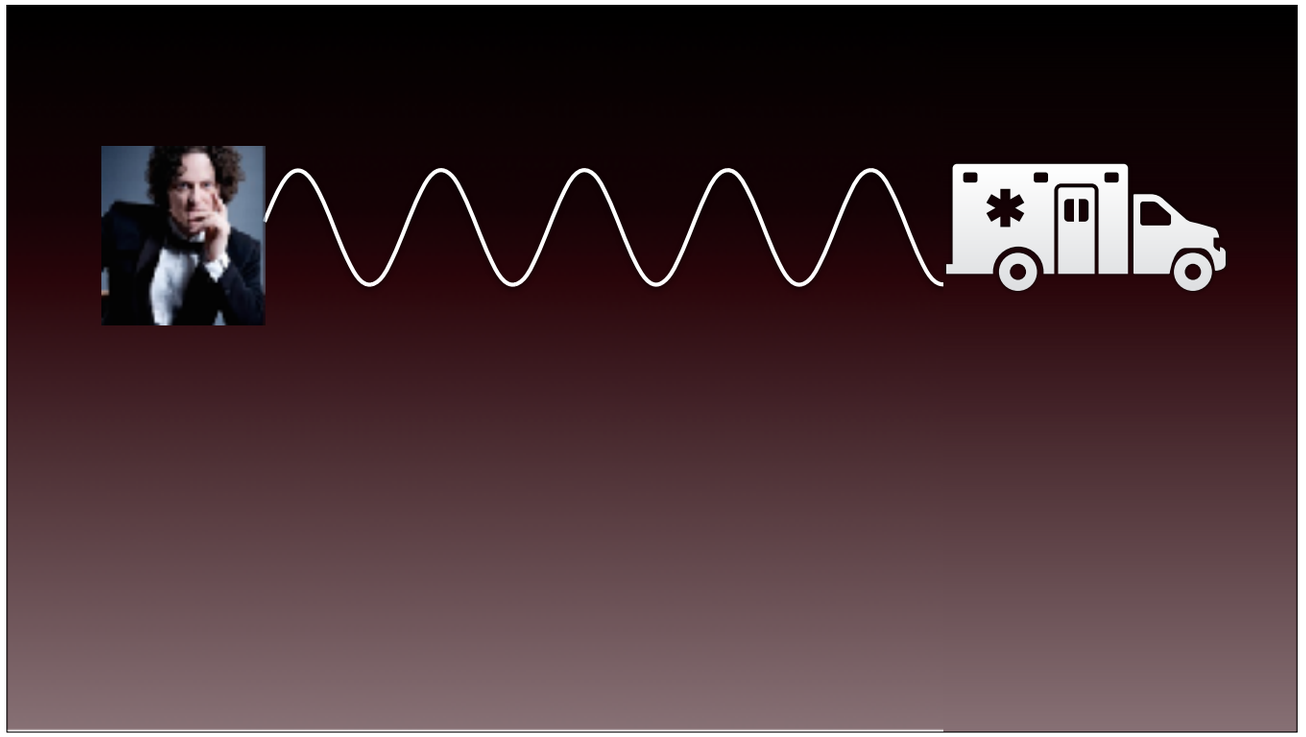
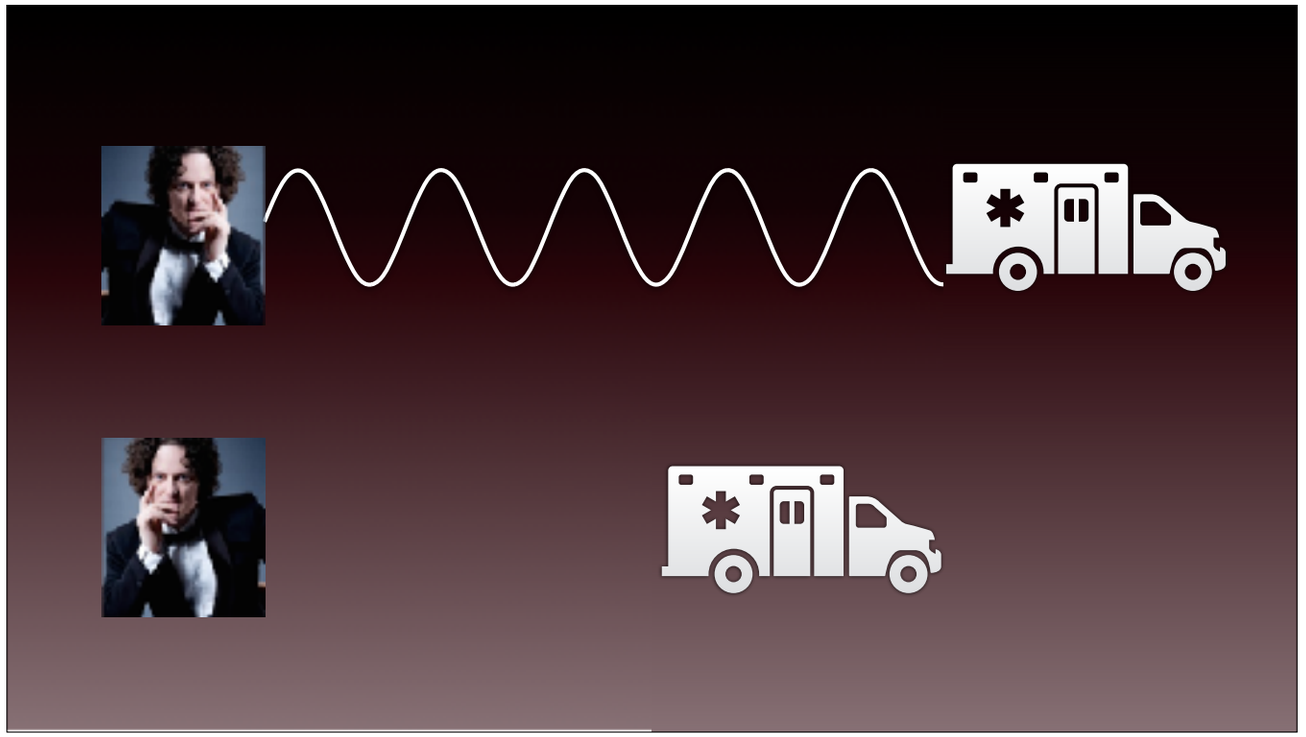
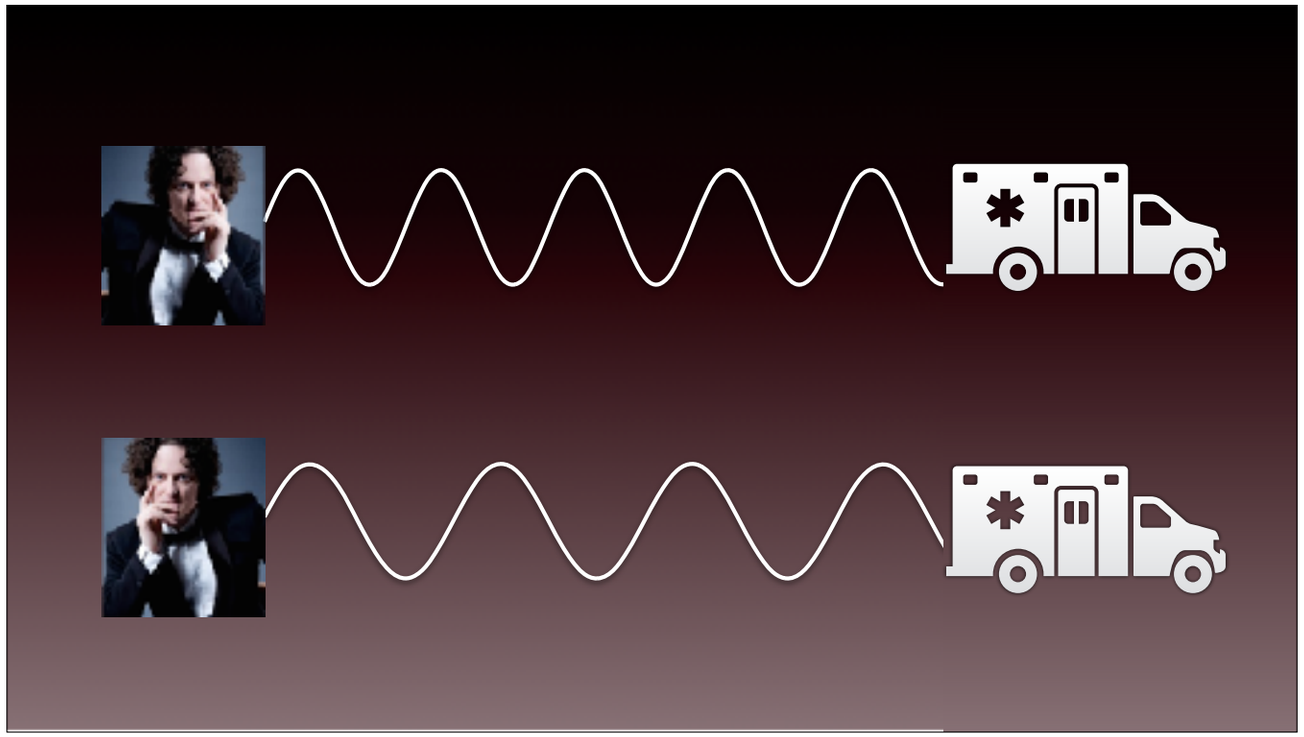
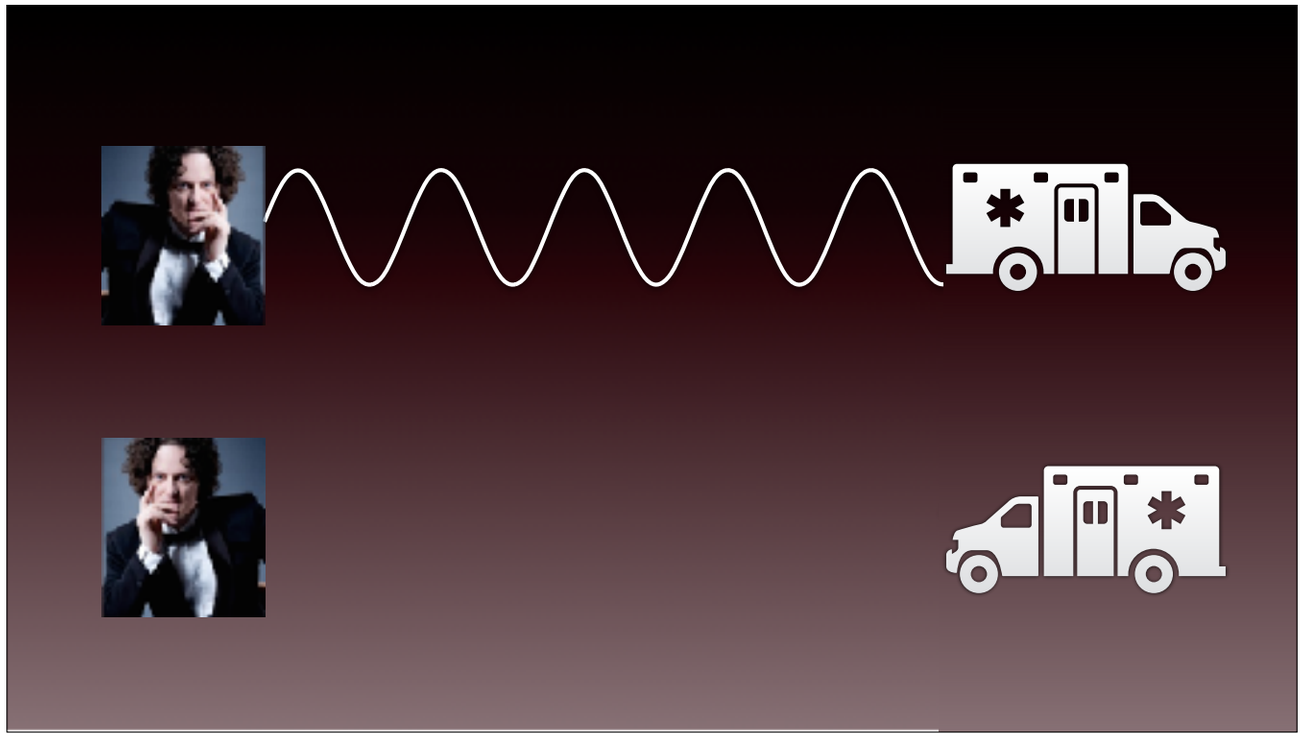
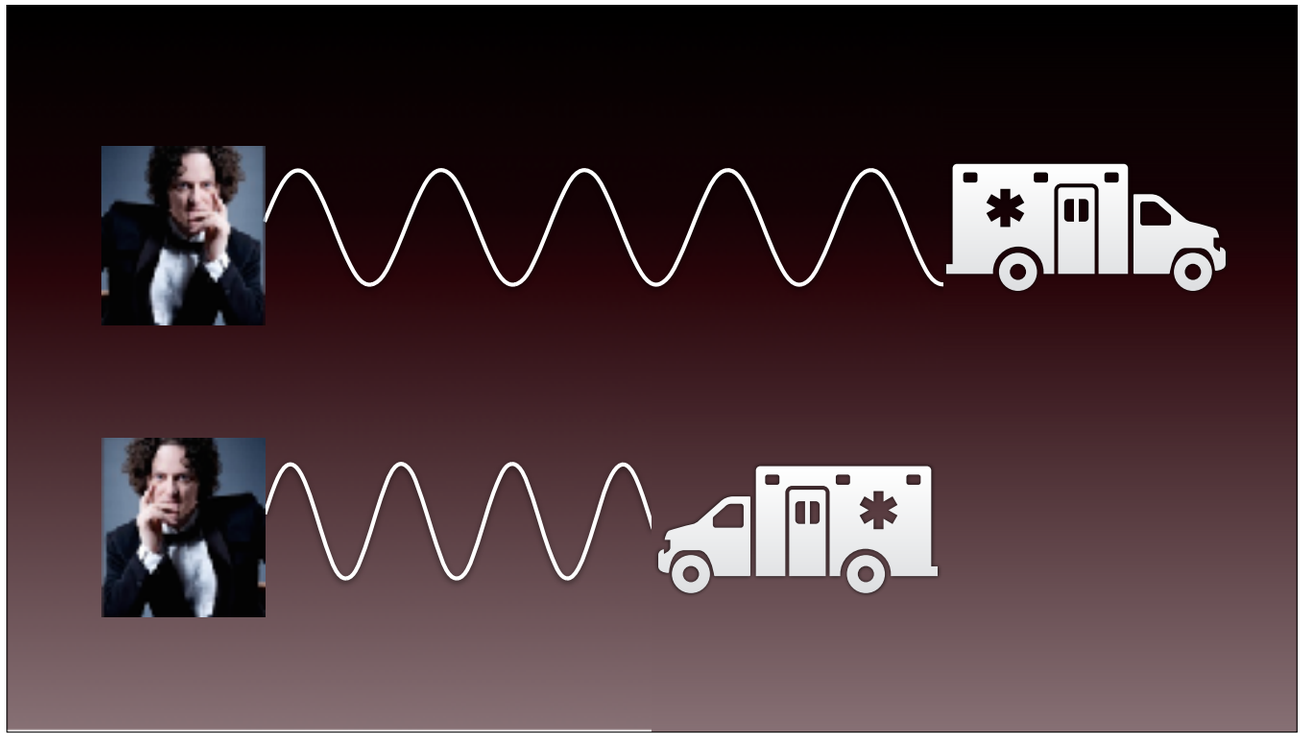
Doppler Effect

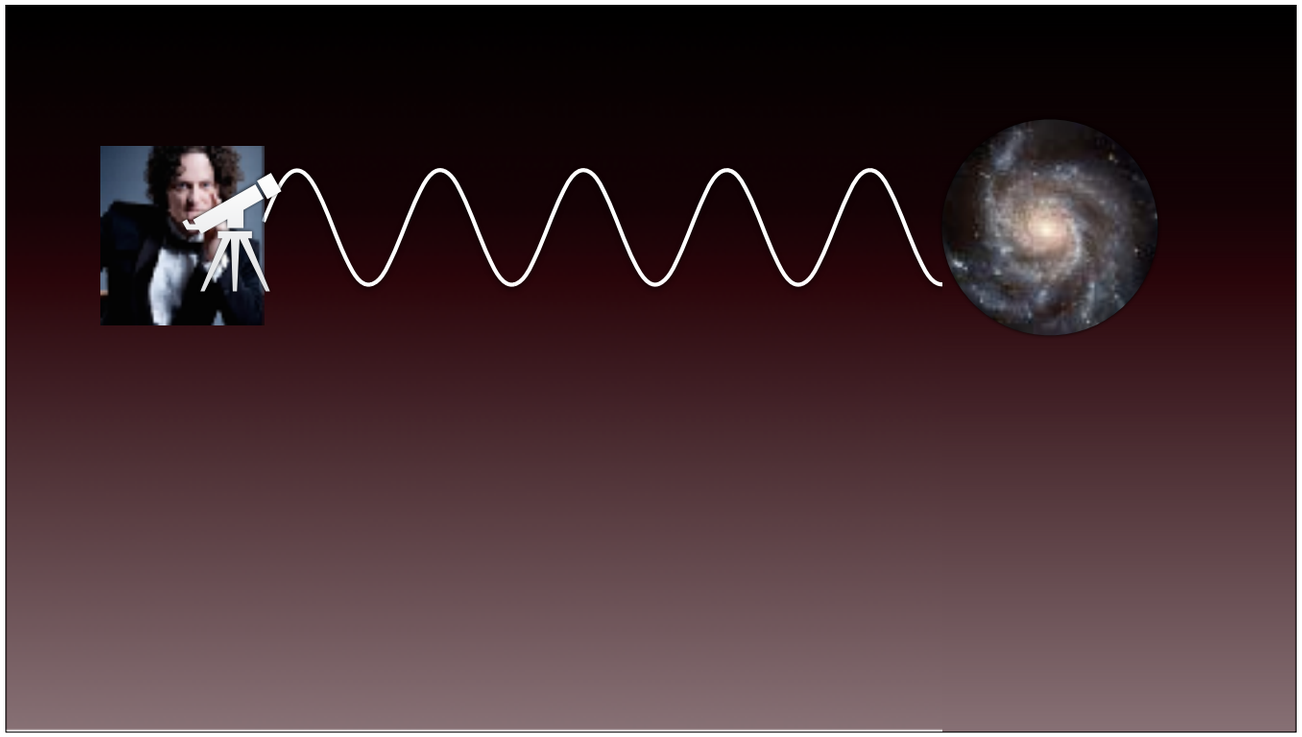


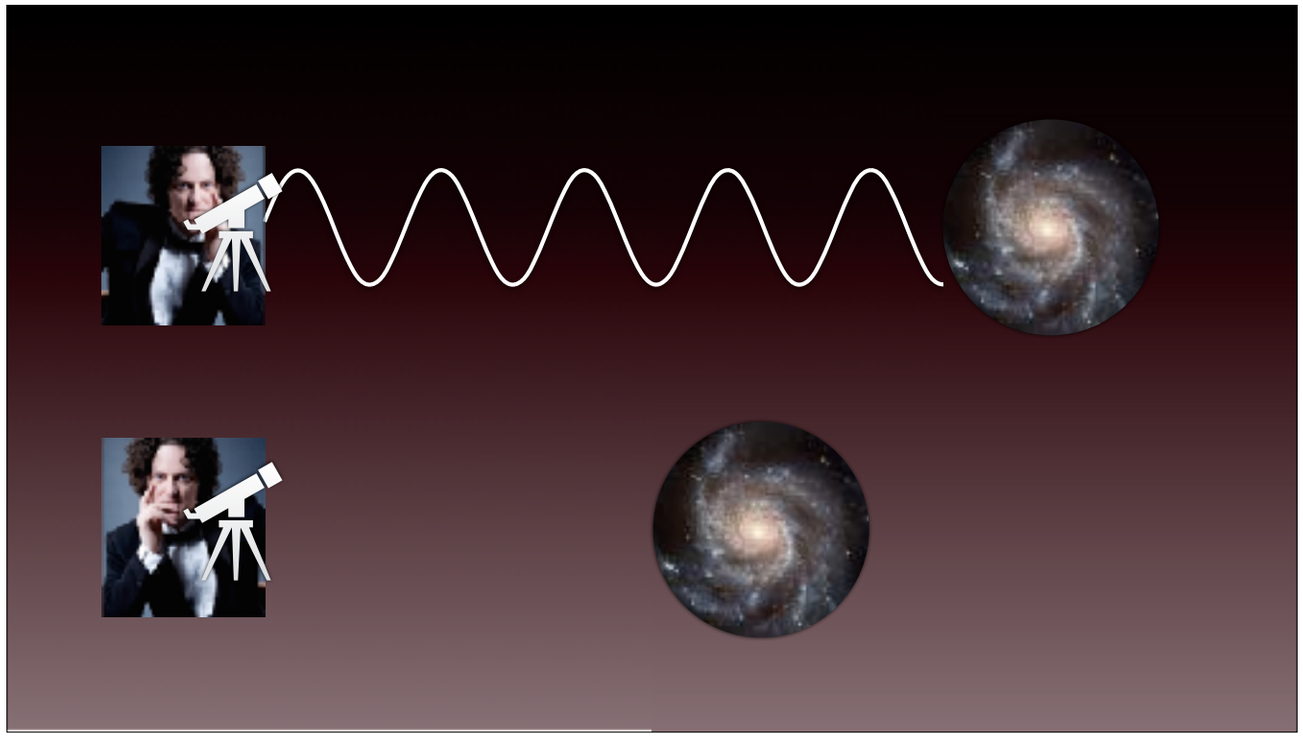


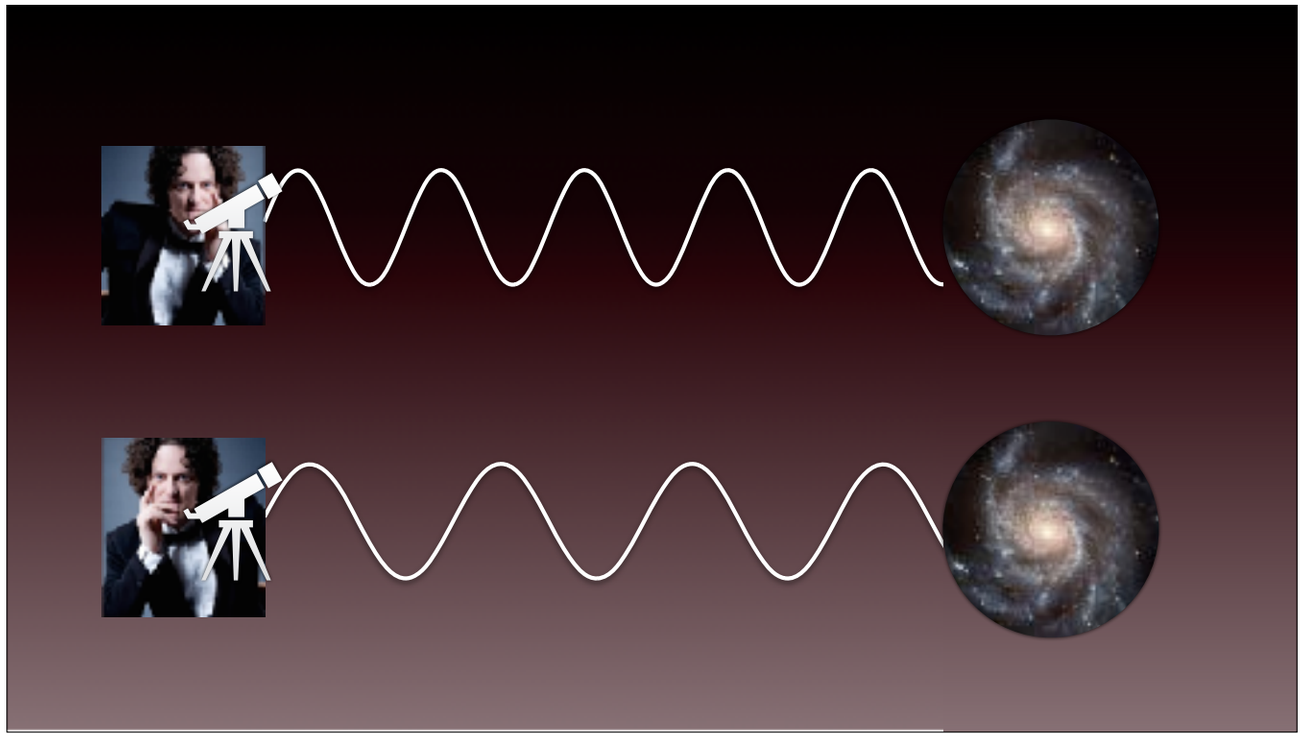


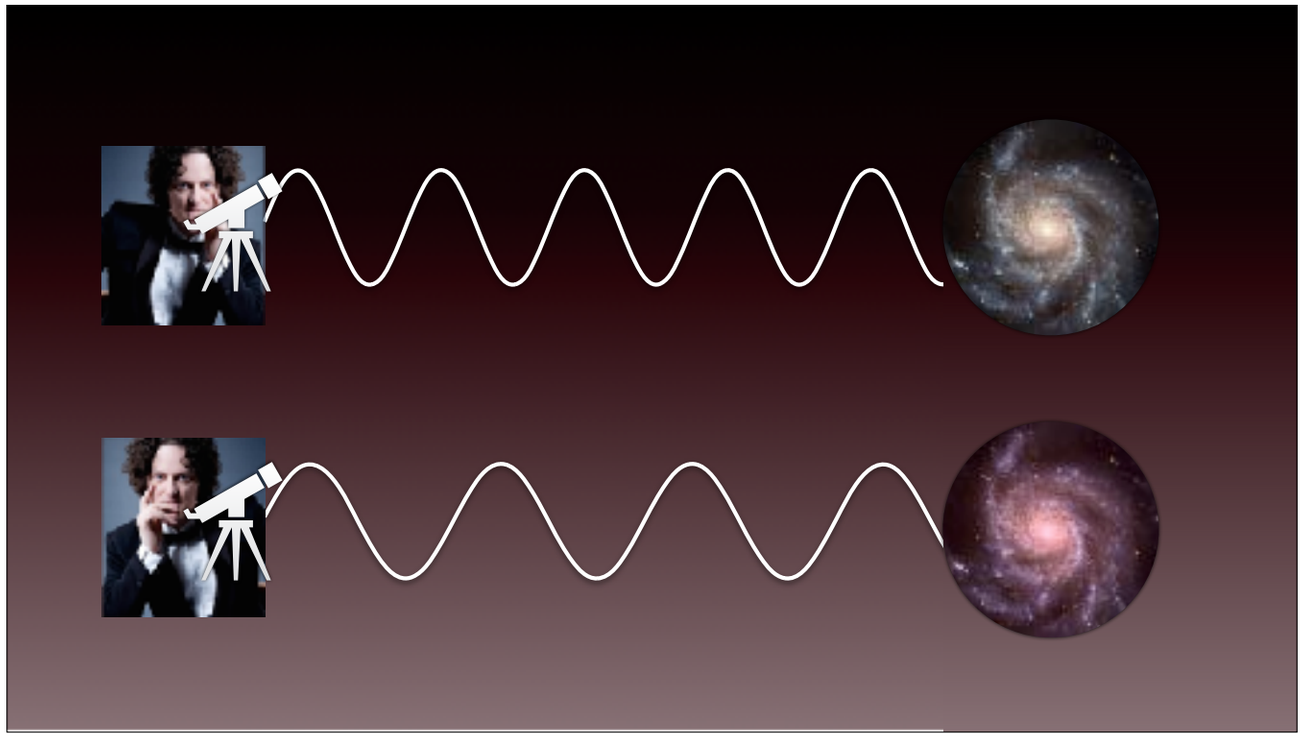


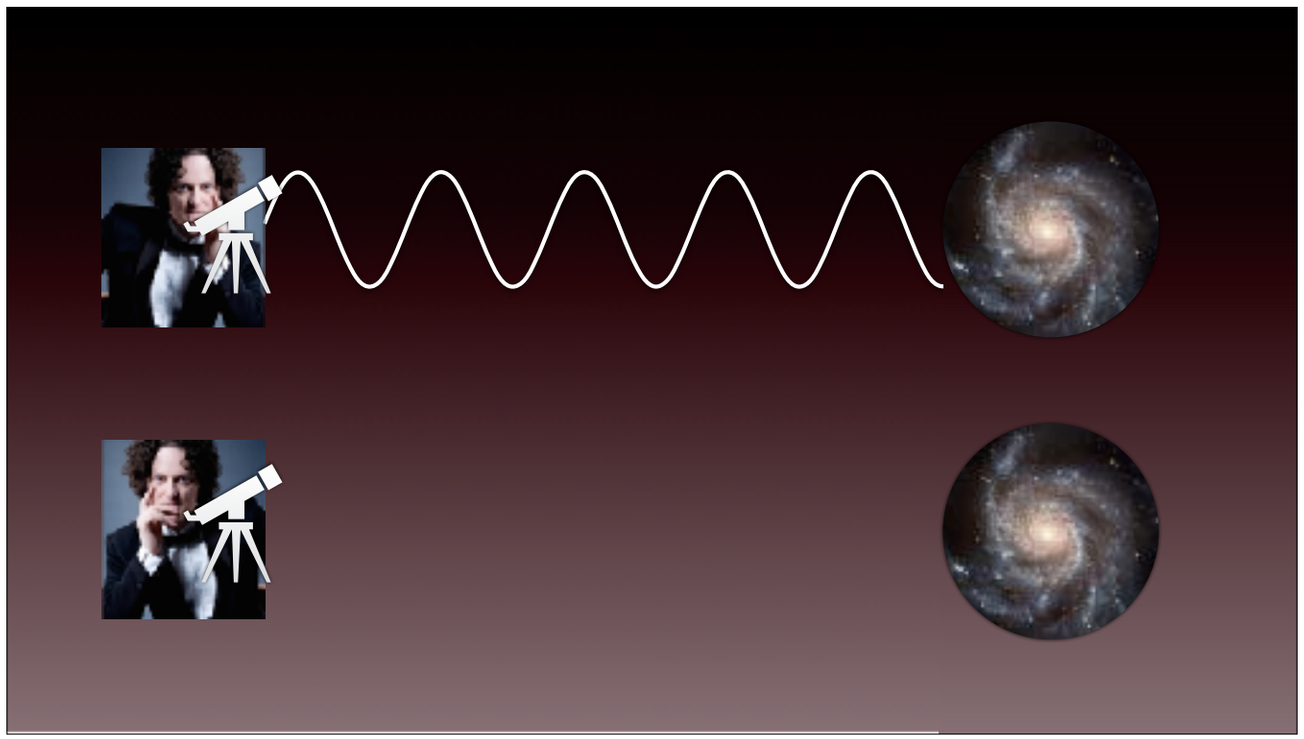


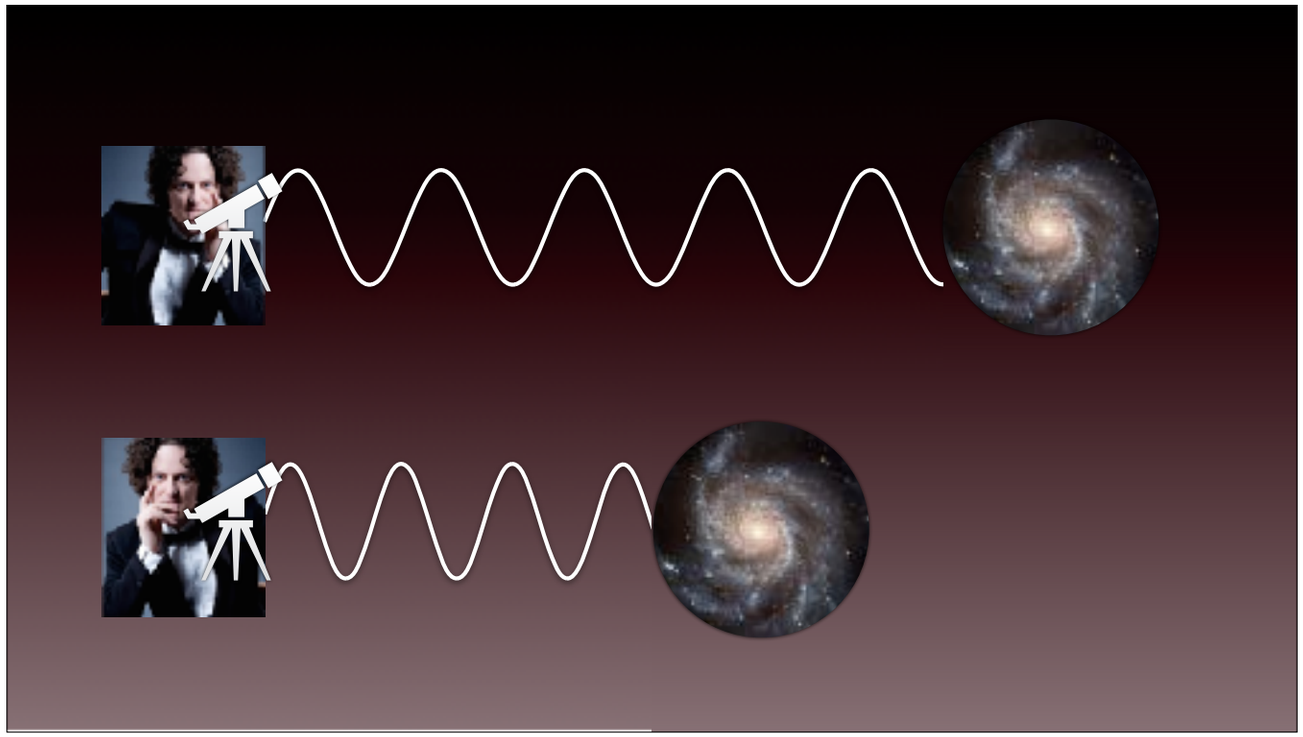


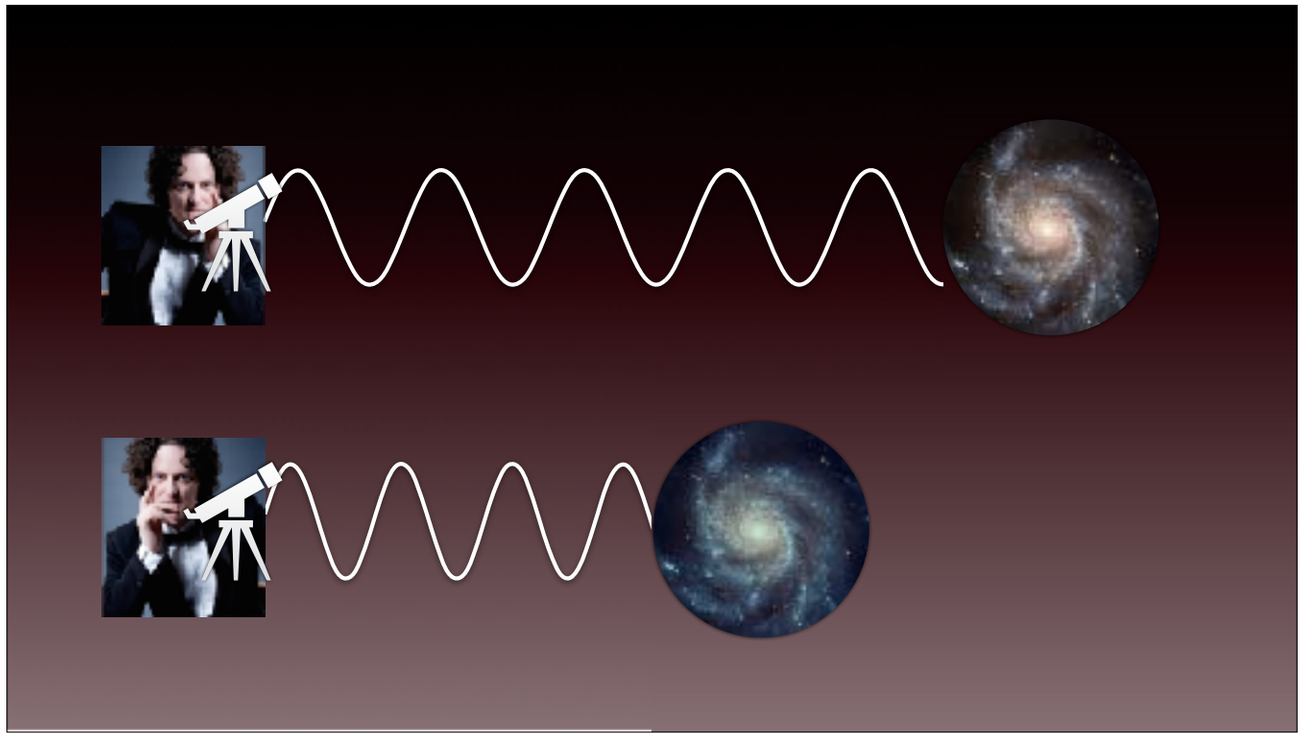












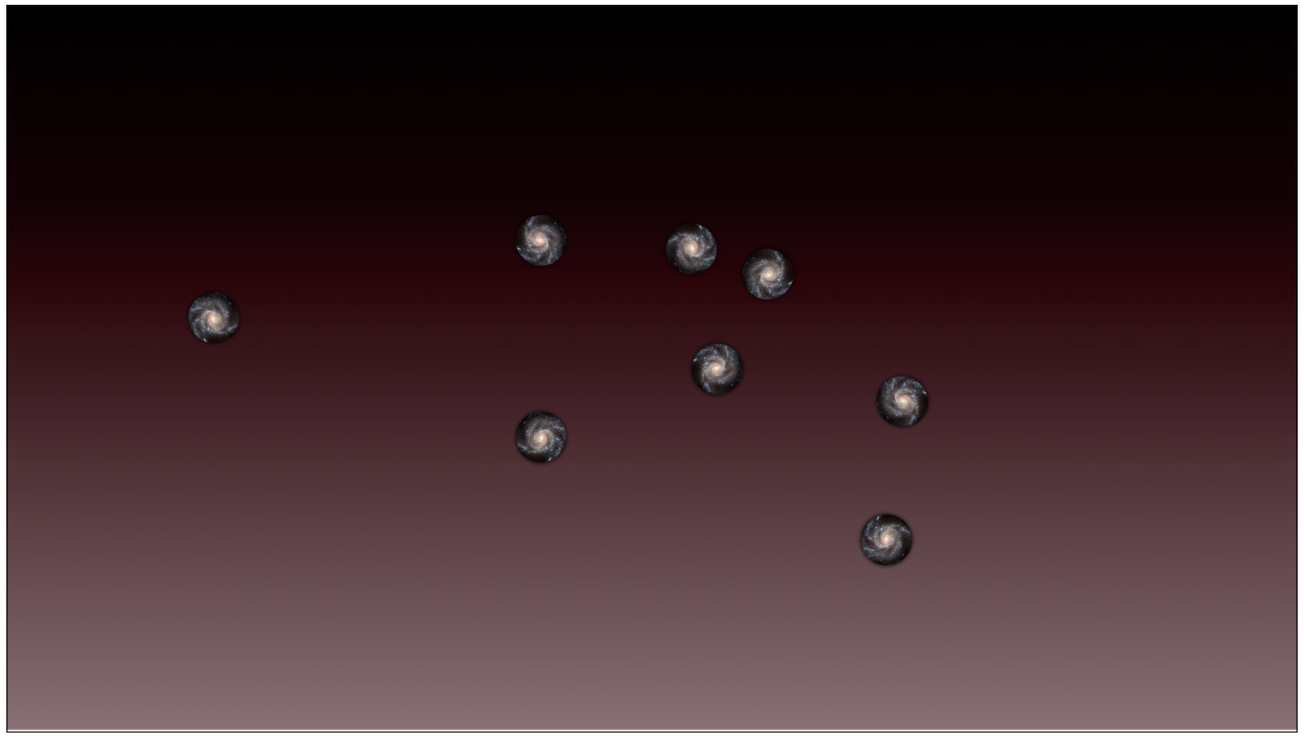
Redshift

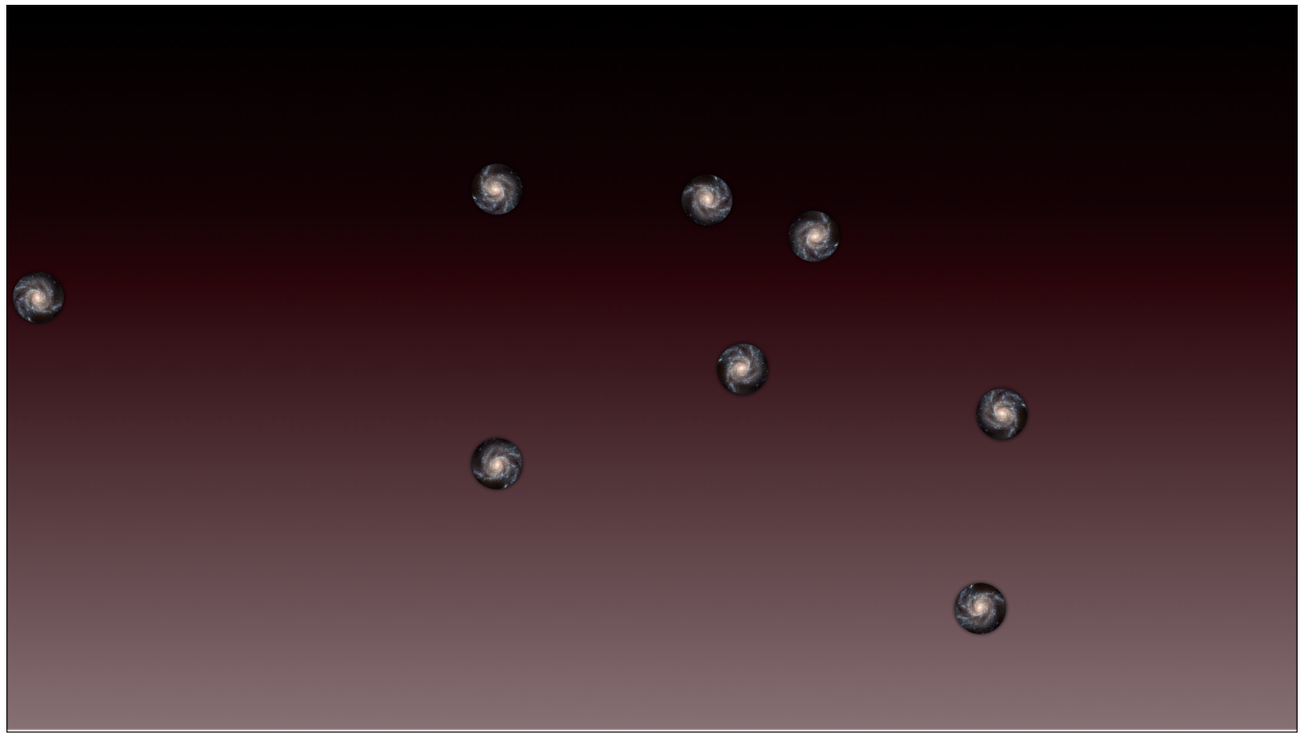
Most galaxies are moving away from us, but not Andromeda. Collision in 4B years.

Redshift

$\propto$

Radial velocity





Redshift
$\propto$
Radial velocity
$\propto$
Distance

Not truly $\propto$ to distance b/c of acceleration of universe expansion. This is why redshift is called *z*.

Redshift

$\propto$

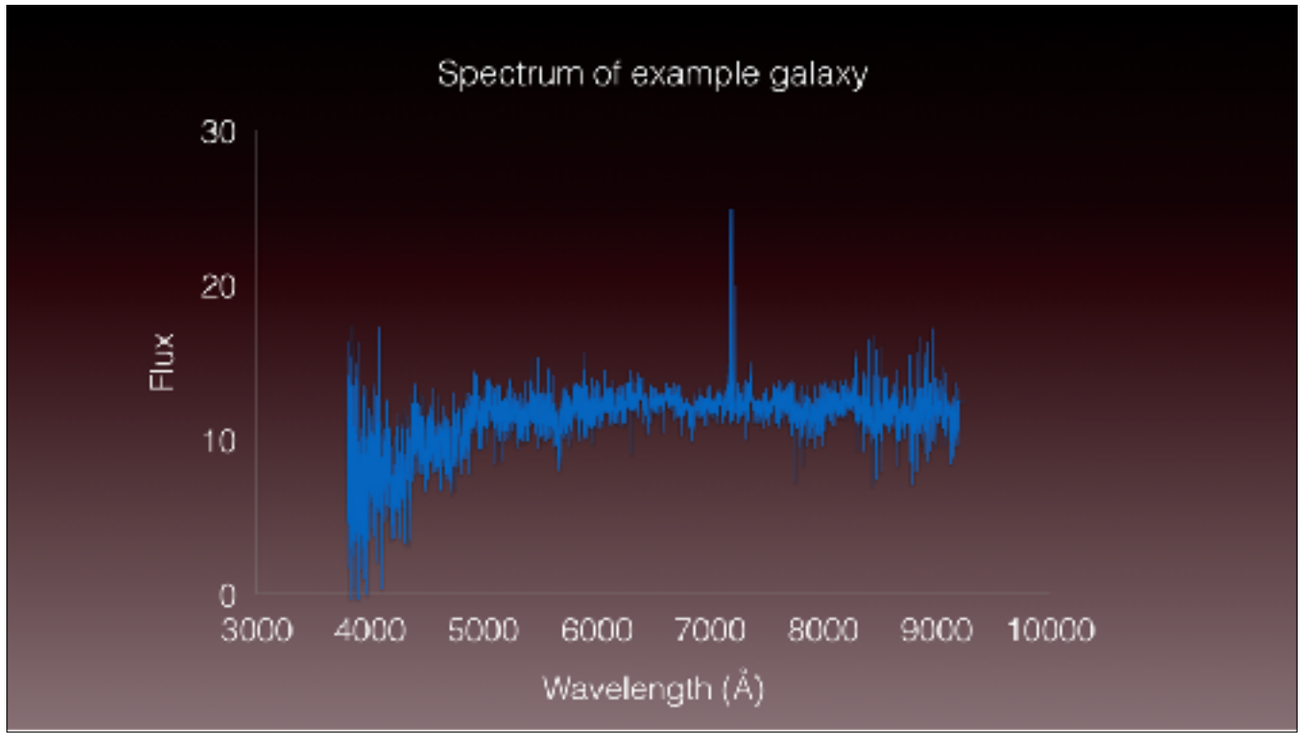
Radial velocity

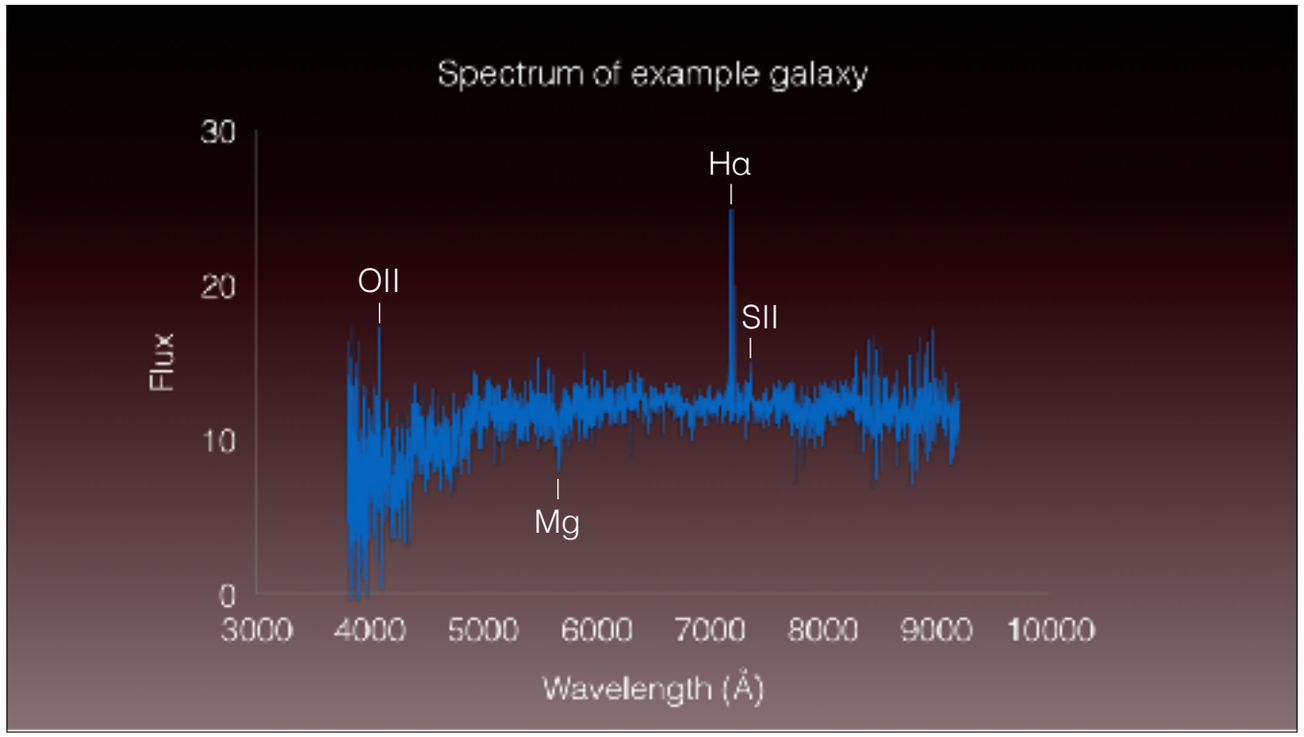
$\propto$

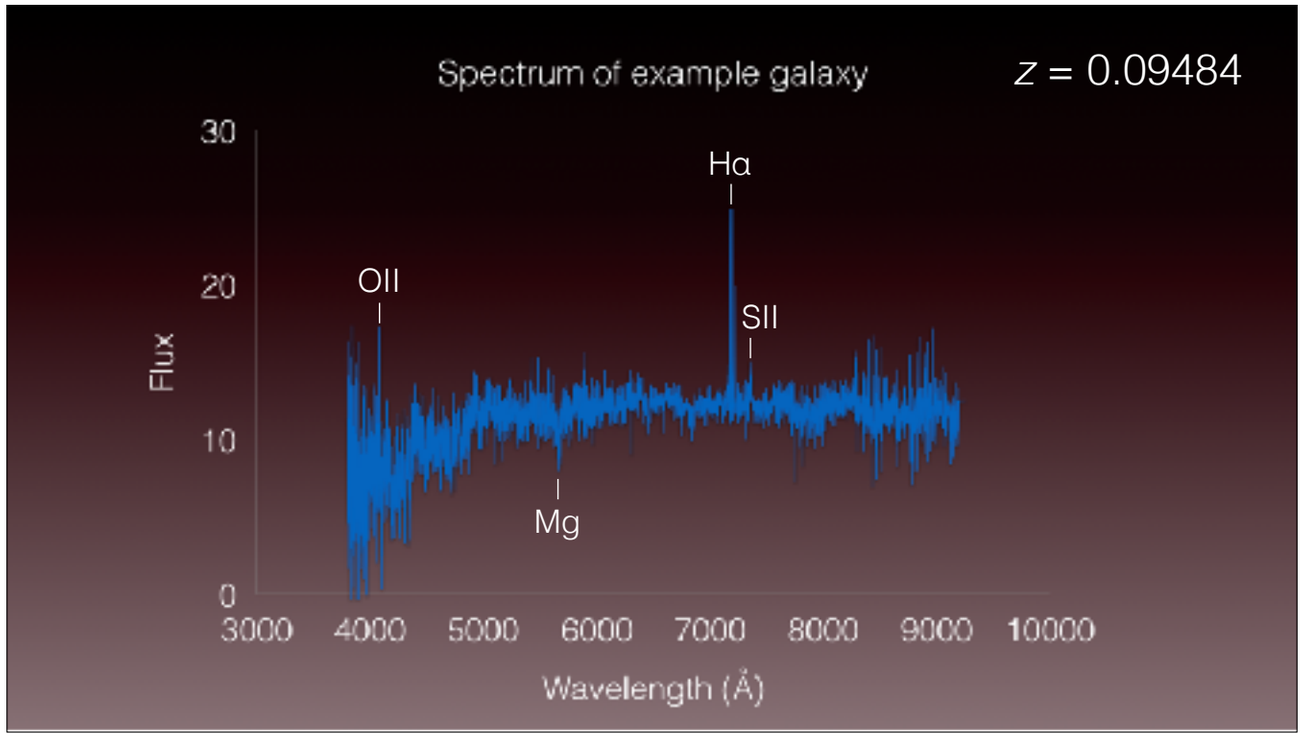
Distance

$\propto$

Age

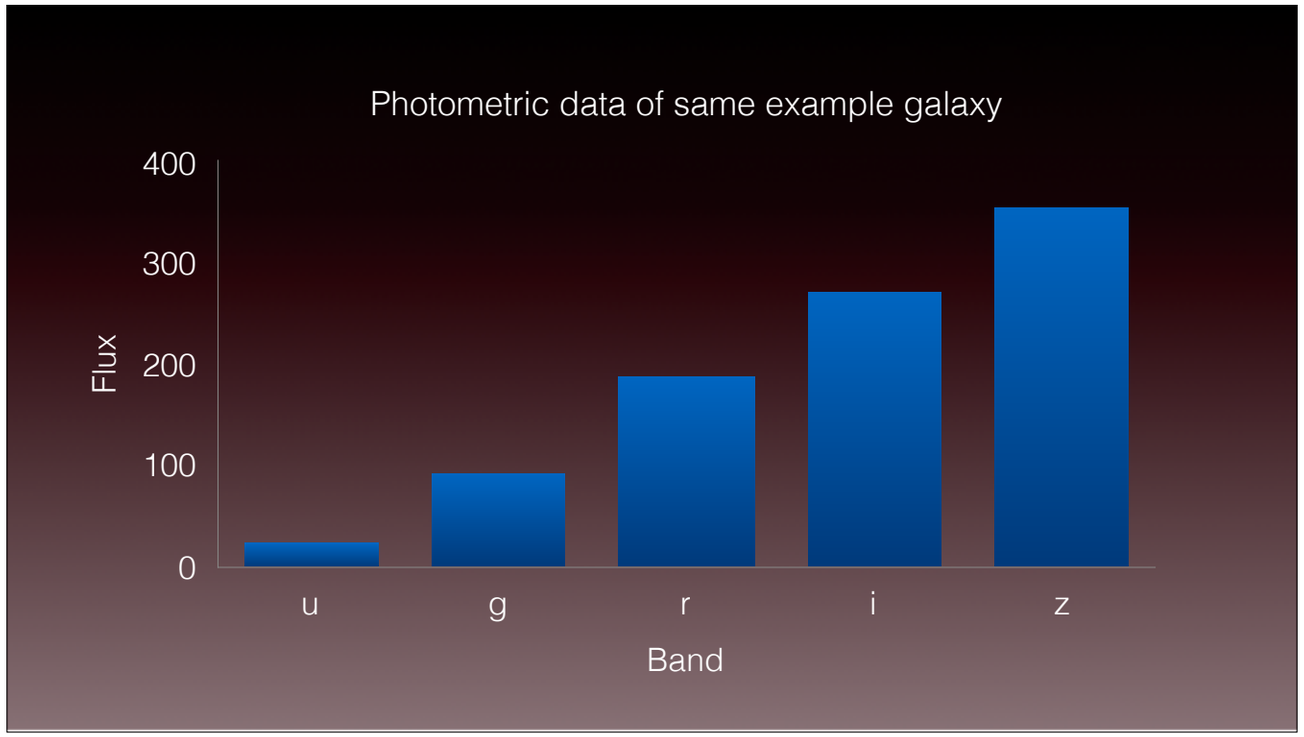

Spectrum of example galaxy
30
20
10
0
Flux
3000
4000
5000
6000
7000
8000
9000
10000
Wavelength (Å)


Spectrum of example galaxy
Flux
30
20
10
0
OII
Hα
SII
Mg
3000
4000
5000
6000
7000
8000
9000
10000
Wavelength (Å)


Spectrum of example galaxy
z = 0.09484
30
20
10
0
Flux
OII
Hα
SII
Mg
3000
4000
5000
6000
7000
8000
9000
10000
Wavelength (Å)

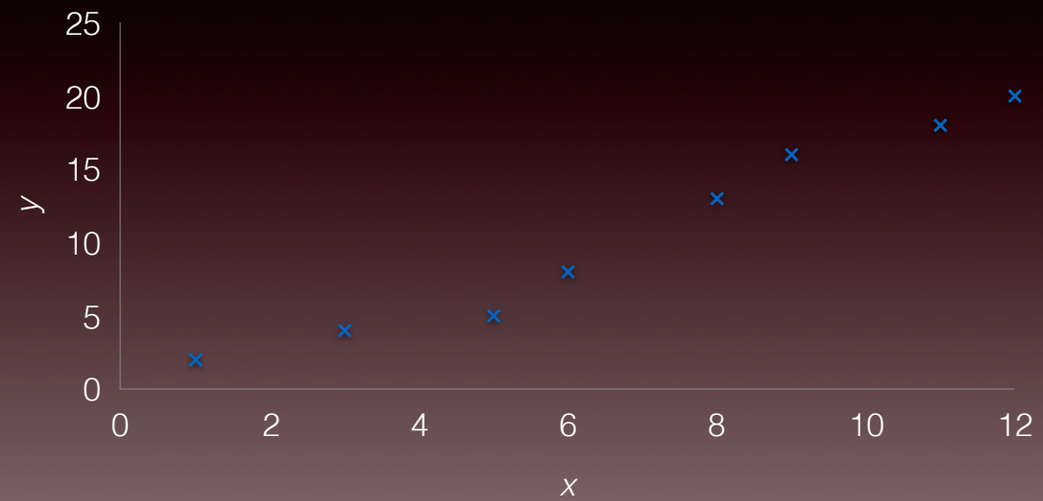
750 Million

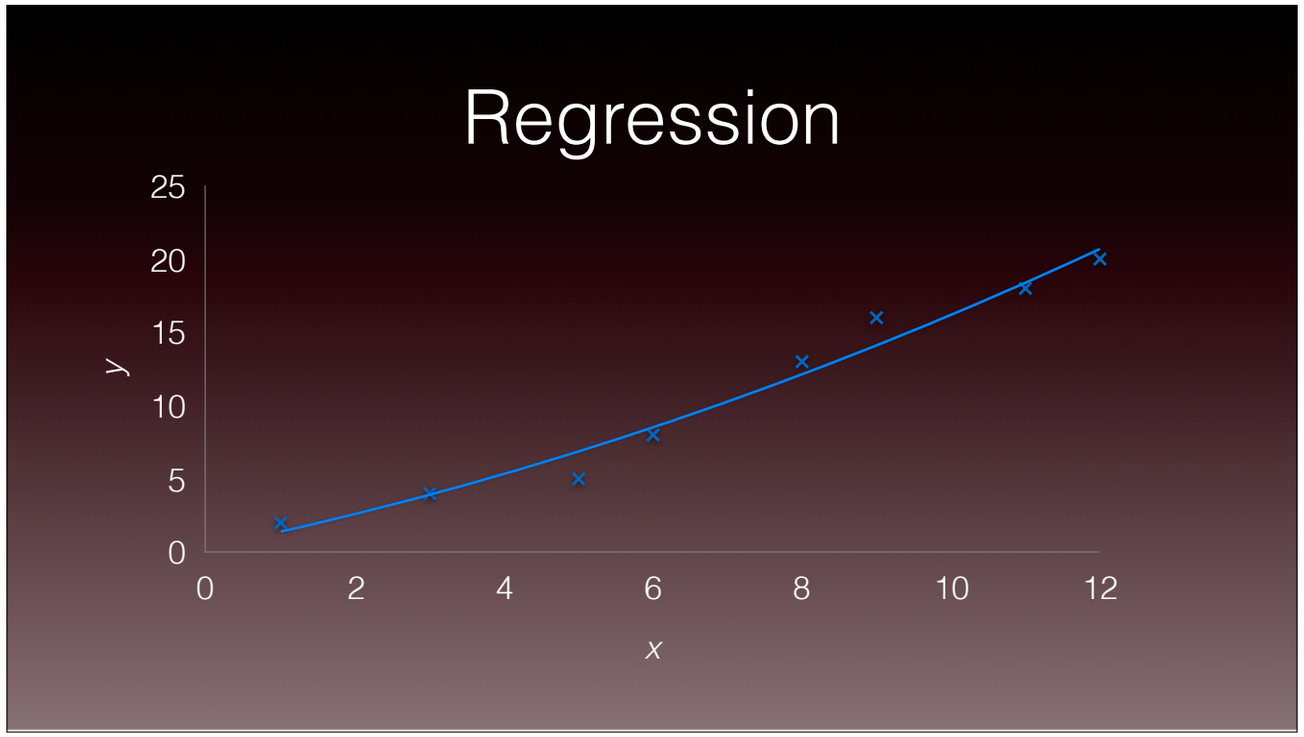
galaxies in the AllWISE survey, $z \leq 0.5$


Photometric data of same example galaxy
400
300
200
100
0
Flux
u
g
r
i
z
Band

Regression

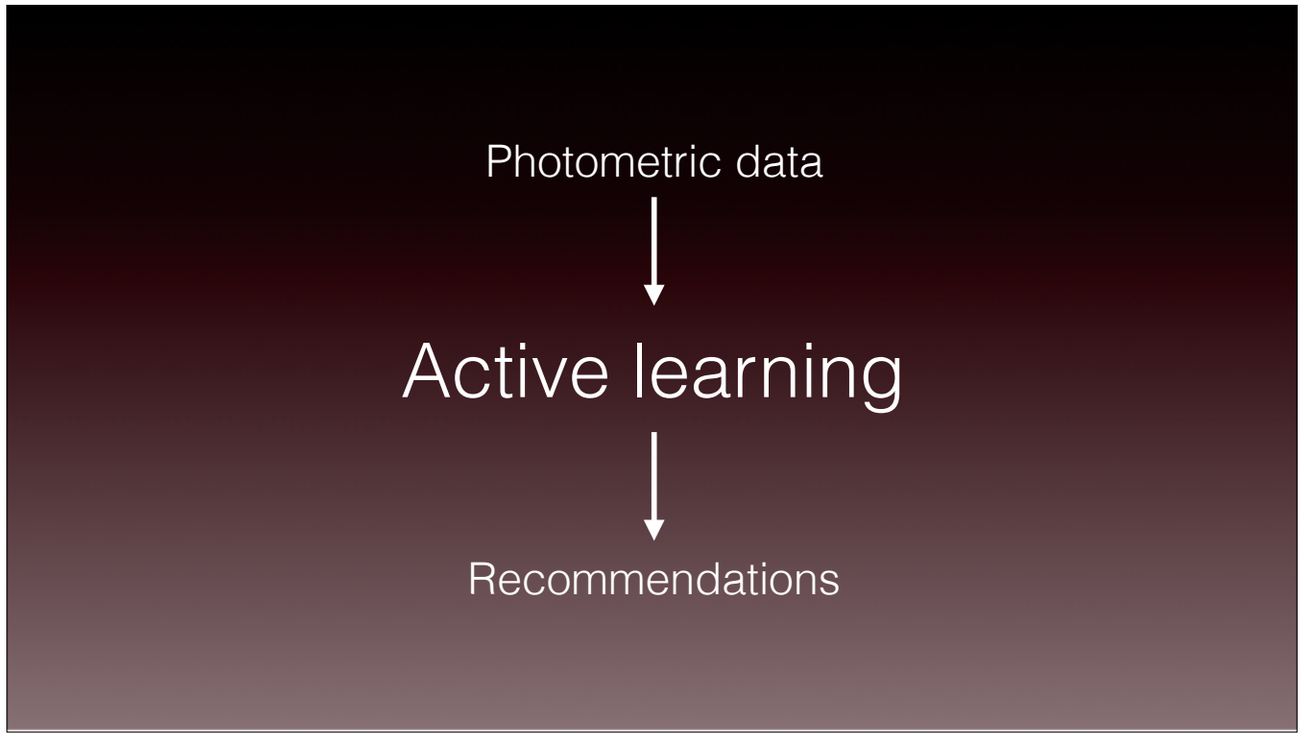
Regression

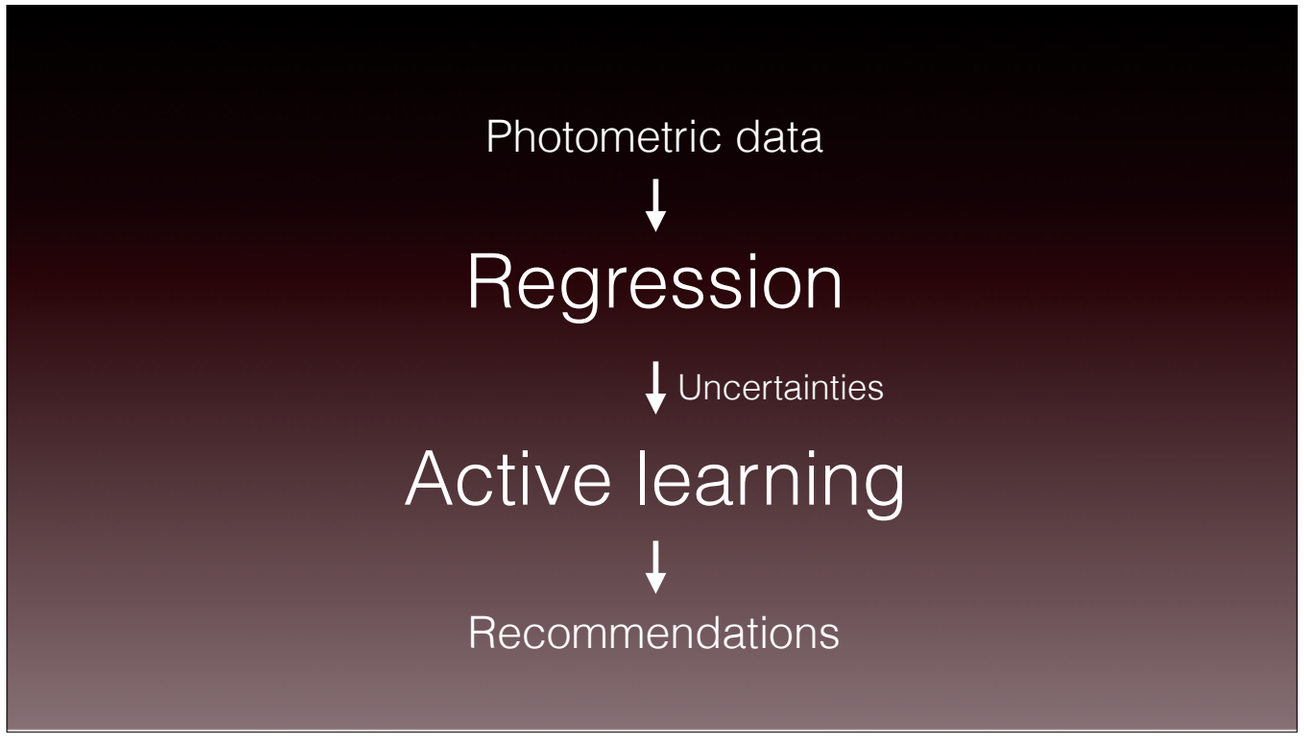


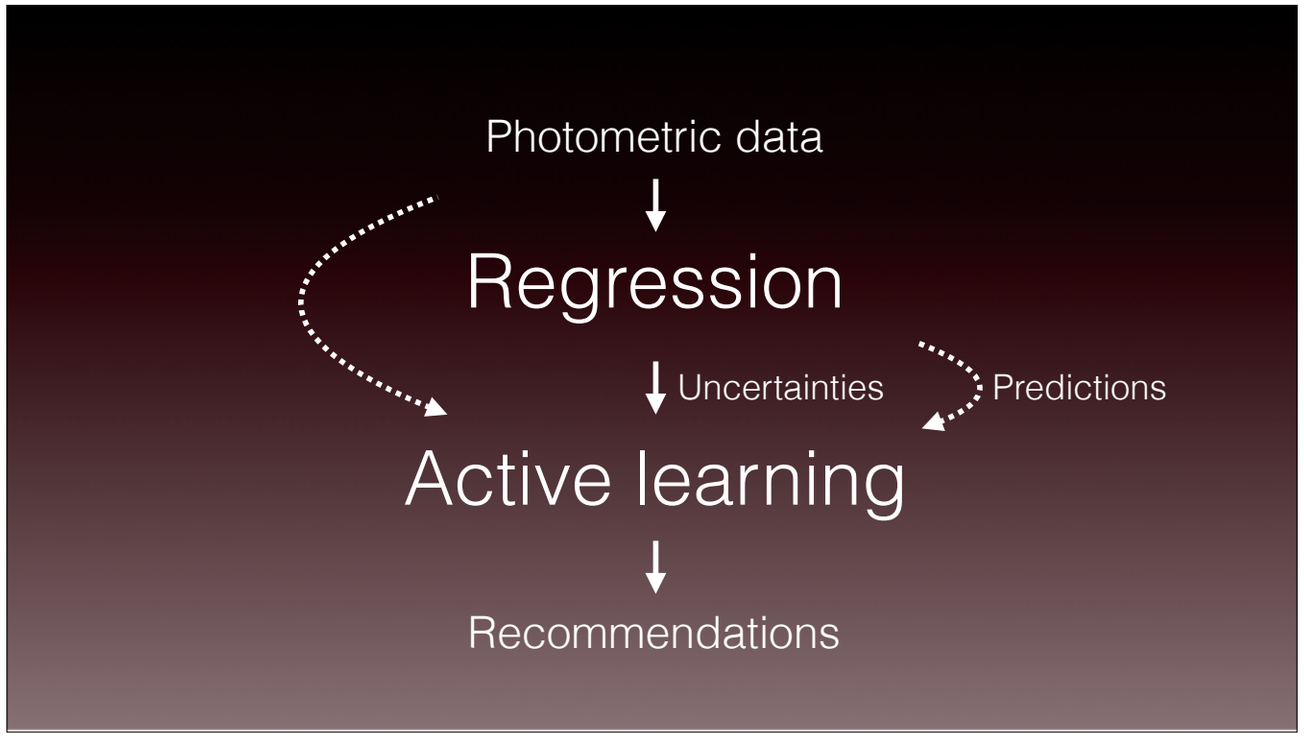


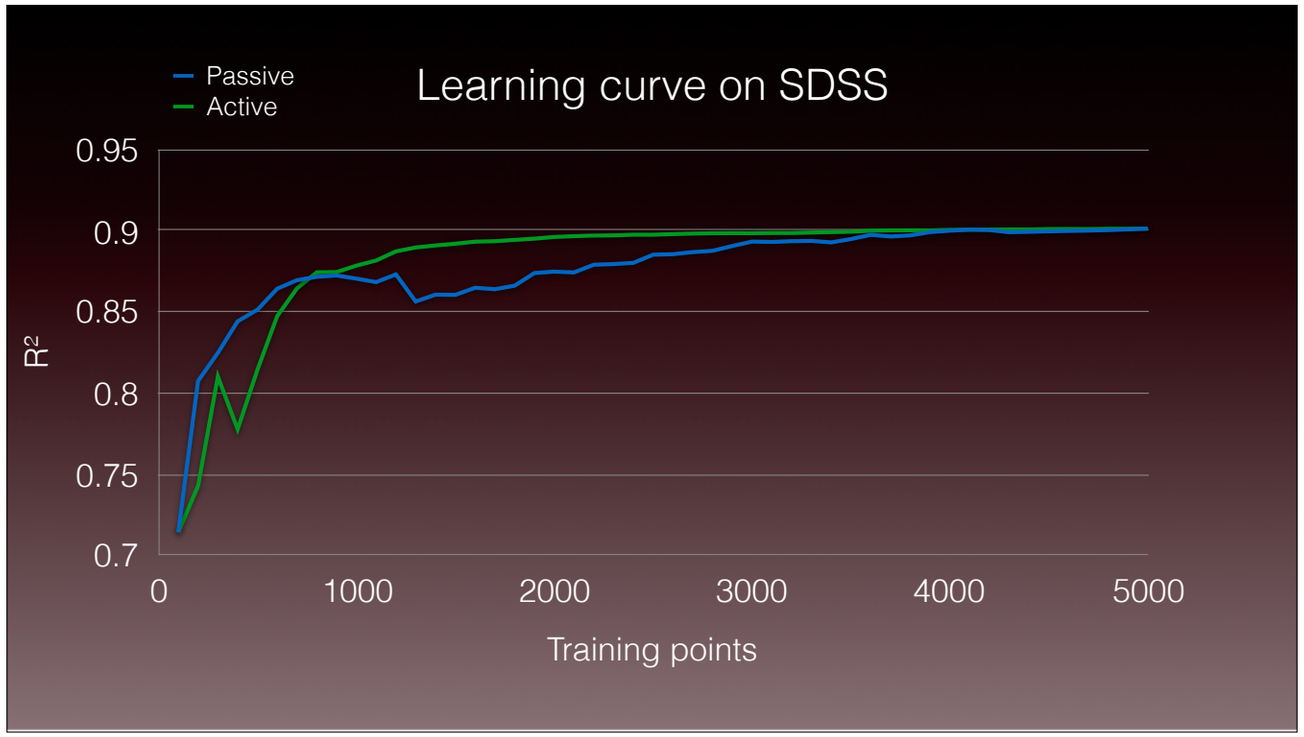
This approach only takes you so far. Mention inaccuracy and limited range.

Active learning


Photometric data
Active learning
Recommendations


Photometric data
Regression
Uncertainties
Active learning
Recommendations


Photometric data
Regression
Uncertainties
Predictions
Active learning
Recommendations


Learning curve on SDSS
Passive
Active
0.95
0.9
0.85
0.8
0.75
0.7
R2
0
1000
2000
3000
4000
5000
Training points

?