How to do a Science Case with your students

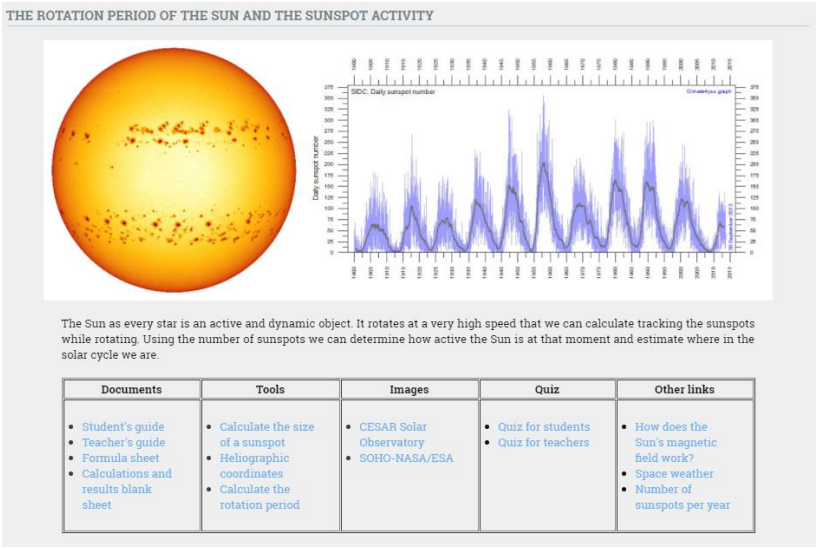
If you are a teacher and you are reading this document, then probably means you want to do a Science Case with a group of students from your school, or university.

In this quick guide, we summarize the steps you should complete, as teacher, which will allow your students to complete any of the Science Cases presented here by CESAR.

The first thing you have to think about is your students' level of knowledge in mathematics and physics. All Science Cases are relatively easy, but some of them have some complex trigonometric formulas that some students (especially those coming from other branches than science) may find difficult. Because we don't want to limit the access to these cases to science students, we have decided to divide them into three levels of difficulty but not by ages.

- Low level of difficulty: these Science Cases are focused on teaching the main and most basic knowledge we have about the Universe. Without almost any formulae, they are recommended for students from primary school or students with some basic knowledge of mathematics.
- Medium level of difficulty: these Science Cases are intended to be done by students with basic knowledge of physics and mathematics. Fundamental physics laws such as Kepler's laws will be used as well as basic trigonometric formulas. These would be recommended for students from secondary school and higher.
- High level of difficulty: these ones have been prepared to be done by students who have coursed at least two years of physics and mathematics since the formulas here used are more complex than in any other case. At this level, students will also be required to gather the data they will use.

Once you have decided the level, the next step is to choose an astronomical topic. For each level, there is a list of Science Cases separated by topic and there is a brief description of each one, so that you can get an idea of the content.



Here are two approaches. If you are teaching one unit in particular, let say the gravity law, for example, you should then look for a Science Case that covers the movement of the celestial bodies or planets. The second approach is to let the students choose the Science Case or topic they want.

As you can see, every case has the same five columns:

- Documents: these are the documents for both the teachers and the students
    - Teacher's guide: this will guide you through the whole Science Case. It describes very detailed each of the steps your students have to follow, all equations you have to explain and all the answers you may need. You have to print one copy of the teacher's guide for you
    - Student's guide: on the other hand, the student's guide is almost free of formulas (which, as said before, you will have to teach), and lays on the understanding of the topic, of course with the same steps you read on the teacher's guide. In this case, print one copy of this guide for each of the students or group of them
    - Calculations guide: a sheet with the formulas required by the students to perform their calculations. Again print one sheet per student or group of students
    - Calculations and results: a sheet where the students will write their calculations. Print one for each student
- Tools: there are the online interactive tools that make the Science Cases even more accessible from your school
- Images: provides students with all the necessary files to complete the case
- Quiz: a set of questions that should be answered by the students to check whether the concepts studied have been assimilated
- Other Links: links to interesting pages or videos which have an important educational content and let a better understanding of the topic

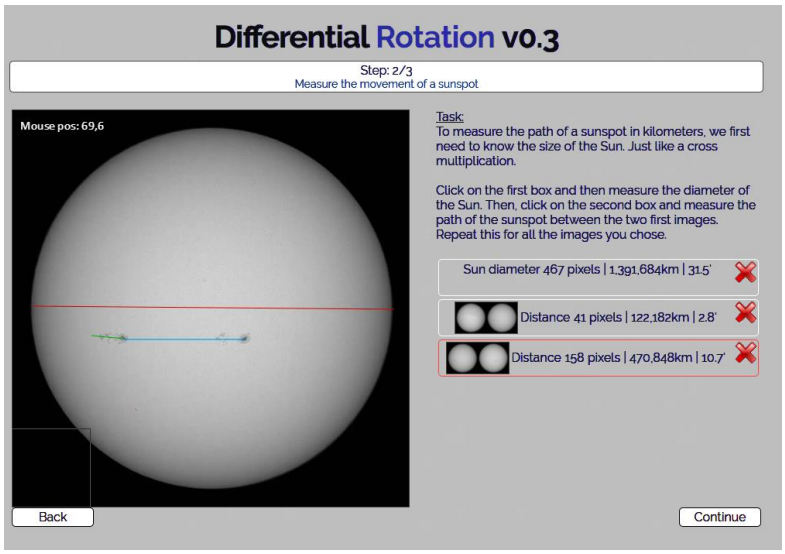
At this point you have to download all documentation of the Science Case.

Now carefully read the teacher's guide. We recommend you to split the Science Case into two classes. One class for teaching the students the mathematics or physics involved and another one with computers for doing the case with the online interactive tools.

As you read the teacher's guide, you may find that your Science Case require from taking the astronomical images yourself (or your students) by using one of the CESAR observatories:

- In the case of the CESAR ESAC Solar Observatory, all images you need to use are uploaded in our archive. See http://cesar.esa.int/index.php?Section=Live_Sun
- For the CESAR Robledo Optical Observatory, you will be asked to contact CESAR to arrange a session where students can make their own "observation request". If that is the case, we will run an observation and we will take care of taking the images you need and send them to you
- Finally, most of the Science Cases have a "demo folder" in the image column, that is, a set of images taken with our observatories so that you can complete the case without requesting any observation

Together with the documents and the images, your students will be able to complete the case. However, CESAR also provides interactive online tools to make the Science Cases easier. We recommend you to use them if you have limited time to spend in this exercise.



To evaluate your students and make sure they learned from the Science Case, we provide you a quiz with 10 short questions.

You can always find more information about the topic with the links we provide with each science case.

One of the main resources we provide, are the Booklets. These are detailed introductions to several topics, separated by field of study (Solar observation, stars, galaxies, etc.). We encourage you to read the corresponding booklet of your Science Case.

Finally, feel free to contact us for any question or suggestion of any of the cases.

CESAR TEAM