

Amateur Telescope Making

...or how to make your own telescope at home

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What is Amateur Telescope Making?

Amateur Telescope Making, or ATM, is a hobby taken by people that have an interest in astronomic observation and enjoy building telescopes.¹

ATM can range from just assembling the individually bought components to actually fabricate some or all of the components of a telescope.

The most common type of telescope made by hobbyists is the so called Newtonian reflector (invented by Sir Isaac Newton).²

¹https://en.wikipedia.org/wiki/Amateur_telescope_making

²https://en.wikipedia.org/wiki/Newtonian_telescope

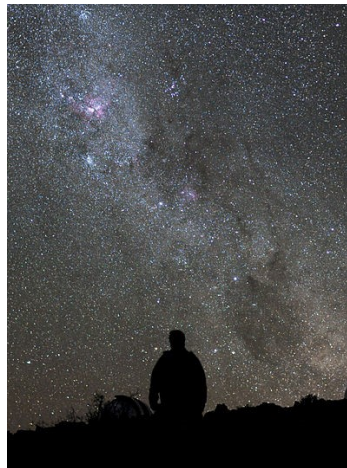
My personal motivation for ATM

One time by chance a few years ago, I had the opportunity to look up at the night sky in Alentejo's countryside, in southern Portugal.

The combination of very low light pollution and clear sky provided for a very distinctive view of the Milky Way.

I had some interest in astronomy in general, but that event was what sparked the beginning of my interest in astronomical observation.

Eventually I found about ATM and ended up deciding to build a telescope myself because I found the challenge interesting.



Not me!

What I'm working on?

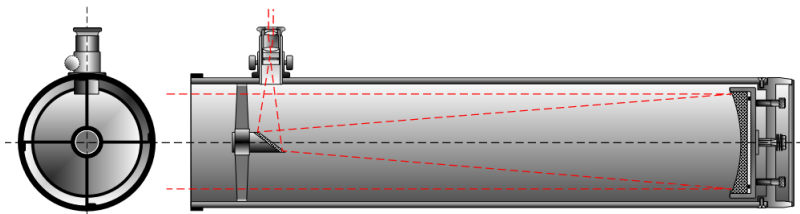
I'm building a Newtonian reflector telescope and I'm making the main mirror lens myself.

It has a 200mm diameter main mirror and initially I planned for a focal length of 1200mm.

Why these choices?

- For a certain telescope diameter (aperture), it is the least complicated type to make (only one convex main mirror lens and a small diagonal flat mirror).
- A 200mm main mirror with 1200mm focal length is one of the most common configurations. It is a compromise between portability and light collection capability.
- Provided you make some simple tools, the mirror's optical quality will only be limited by the amount of time you want to spend and patience (or lack thereof).

The Newtonian Reflector telescope



Newtonian telescope

The main components of a Newtonian reflector telescope are the main concave mirror³, the diagonal flat mirror, and the eyepiece⁴. Incoming light (red dashed line) comes from the top of the telescope, illuminates the main mirror, and is reflected back to the eyepiece by the diagonal mirror.

³https://en.wikipedia.org/wiki/Primary_mirror

⁴<https://en.wikipedia.org/wiki/Eyepiece>

Making the main mirror

In a good mirror, its surface must not have any imperfections with more than $0.07\mu m$ of deviation from the theoretical ideal surface [texereau]. This ideal surface must be a paraboloid⁵ to correctly focus the light rays coming from very far away objects.

How does one make such smooth surface? It turns out it can be done with easily built hand tools and a simple set of steps:

- *Rough grinding.* Generates a first approximation of the optical surface. Results in a rough surface.
- *Fine grinding and smoothing.* Removes all the major pits and scratches created in rough grinding and further approximates the optical surface.
- *Polishing.* Complete removal of small pits and scratches.
- *Testing and retouching.* Examination of the mirror for defects and their correction.

⁵https://en.wikipedia.org/wiki/Parabolic_reflector

Mirror grinding

bla bla



Mirror polishing

bla bla



Mirror testing

bla bla



Foucault test

bla bla



Interferometry test

bla bla



About the author

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My name is Nuno and ...

The end

Thank you!