

Group Design Project: Automated Star-Tracking Mechanism

The motion of the stars across the sky is primarily a result of the rotation of the earth (there is a small component of “proper motion” related to the motion of the center of mass of each star, but this is negligible over time frames on the order of days). Since the earth’s axis is tilted, the stars appear to rotate about an axis that corresponds to the North-South axis, and this axis has a specific tilt to it that depends on the latitude of the observer.

Telescopes that are intended to track the stars across the sky (for long-exposure photography, for example) must be able to compensate for the rotation of the earth about its axis. There are several ways to mount the telescope to do this, the most common being what is called an equatorial mount using motors that provide the appropriate rotation. However, such mounts are heavy and expensive.

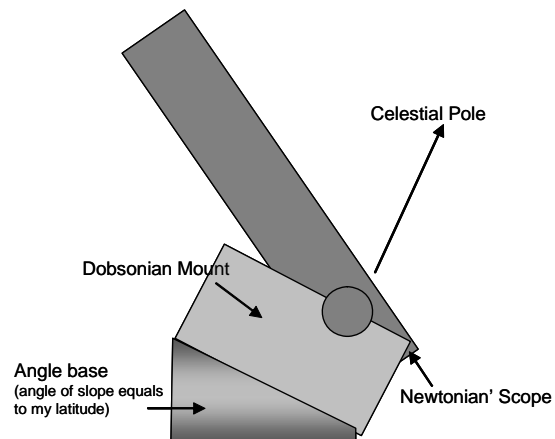


A much cheaper kind of telescope mount is called a Dobsonian mount, and essentially provides two axes of rotation: one vertical and one horizontal (see Fig. 1).

While cheap and easy to build, this kind of mount cannot track the motion of the stars, since neither axis of rotation of the mount corresponds to the axis of rotation of the earth,

One approach to modifying the Dobsonian mount to provide star-tracking abilities is to tilt the mount to an angle corresponding to the latitude of the observer, and then to motorize the motion to provide automated star tracking. This “angle base” is sometimes called a wedge.

The objective of this design project is to design a wedge that will be able to provide automated star-tracking capabilities to a telescope mounted on a traditional Dobsonian mount. The wedge should include the appropriate motors and speed controls, and must be designed to work at approximately the latitude of Baltimore. It is critical that the cost of this wedge be no more than \$700 (the typical telescope on a Dobsonian mount cost no more than \$1,200).



Design Requirements

- Drive a 10” Newtonian reflector telescope on a Dobsonian mount so that it can track the motion of the stars that results from the rotation of earth.
- Should be usable at design latitude plus or minus 3 degrees.
- Should cost no more that \$700.
- Should run on batteries.
- The design should not introduce substantial vibrations to the optics.
- Should be light enough to carry in two hands.

Details

Your design should include the following:

- A dimensioned drawing or set of drawings.
- If you need to buy parts for the device, a statement of the source, and a price for the part.
- If you need to have something machined, a drawing suitable for the machinist, and a quote from the machinist (Mike Johnson, Latrobe 3).
- A full statement of the costs involved.
- A name for your product.
- A formal report describing the device, costs, ethical and legal considerations, the choice of your design parameters, and all calculations. The report should include all of the drawings and cost statement, all necessary quotes, and a description of the design team.

The formal report (which is a group report) is when you come in for final exam (2pm, May 14). You may be asked, as a group, to make a presentation to me before that date.