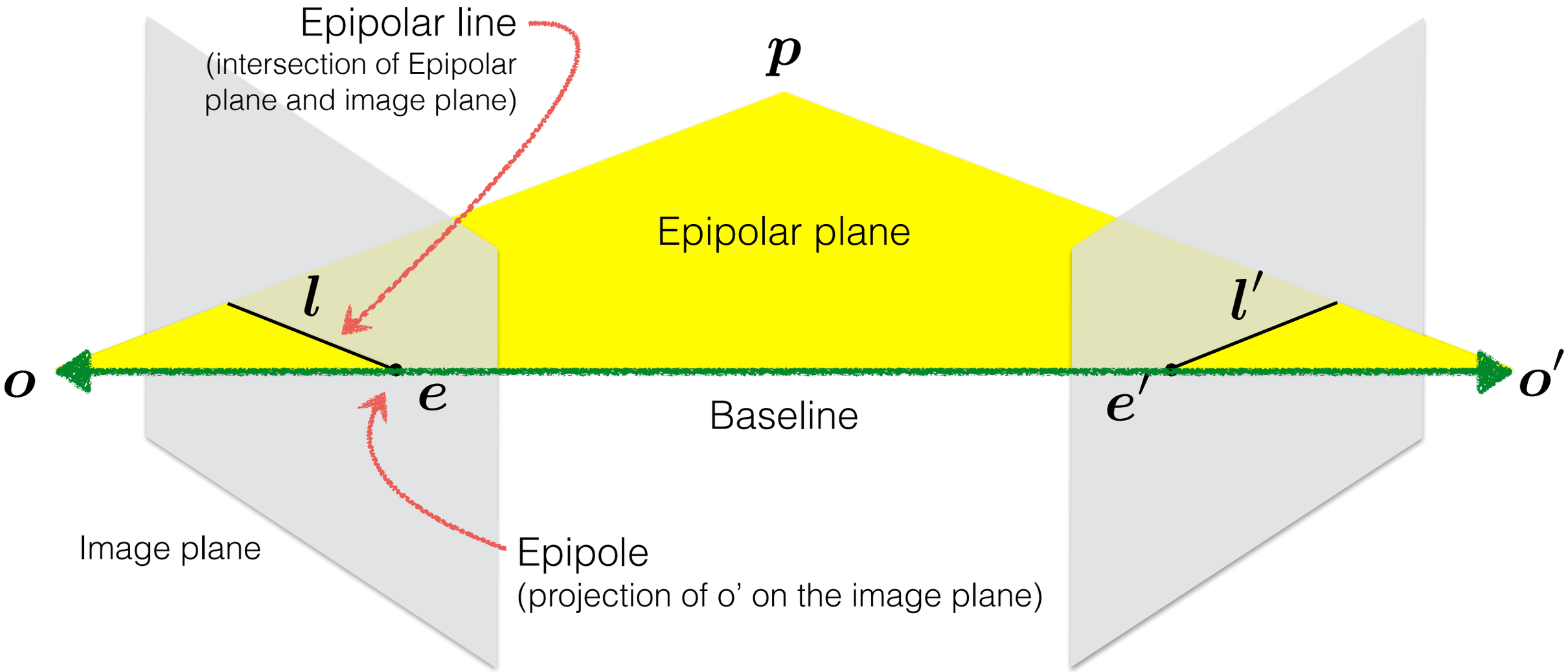
Epipolar geometry



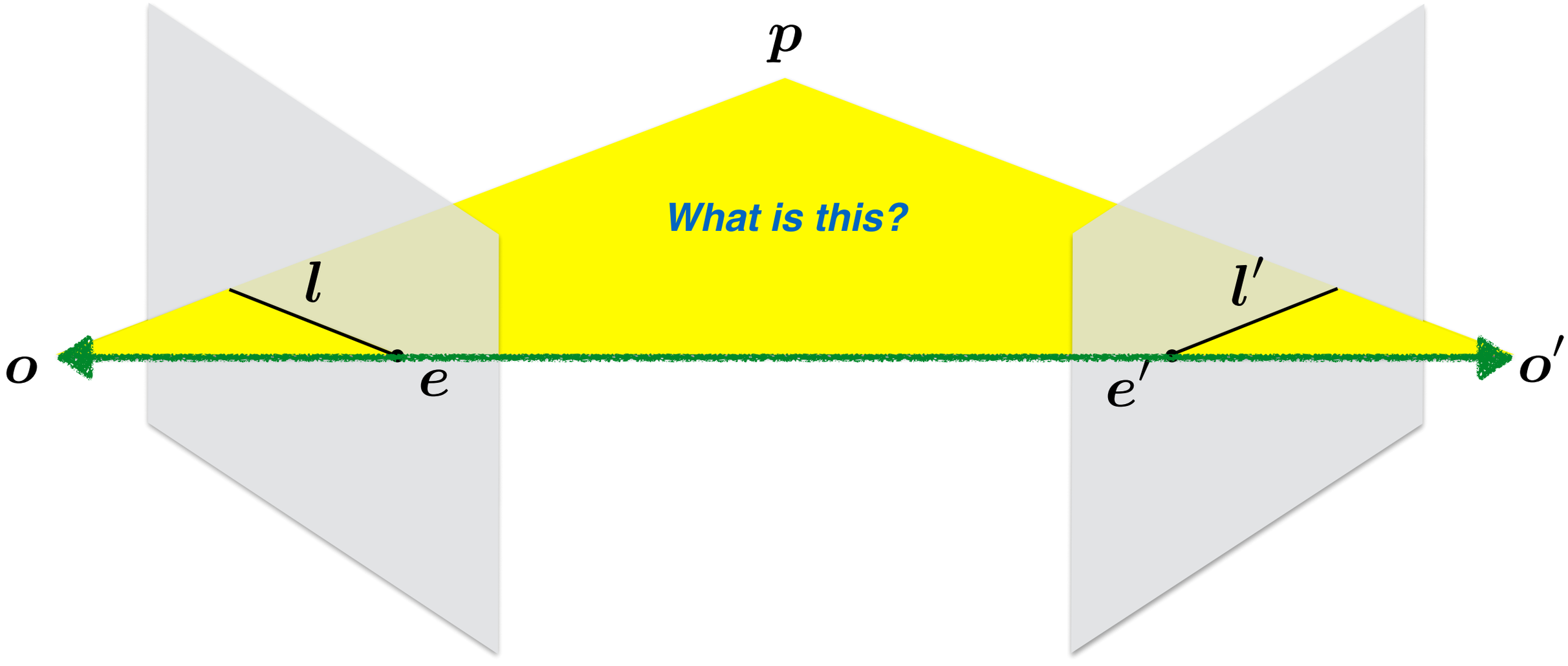
Epipolar geometry



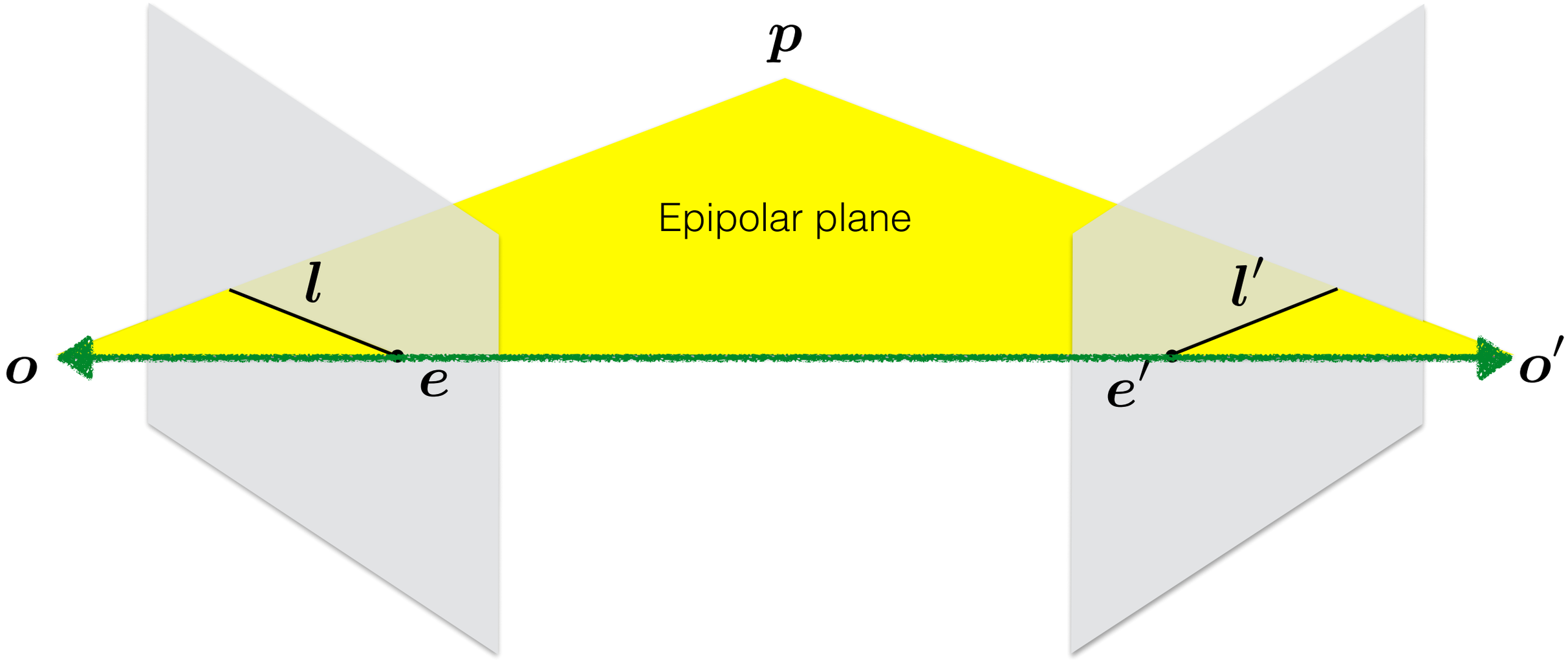
Epipolar geometry



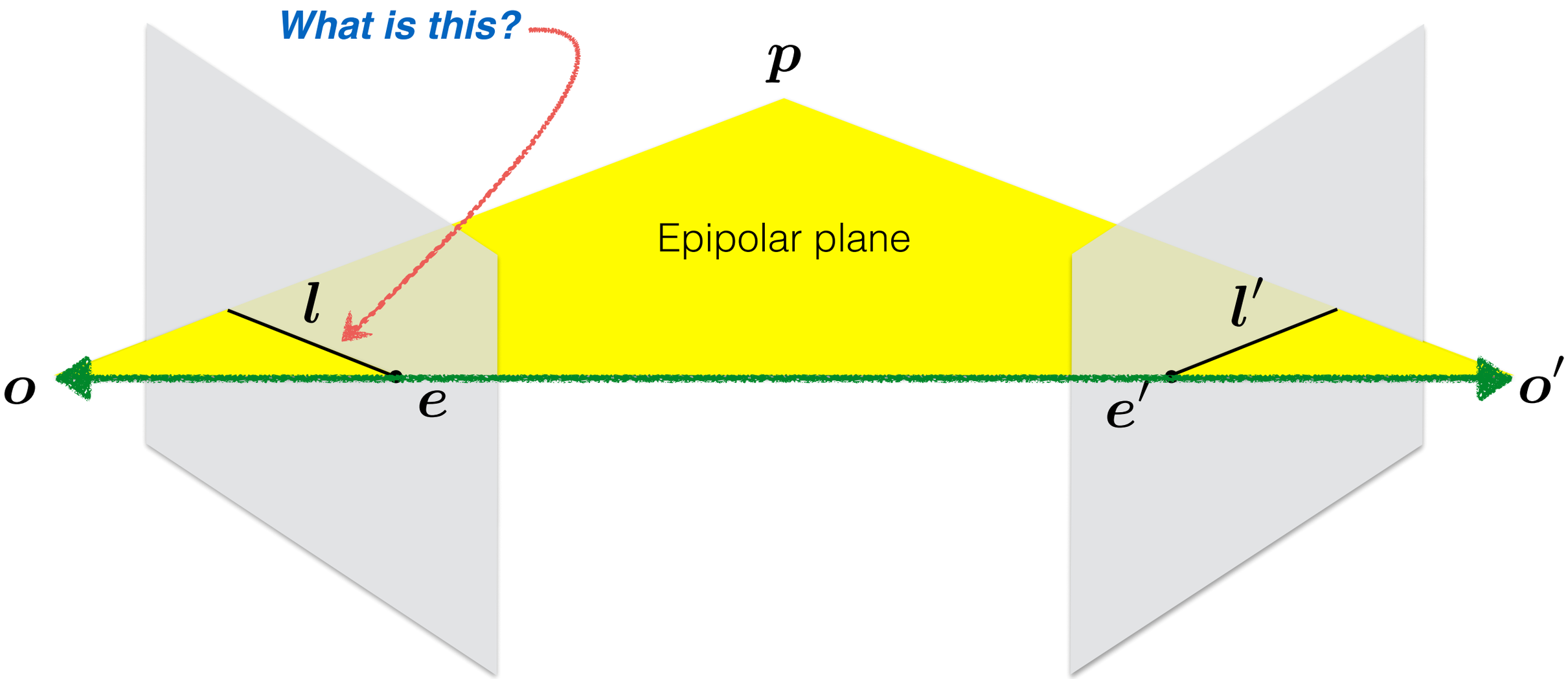
Quiz



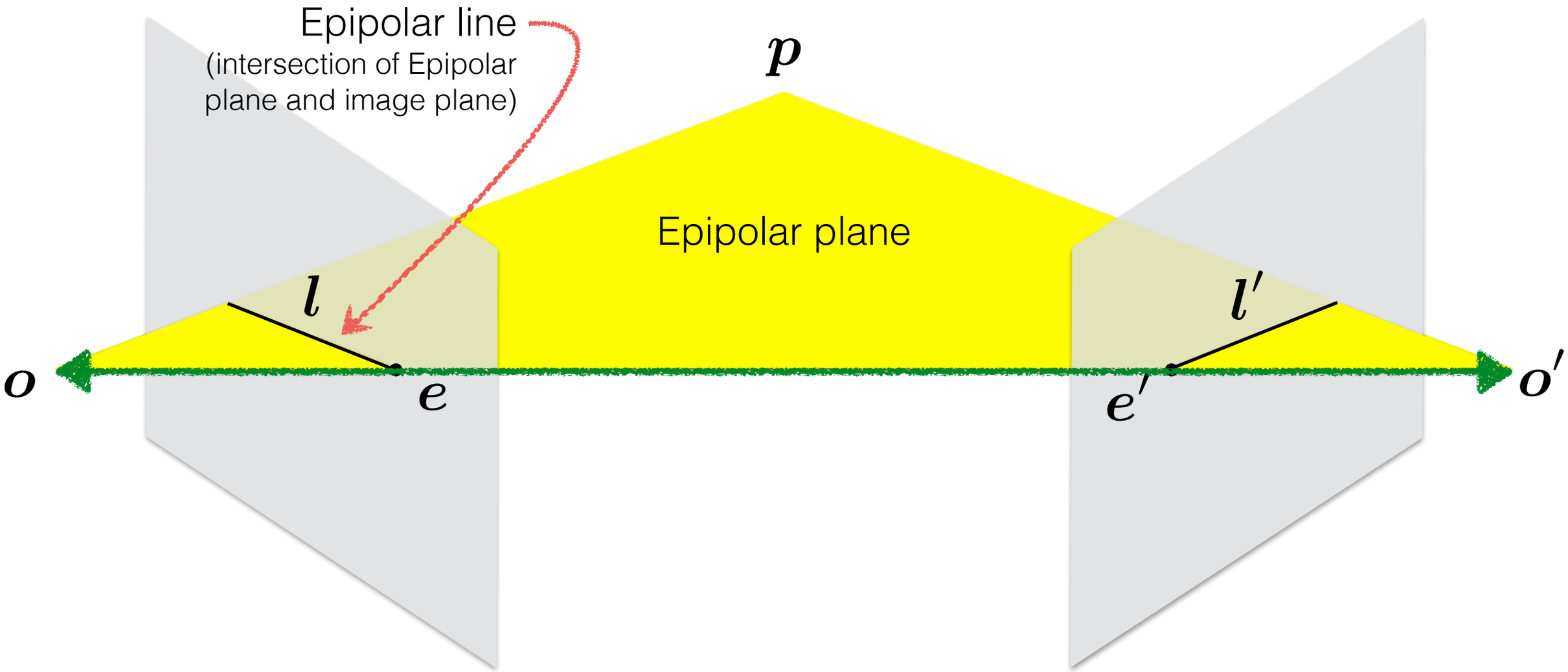
Quiz



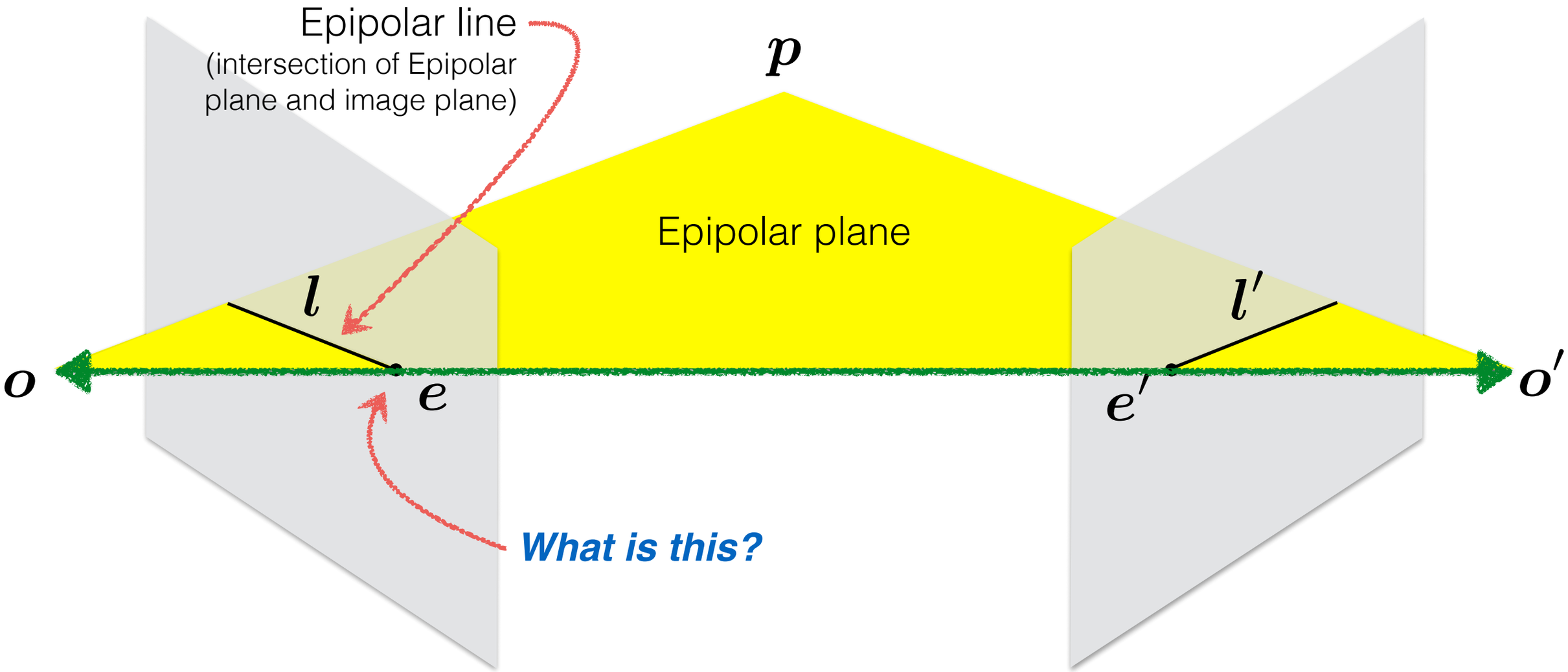
Quiz



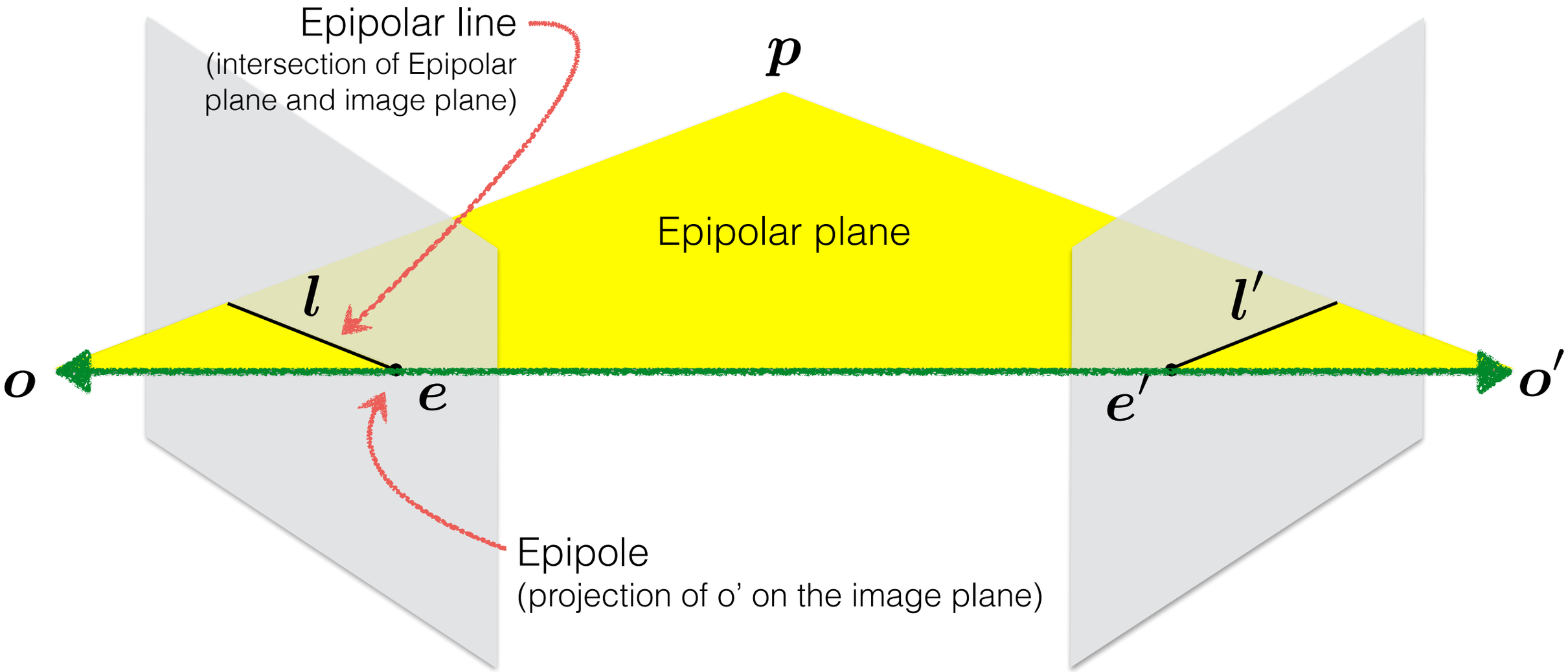
Quiz


Epipolar line
(intersection of Epipolar
plane and image plane)
p
Epipolar plane
l
l'
o
e
e'
o'

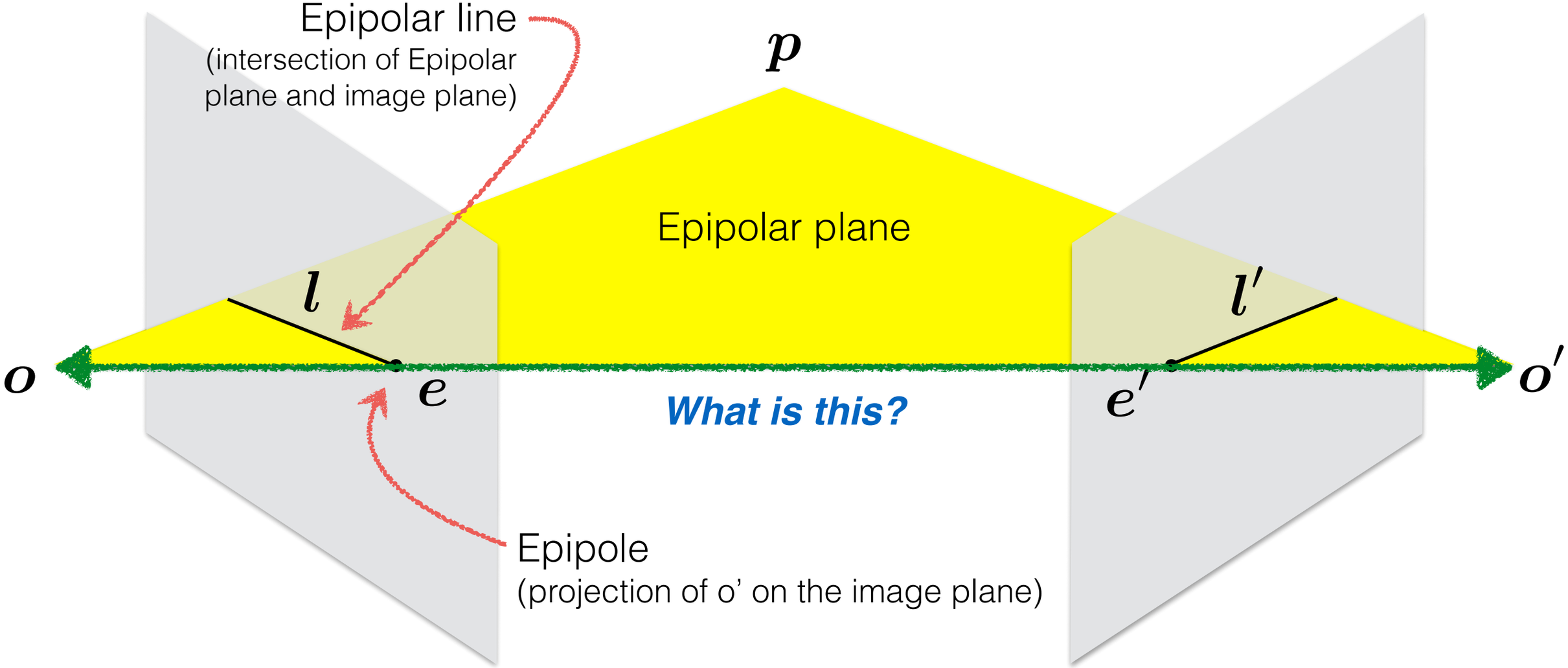
Quiz


Epipolar line
(intersection of Epipolar plane and image plane)
p
Epipolar plane
l
l'
o
e
e'
o'
What is this?

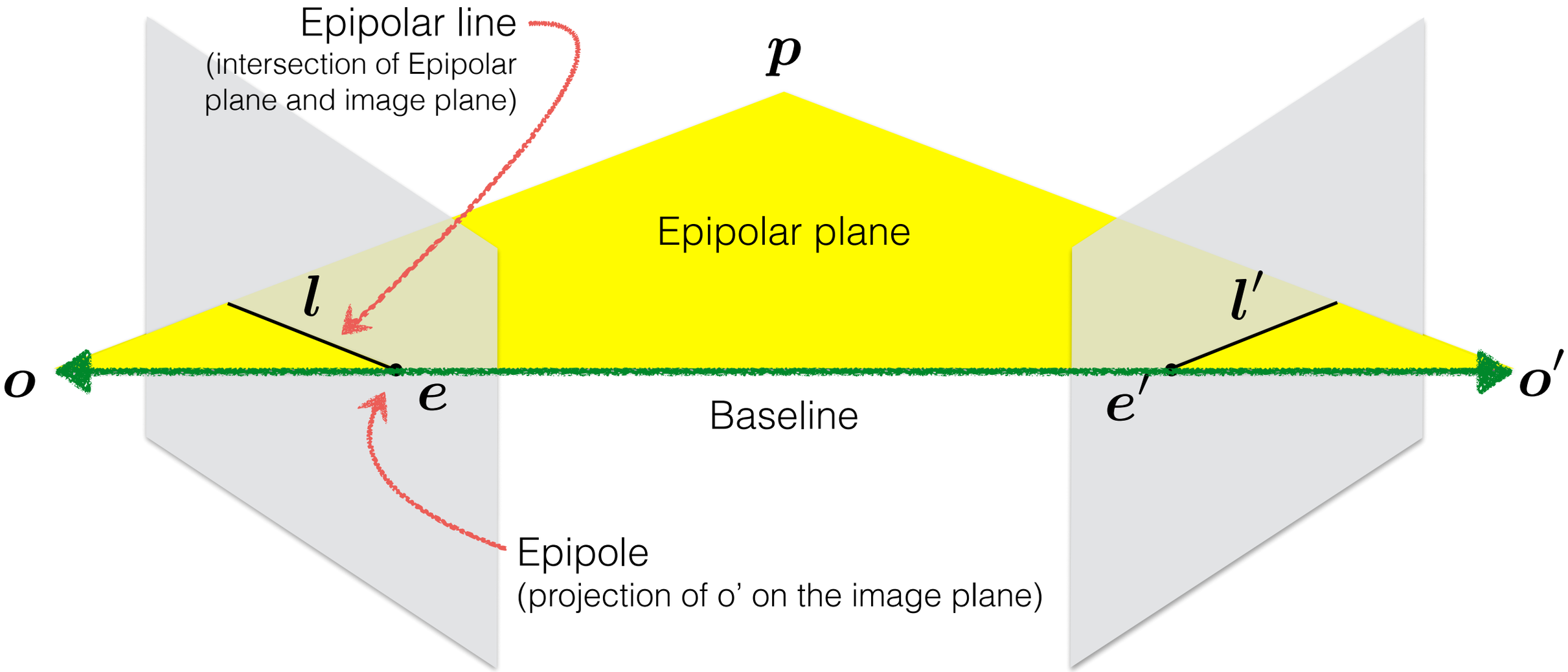
Quiz


Epipolar line
(intersection of Epipolar plane and image plane)
p
Epipolar plane
l
l'
o
e
e'
o'
Epipole
(projection of o' on the image plane)

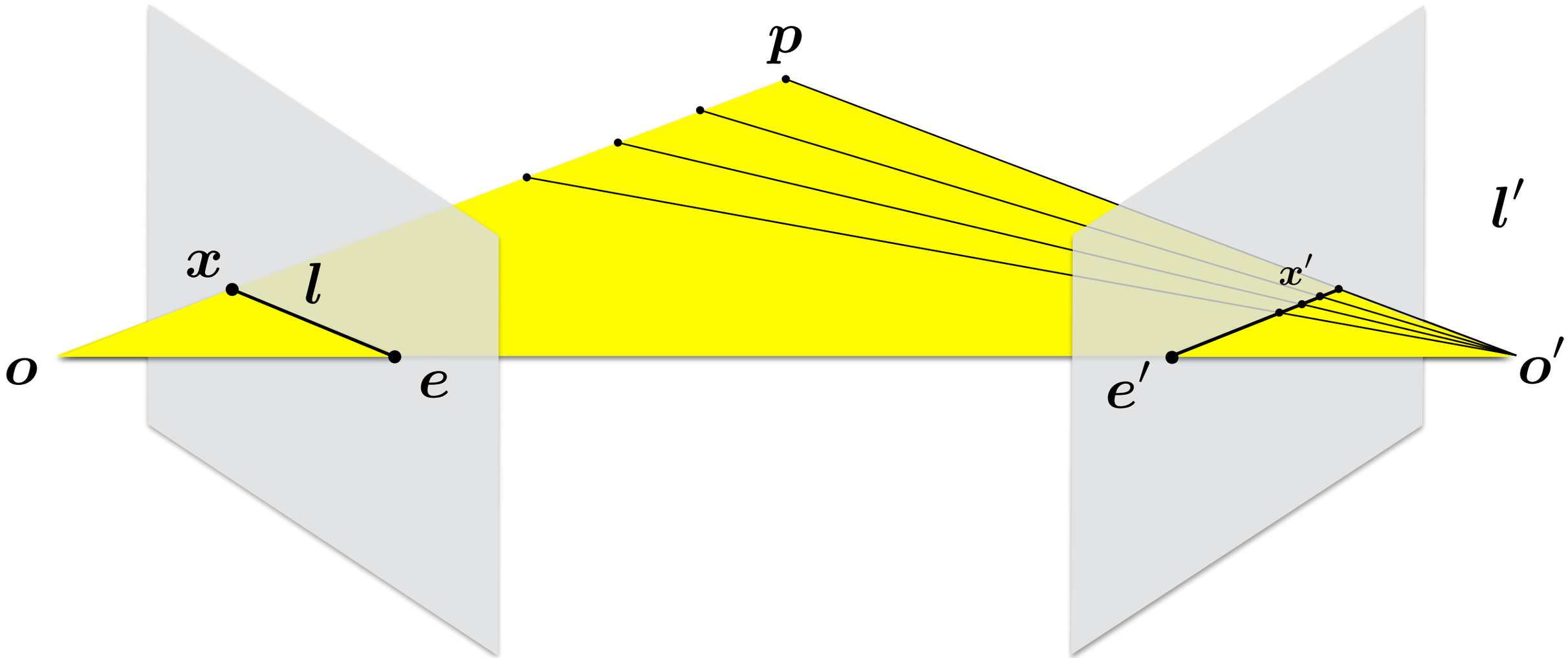
Quiz


Epipolar line
(intersection of Epipolar plane and image plane)
p
Epipolar plane
l
l'
o
e
e'
o'
What is this?
Epipole
(projection of o' on the image plane)

Quiz

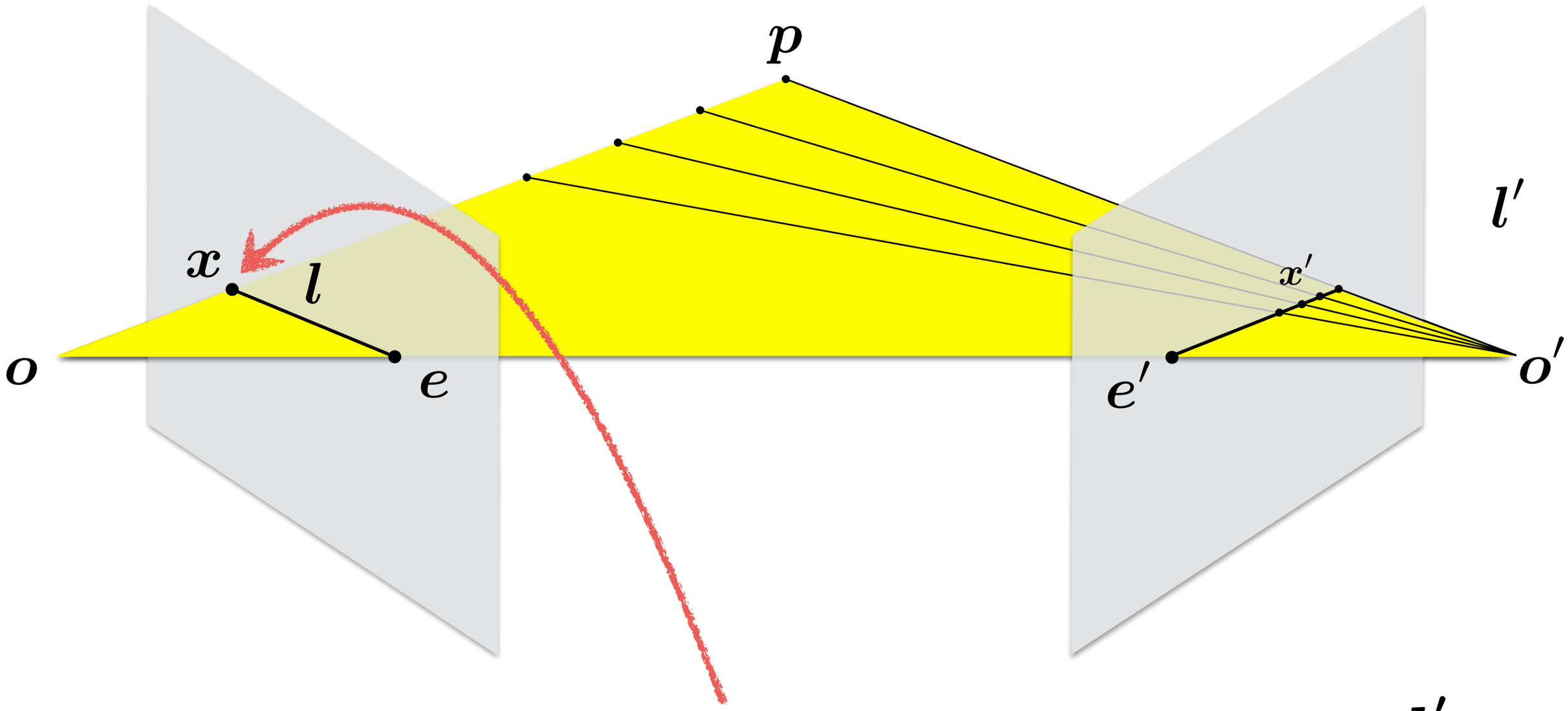

Epipolar line
(intersection of Epipolar plane and image plane)
p
Epipolar plane
l
l'
o
e
e'
o'
Baseline
Epipole
(projection of o' on the image plane)

Epipolar constraint



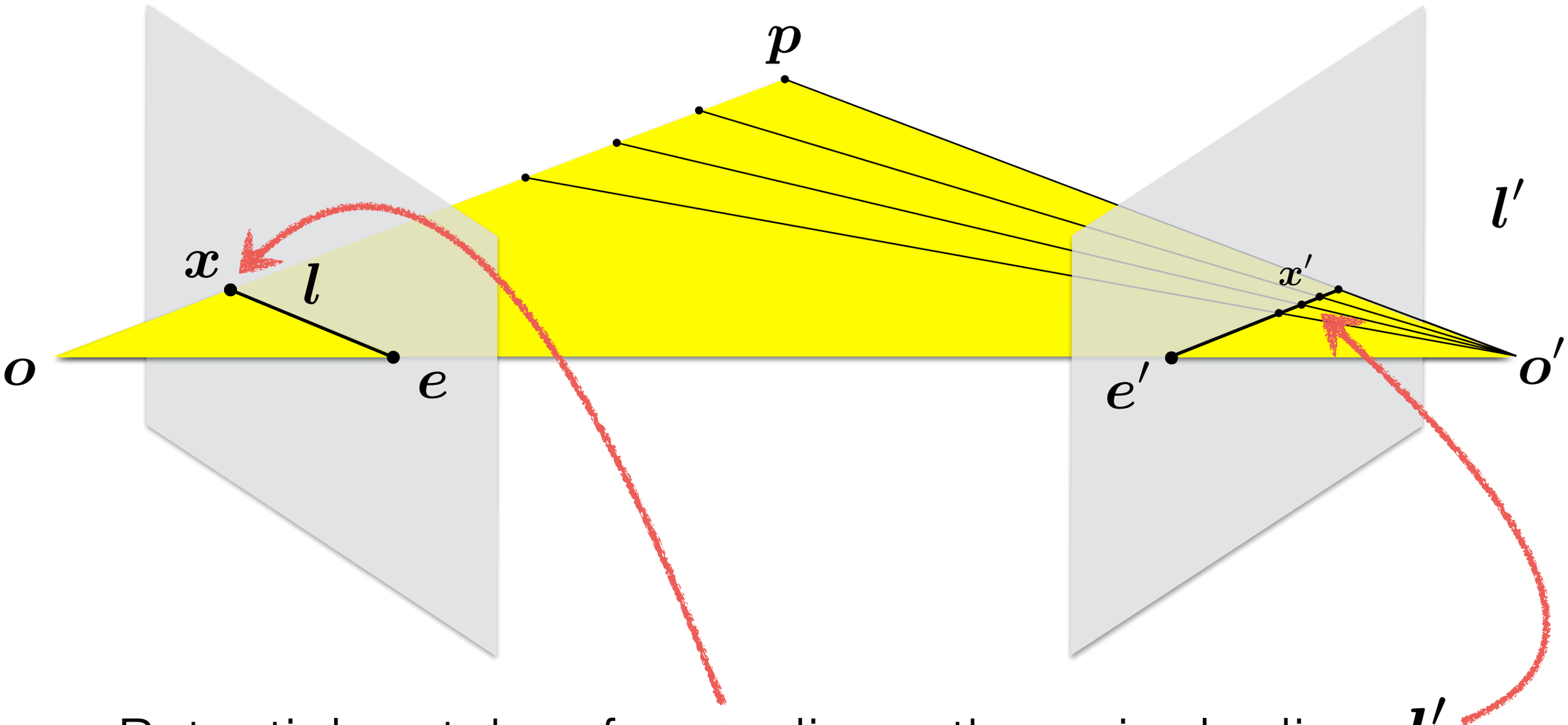
Potential matches for x lie on the epipolar line l'

Epipolar constraint

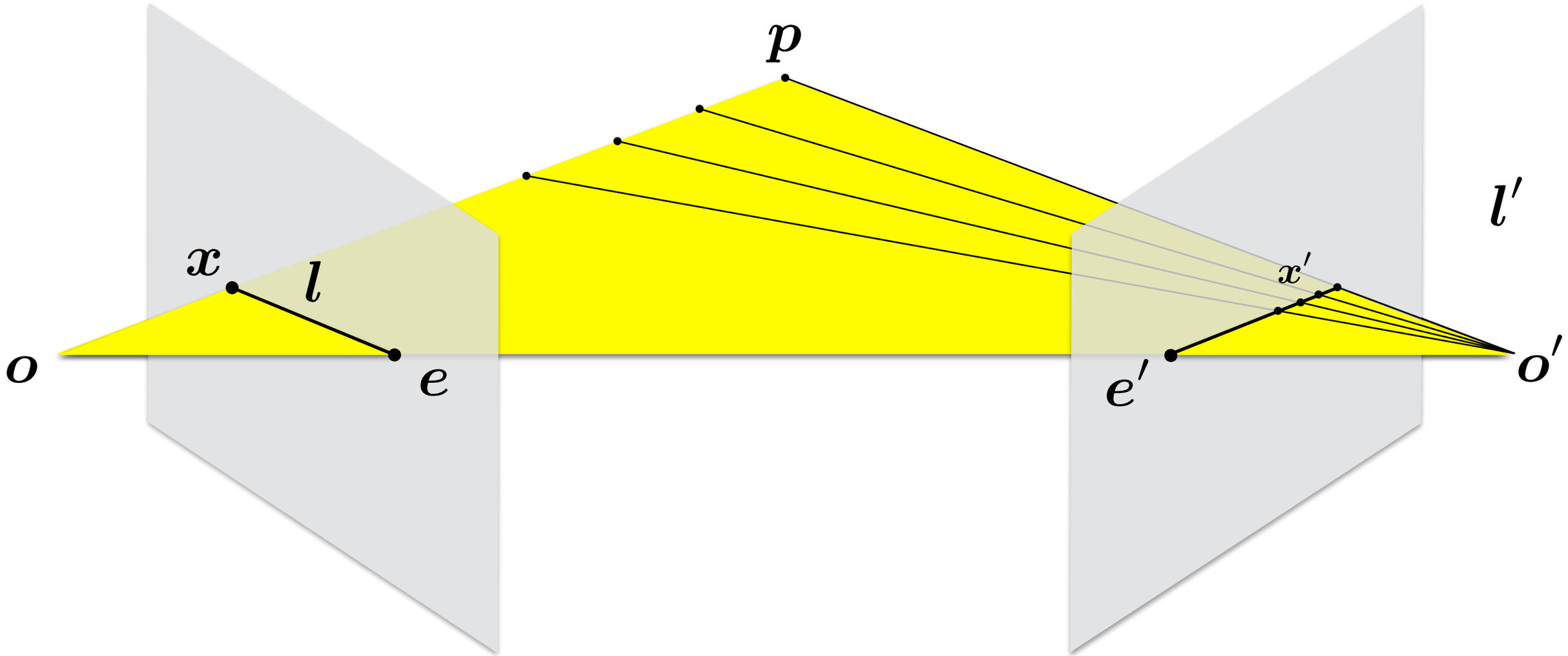


Potential matches for x lie on the epipolar line l'

Epipolar constraint



Potential matches for x lie on the epipolar line l'



The point **x** (left image) maps to a _____ in the right image

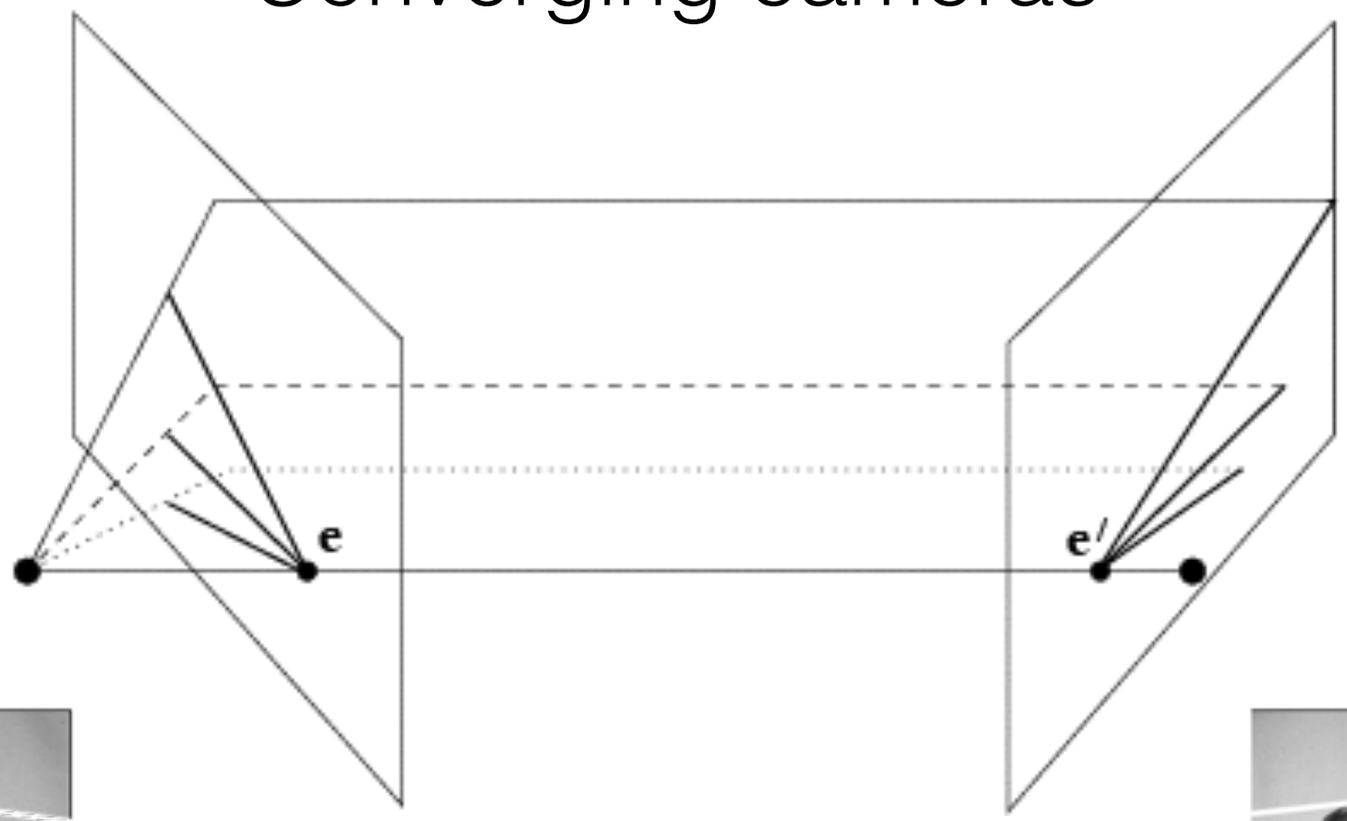
The baseline connects the _____ and _____

An epipolar line (left image) maps to a _____ in the right image

An epipole **e** is a projection of the _____ on the image plane

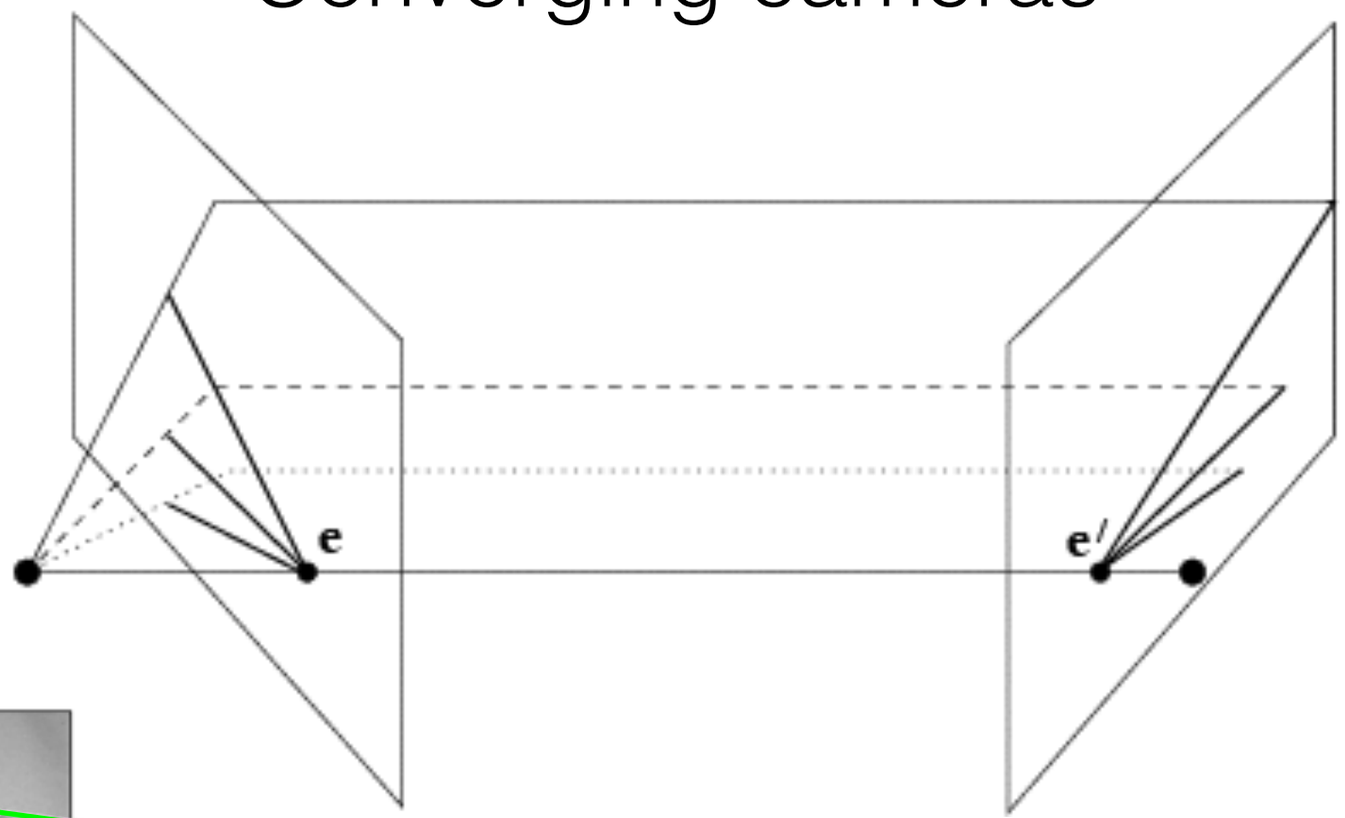
All epipolar lines in an image intersect at the _____

Converging cameras



Where is the epipole in this image?

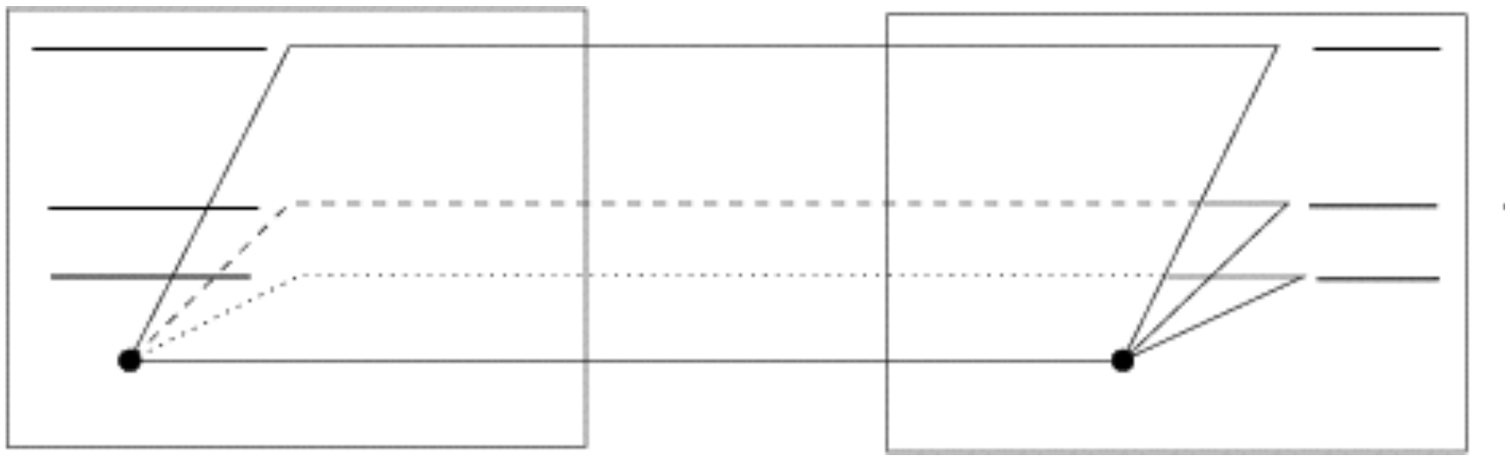
Converging cameras



Where is the epipole in this image?

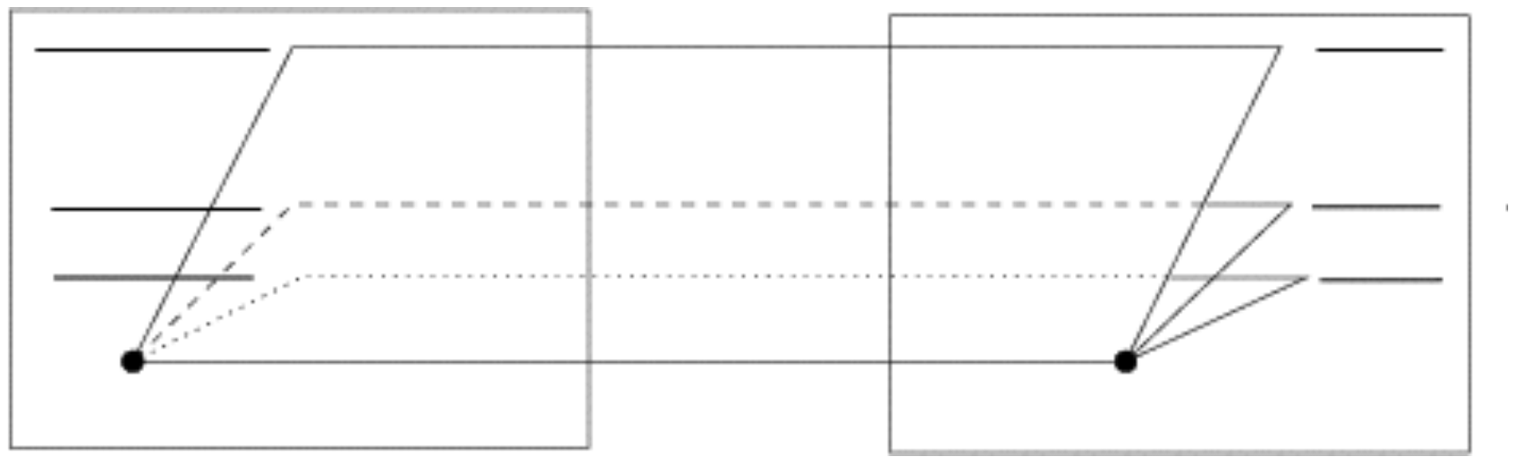
It's not always in the image

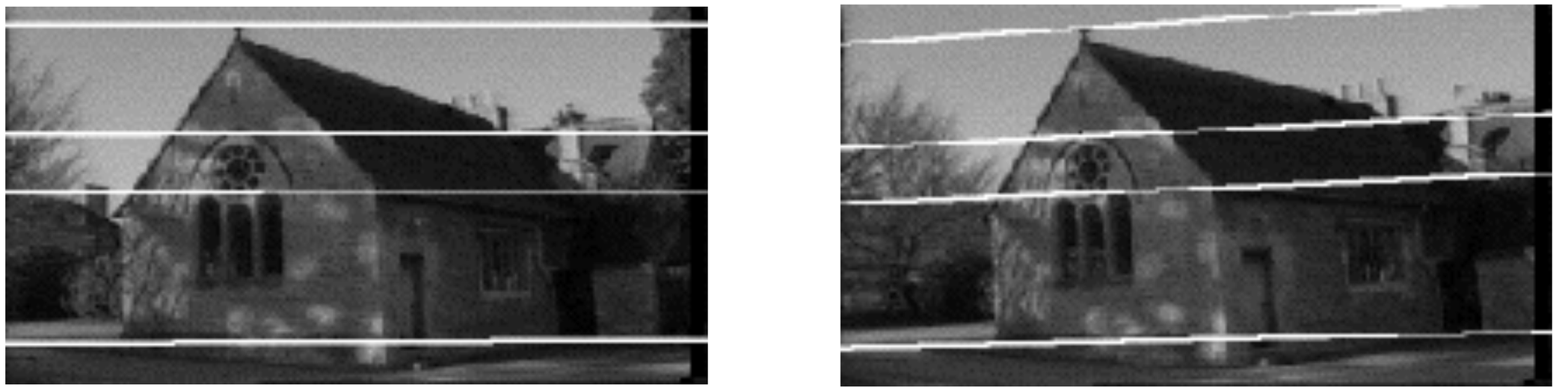
Parallel cameras



Where is the epipole?

Parallel cameras





epipole at infinity

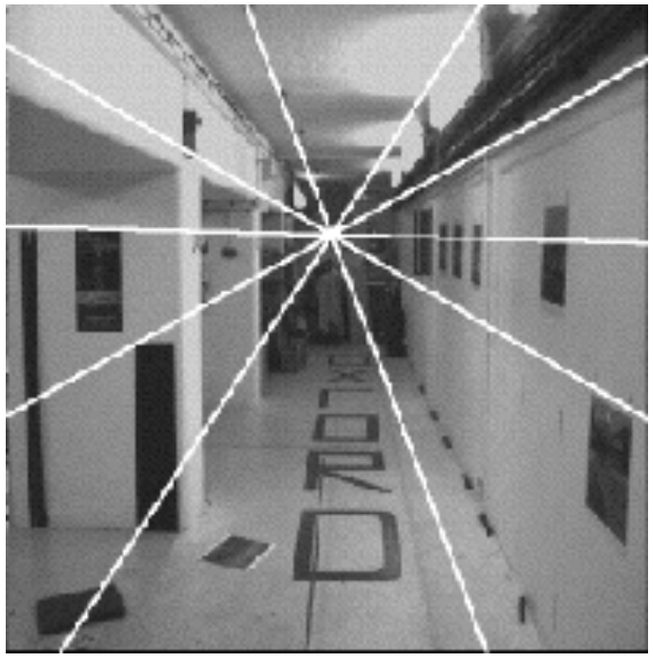
Forward moving camera

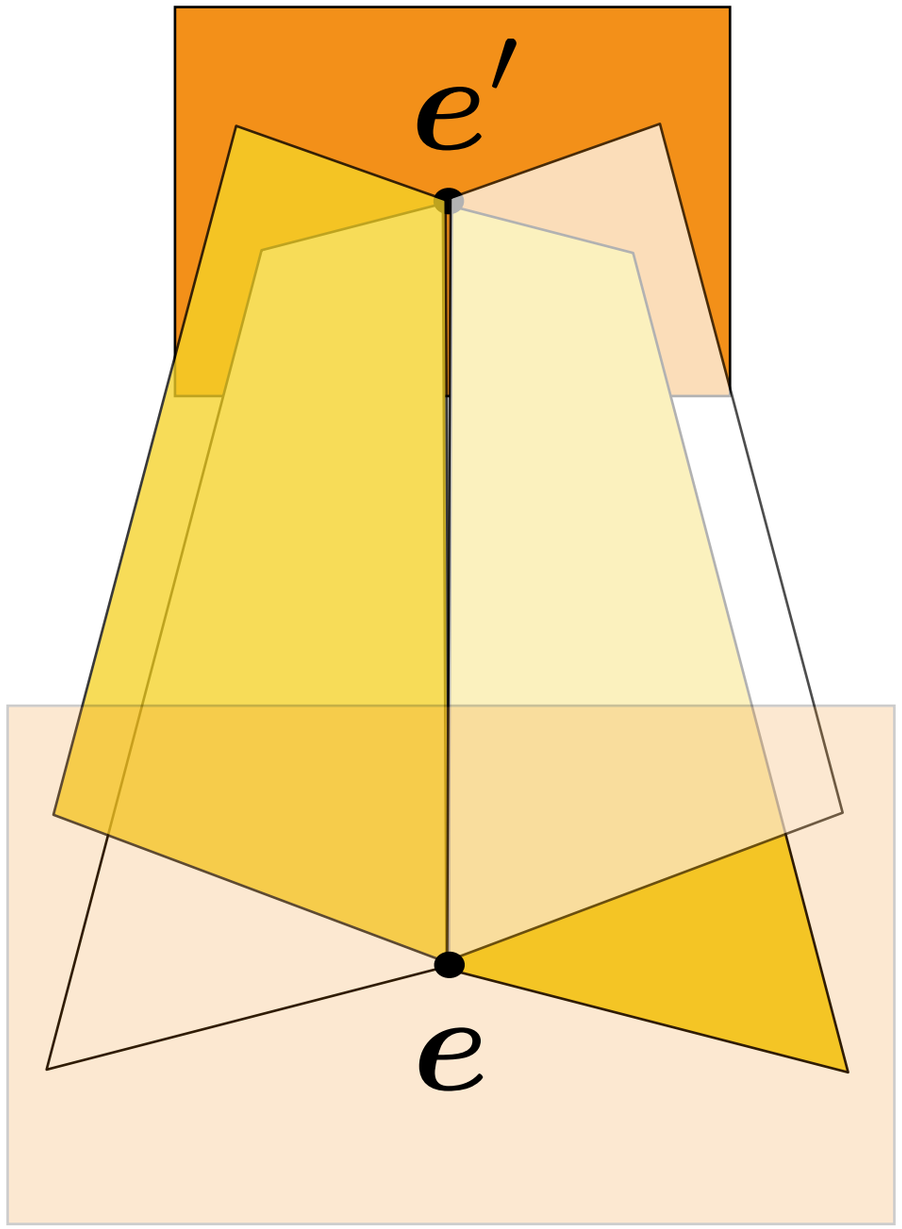
Forward moving camera

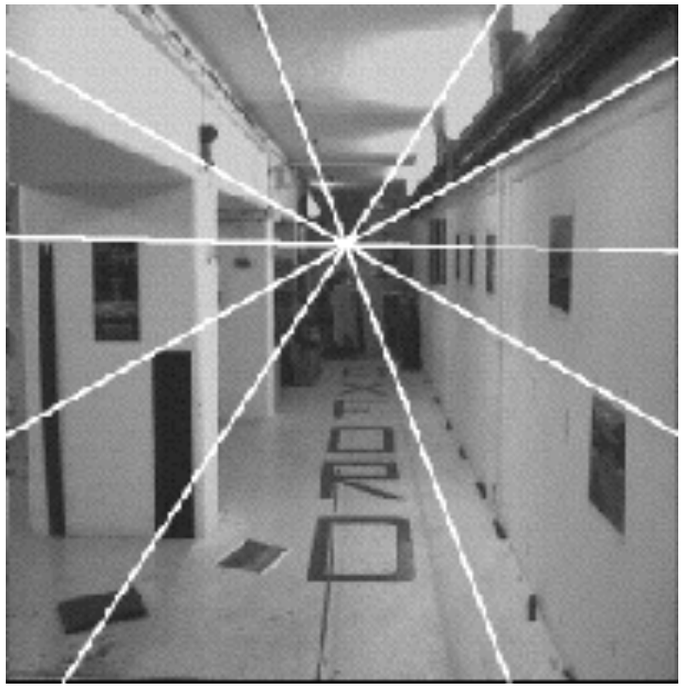
Where is the epipole?

What do the epipolar lines look like?

Epipole has same coordinates in both images.
Points move along lines radiating from “Focus of expansion”

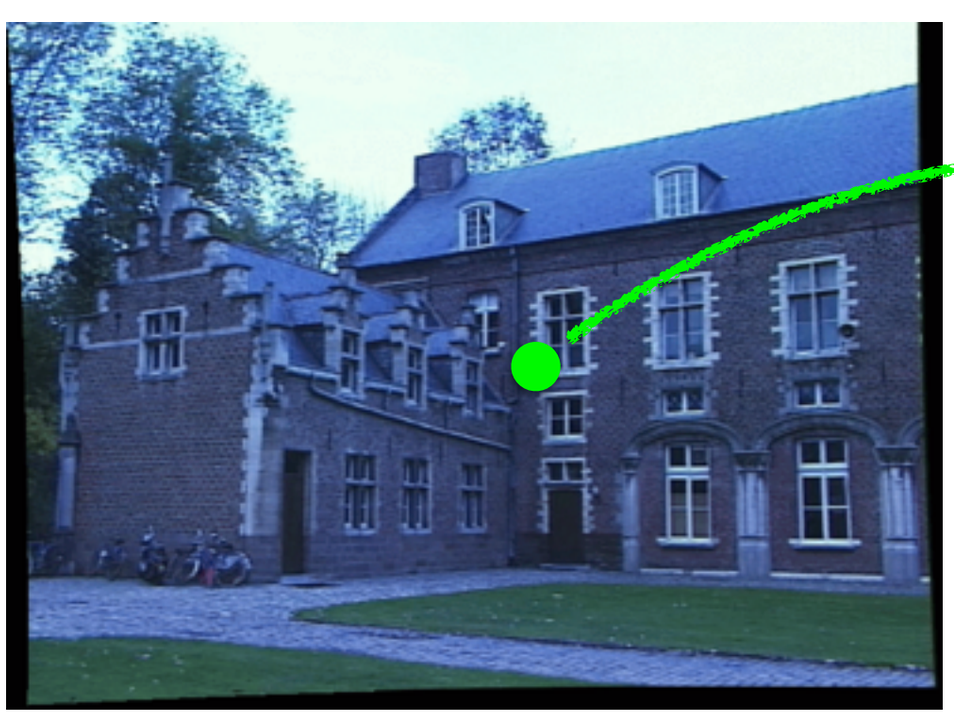




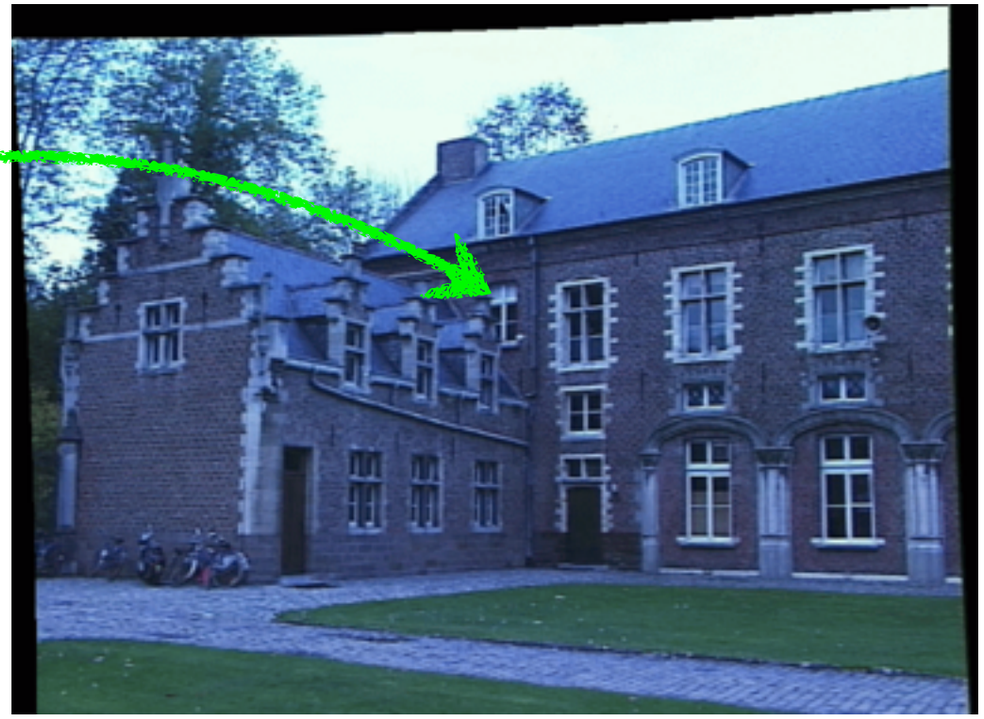


The epipolar constraint is an important concept for stereo vision

Task: Match point in left image to point in right image



Left image

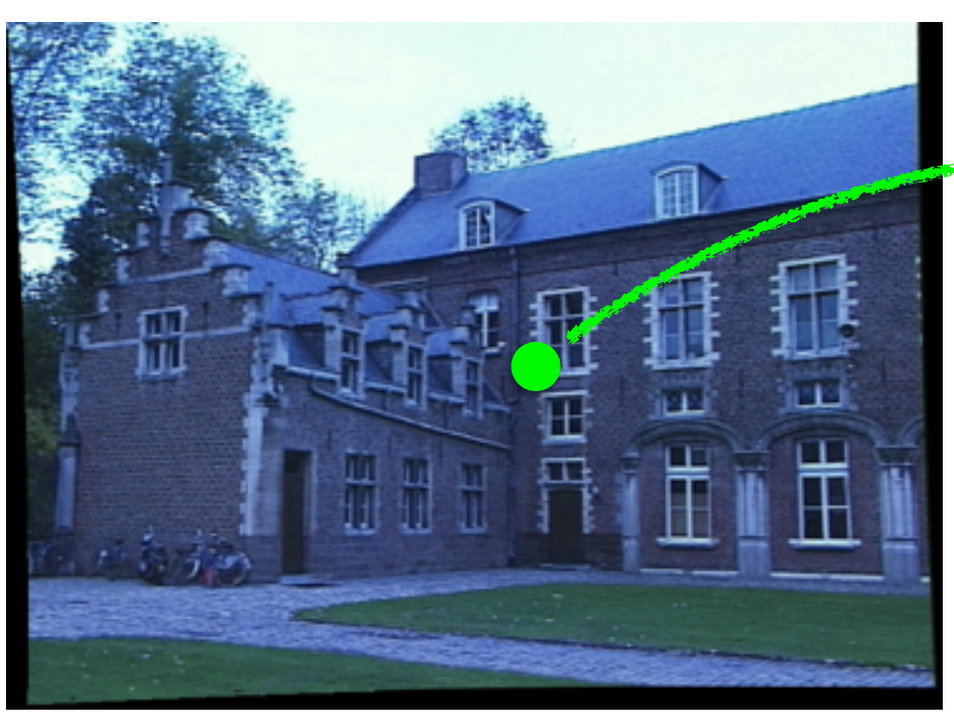


Right image

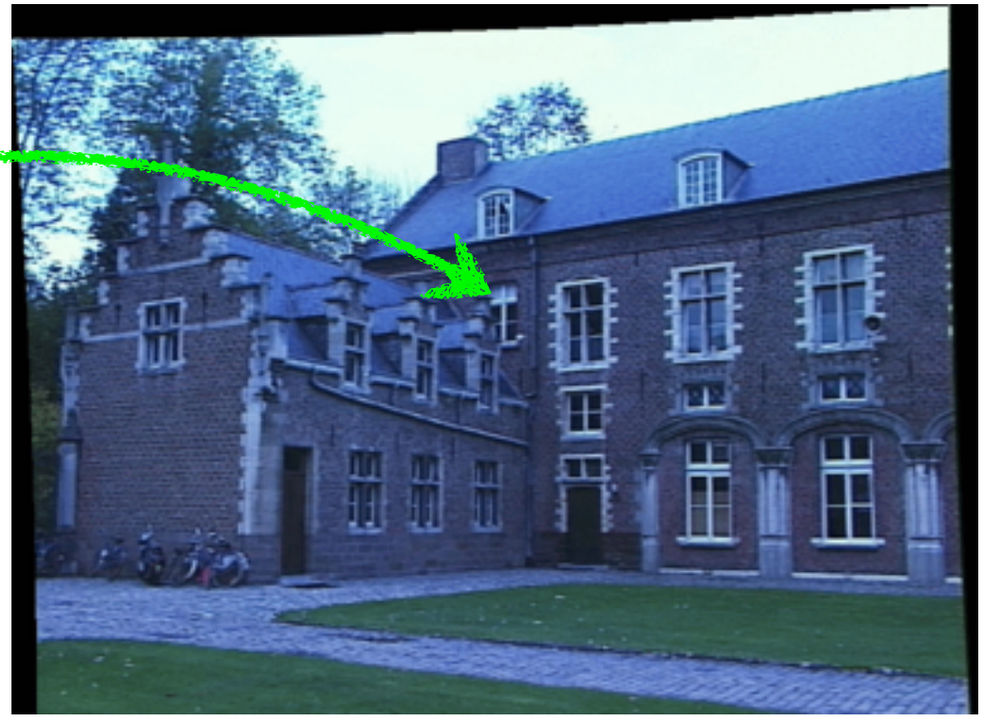
How would you do it?

The epipolar constraint is an important concept for stereo vision

Task: Match point in left image to point in right image



Left image



Right image

Want to avoid search over entire image

(if the images have been rectified)
Epipolar constrain reduces search to a single line

iv-tec

imagination and vision