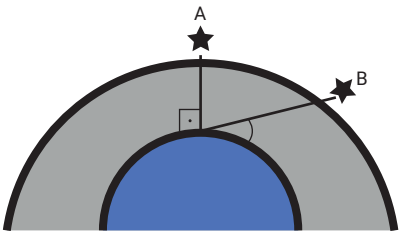
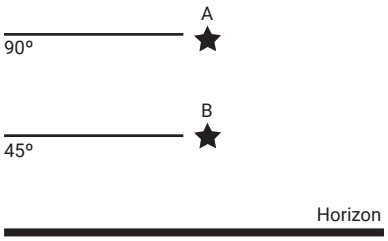
Challenge week presentation

This is what I have understood of what the problem is and how it can be solved

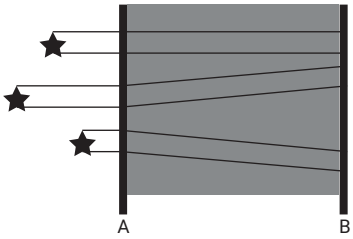
What is the problem?

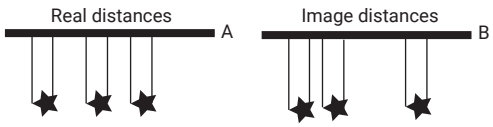


When observing astronomical objects, the image we recieve if we are on the earth surface has to go through the atmosphere, and the higher we observe the object, the less distance the image has to travel



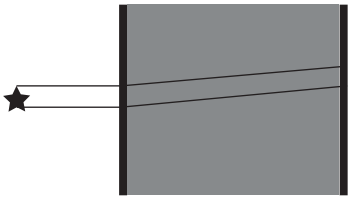
The light that we receive from the objects we see is affected (refracted) by the atmosphere as it passes through it.





The atmosphere is not homogeneous, which means that depending on where the light is passing through it gets refracted with a different angle.

However, if we observe a small region of the sky, the light we receive at an instant is mostly refracted with the same angle.

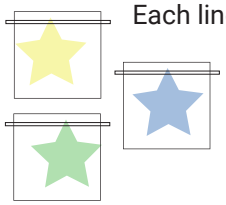


The problem is that the atmosphere, appart from not being homogeneous, is changing constantly, meaning that if we keep observing, the object image will constantly move slightly in a random (or pretty much unpredictable) manner.
This limits the resolution of long exposure pictures, which get blurrier as we increase the exposure time.

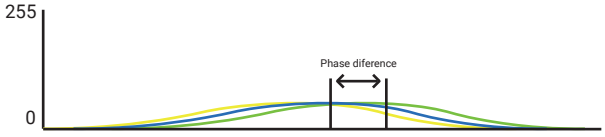
How can it be solved?

The problem is solved by taking multiple short exposure pictures, calculating how much they are shifted from each other and combining them to form a better picture.

First step: calculating the shift of each image



Each line of an image represented in scale of gray can be seen as a wave



Since all the pictures are images of the same object/objects the waves will be pretty much the same, so to calculate the shift between two images we can calculate the phase difference of the waves using the Fast Fourier Transform (FFT) algorithm.

Second step: median combining