# Exercices en anglais sur le télescope (extrait du CNESMag)

## Ex 1 : Study of an amateur ground telescope

Here are the features of a simple amateur ground telescope:
Objective lens aperture D1 = 114 mm
Focal length of objective lens f'1 = 1,000 mm
Accessories: 25X eyepiece with focal length f'2 = 25 mm
9X eyepiece with focal length f'3 = 9 mm

Given that the magnification M of an afocal telescope is given by the relation:

$$M = \frac{focal\ length\ of\ objective}{focal\ length\ of\ eyepiece}$$

1. Which of the two eyepieces above would you need to obtain the highest magnification, noted $M_1$? What would be the value of $M_1$ ?

*The magnification of a telescope can also be written:*

$$M = \frac{apparent\ diameter\ of\ object\ through\ telescope}{apparent\ diameter\ of\ object\ with\ naked\ eye} = \frac{\theta'}{\theta}$$

2. Calculate the apparent diameter θ (in radians) of a geologic feature with an actual diameter d = 2.1 km on the surface of the Moon, observed from an estimated distance D = $3.8.10^5$ km.

3. Calculate the apparent diameter $\theta_1$' of a geologic feature observed through the ground telescope using the eyepiece with a focal length of $f'_3$ = 9 mm.

4. What would this diameter be if we used a telescope with features similar to the formation-flying space telescope? What do you conclude from your answer?

## Ex 2 : A telescope as a time machine?!

The Planck space telescope, orbited by Ariane 5 on 14 May 2009, sees the Universe as it was just after it formed. Estimated to be 13.7 *billion** years old, the Universe became visible when its first light appeared 380 000 years after its birth. This remnant light, called fossil radiation, is still traveling through space, which is why Planck can see it today.

**To see into the past, we need to see a long way:**

Light is propagated at a finite velocity c = 299 792 458 meters per second in a vacuum. Assume that a ground telescope is pointed at a distant galaxy, for example Andromeda M31, at a distance d = $2,44.10^{22}$ meters away.

1 - How long, in years, will it take the light from this galaxy to reach us ?

2- When we observe the Andromeda M31 galaxy through a telescope, we see it as it was how long ago ? Justify the expression 'To see into the past, we need to see a long way'.

* **Attention, pour les anglophones : 1 billion = 1 milliard**