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Write a scientific proposal to fulfill the qualifications for submitting it to a telescope.
The process is highly iterative and may require several iterations and trials.
The main steps are as follows:

1. Think of a scientific problem that needs to be solved by observations. Read scientific background material. Make sure that the problem has not been studied yet. It could well be something that has been investigated quite some time ago, but then you have to have good reasons to argue that repeating the observations with modern instruments and telescopes will reveal new aspects and that these observations are important to pursue.

2. Consider carefully the telescope/instrument combination you would require. Look at the web sites of the specific scopes/observatories.
   - 2.1. You may select your telescope on scientific grounds from the choice of
     - 2.1.1. gamma-ray telescopes
     - 2.1.2. X-ray telescopes (XMM)
     - 2.1.3. optical/IR telescopes (ESO, NOT, WHT, GEMINI, KECK, AAT, Tuorla, HST, Herschel, Kepler,...)
     - 2.1.4. mm telescopes (ESO/APEX/ALMA, Metsähovi, Onsala, VLA)
     - 2.1.5. radio telescopes (VLA, EVN, GMRT, VLBI)
   - 2.2. And a range of instruments available at the telescopes
     - 2.2.1. bolometers / wide band filters (eg. UBVRI or ugri)
     - 2.2.2. spectrometers (what spectral resolution?)
     - 2.2.3. Integrated field spectroscopy (IFS, IFU, see link)
     - 2.2.4. (spectro)polarimeters
     - 2.2.5. interferometers /coronographs etc

3. Once you think you have found the optimum setup
   - 3.1. Calculate your integration time. Check that it makes sense. The integration time per source is normally from 1min to a few hours. If very small consider a smaller telescope. If very long consider a larger telescope. Check that the ”dead time” between integrations/filter changes is not excessive.
   - 3.2. Check the pixel size and field of view.
   - 3.3. Consider your calibration sources and strategies carefully. Will your calibration be standard or do you need extra calibration. Every step has to be reasoned at least in your mind.
4. Calculate that your target source is visible from your observatory for a long enough time and that the Sun, Moon or bright planets are not too close. If you do optical/IR check that it is night. If you observe in IR/mm check that the season is a dry season (usually winter when there is less water vapor in the air – in the tropics choose the local dry season).
5. Return to step one at the latest at this point and check at least once that your idea is self consistent.
6. Get the proposal form (or ask you teacher for a form).
7. Read more background literature.
8. Start writing the first version of your proposal. Fill out every entry. If some point doesn't apply to you specifically enter N/A. Usually all sections have to be filled out. If you need to find additional information read the instructions for filling our the proposal. Get second opinions. Discuss. Remember that your aim is to submit this proposal next time there is a

call of applications at the telescope you have chosen. Double check points 1-5, 7.

9. Remember that only if your proposal is novel, new, unique and extremely well written will you get observing time.
10. Some general guide lines to writing your proposal.
    - 10.1. The proposal should contain all the relevant information for arguing why these observations need to be done.
    - 10.2. It should be written at a level, which is about the level of the advanced astrophysics class. You don't need to explain terms such as a star, a galaxy, or cosmic microwave background. Because the referees will be astronomers, but most likely not from your expertise area you need to *explain the grand picture where the science of your proposal is being placed.* So just mentioning that ”obtaining a FeVII line is important for understanding the evolution of iron bearing comets” is not at all sufficient without a reasonable background. The missing grand picture is the single greatest reason for not getting observing time.
    - 10.3. You should itemize the specific questions you are addressing. How will you probe into/address these questions? What biases or sources of confusion have you considered. How will they affect your plans and how do you plan to solve these problems that you are likely to encounter.
    - 10.4. Finally tell what you will get from your observations and what scientific points they will address and how will these be placed in the grand picture.
    - 10.5. A simulation of the data you are aiming to obtain would always be useful. This could also address the question of what kind of accuracies or tolerances you will need in investigating your problems.
    - 10.6. What if you don't see what you are looking for. What are the consequences for science then? What would a negative result explain?
    - 10.7. Be clear and avoid using “candy” words (unique, once in a life time, truly extraordinary) unless you have truly unique reasons for using them – the universe tends to be full of unique objects.
    - *10.8. Make sure that your proposal is not a “fishing experiment”, e.g. “I will be looking at galaxy x to see if I can see variability /a broad H_α line”*
    - 10.9. Why do you select this/these source/sources and not some other kind of a sample? What are the (objective) criteria of your sample. Why 10 sources and not 5 or 100? What is necessary and what is sufficient?
    - 10.10. Do you have alternative strategies to address the same or very similar questions. Why you are not using them but rather select the very strategy in your proposal. Why is your research direction different from the lines taken by other scientist on the same/similar questions.
    - 10.11. Is this telescope and instrument THE best for your purpose. Why is it the only possible or the most optimal one in the world for addressing your very problem. This is a very important point.
    - 10.12. Do your observations have a special requirement - scientific restrictions - when the observations must be or cannot be done? (see point 4 for the main types of reasons).

11. Discuss the different options with your teacher – but do the ground work well. Later you can discuss your proposal with proper collaborators.

    Your work will be evaluated at this point. The next point is not mandatory, but recommended.

12. The final aim once your work has been accepted by your teacher is that you submit your proposal for real, preferably at least 3-4 days before the deadline to avoid possible computer problems. Here you will need an approval from all your collaborators too.

Links: (for observing proposal for the Tuorla 70cm or 1m use the NOT proposal form)

http://www.not.iac.es/
http://www.eso.org/sci/
http://science.nrao.edu/
http://science.nrao.edu/observing/observing.shtml
http://ifs.wikidot.com/