On Friday, September 9, 2011, you will perform 3 trials. Each trial is individual, but in some cases you will have to work together with some of the other participants. This is what happens every day in science: you compete and cooperate at the same time with other scientists, to get an higher level of shared knowledge.

**ACT I: THE POLE STAR FOR MARS (60 minutes for each group of individual participants)**

*Materials:* Pocket torch light (red), paper, pencil, rubber

Remember that the celestial poles are the projection of the geographic poles onto the sky. At the present time there is a star, visible from Earth with the naked eye, close to the celestial North Pole: for this reason it is called Polaris. But what if you were at the geographic North Pole of Mars?

The celestial North Pole of the red planet is not the same of the Earth. To do the comparison, recall that the stars are so far that the imaginary designs of the constellations remain the same as seen both from the Earth and Mars. So the orientation of Mars' axis is such that its celestial North Pole has Right Ascension 21h 10m 42s and Declination +52.9°. This means that is in the constellation of Cygnus.

(i) The most brilliant star of the constellation of Cygnus could be a good choice for the martian North Pole star. Which way the modern terrestrial astronomers indicate it? For the Martian sky watcher, who knows... /1 pt.

a. 1 Cyg  
b. A Cyg  
c. α Cyg  
d. β Cyg

(ii) Look at the sky projected by the Planetarium on the inner surface of the dome. At the zenith you have the North Pole of the ecliptic. Find Polaris and thus you know the position of the Earth’s celestial North Pole. Please notice the scale on the celestial meridian joining the Earth’s North Pole with the zenith: every step is 10°. There is the same scale also on the quarter of celestial meridian joining Mars’ North Pole with the zenith. What can you say about the axial tilt of the Earth and Mars with respect to the North Pole of the ecliptic? /3 pt.

a. The axial tilt of Mars is twice the axial tilt of the Earth  
b. The two planets have more or less the same axial tilt, but in different directions  
c. The axial tilt of Mars is one half of the axial tilt of the Earth  
d. The two planets have more or less the same axial tilt, but in opposite directions
(iii) Considering all the information you have collected, can you say something about the inclination of the orbital plane of Mars with respect to that of the Earth, called the ecliptic plane? /3 pt.

a. The orbital plane of Mars has a slight inclination with respect to the Earth’s ecliptic
b. The orbital plane of Mars is exactly the same of the Earth and all the other planets in the Solar System
c. The orbital plane of Mars is perpendicular to the Earth’s ecliptic
d. The orbital plane of Mars has an inclination of 45° with respect to the Earth’s ecliptic
Materials: Pencil, rubber, paper, chronometer, piece of chalk

In the Solar Laboratory in Modena you can look at the image of the Sun projected on a blackboard without risks for your sight (remember: never look directly at the Sun!). When the tracking of the telescope pointed toward the Sun is on, the image is still and you can appreciate, for instance, if there are sunspots. When the tracking is off, the Sun moves until it disappears from the blackboard. Even when not working, the instrument is useful: the magnification of the Sun’s image allow you to measure the time the Sun needs to cover a certain angular distance and thus the angular speed of its apparent daily motion in the sky.

(i) The apparent angular diameter, in degrees, of the Sun as seen from the Earth is about... _2 pt._

(ii) After taking the measurements in the Solar Laboratory, which is the angular speed for the daily motion of the Sun, in degrees per hour, that you have found? Write your calculation process. _4 pt._
ACT III: NEVER LOOK DIRECTLY AT THE SUN (45 minutes for each group of individual participants)

Materials: Pencil, rubber, paper, aligned telescope with solar filter

... Unless you use the filters as you have on your telescope for the practical test -- but also in this case it is better not to look through it more than few seconds. This is enough time as to point the telescope, already aligned with the celestial poles, toward to the Sun. So you can find some quite interesting information about the position of our star and the position of the celestial North Pole, even if it’s daytime!

(i) First complete the following scheme, inserting in the squares the cardinal points (N, E already inserted, S, W) and in the rectangles the name of the local coordinates (Altitude, Azimuth):

(ii) Now you can move the telescope, center the Sun and complete the following table:

DATE OF THE OBSERVATION: _____________________ _/0.5 pt.
SUN’S RIGHT ASCENSION: ______________________ _/1.5 pt.
SUN’S DECLINATION: __________________________ _/1 pt.
CELESTIAL NORTH POLE ALTITUDE: _______________ _/1 pt.
**ACT II PLAN B: THE STARS LOOK DOWN** (45 minutes for each group of individual participants)

*Materials: Pencil, rubber*

... And you look up all the same! Unluckily, the weather is not fine, but you can see the stars: ok, it is only a drawing on your worksheet, but these are the same constellations and stars that will be above your head tonight in Modena -- and that those nasty clouds probably will not allow you to see 😢

Can you identify the constellation indicated by the numbers?

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<td></td>
<td>a. Libra</td>
<td>b. Virgo</td>
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<td>a. Delphinus</td>
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<td>4</td>
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<td>a. Ursa Major</td>
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<td>a. Ursa Major</td>
<td>b. Ursa Minor</td>
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Unluckily, the weather is not fine and it seems you can not use the telescope... But it has been already aligned by the responsible of the Planetarium in Modena. You can find very quickly and easily some quite interesting information about the telescope itself and the position of the celestial North Pole, even if it’s daytime and clouds do not allow to look at the sky.

(i) First complete the following scheme, in the squares insert the cardinal points (N, E already inserted, S, W) and in the rectangles the name of the local coordinates (Altitude, Azimuth): /2 pt

(ii) Now complete the following table:

DATE OF THE OBSERVATION: ______________________________/0.5 pt.
CELESTIAL NORTH POLE ALTITUDE: ______________________________/1 pt.
LATITUDE OF MODENA: __________________________________________/1 pt.
REFLECTOR OR REFRACTOR TELESCOPE? __________________________/1 pt.
DIAMETER AND FOCAL LENGTH (mm): ___________________________/1.5 pt.