Handout 10 /week of 2002 April 1 **12.409 Hands-On Astronomy, Spring 2002**

▪ The LX200 Object Library

What's in the Library?

The LX200 has a library with 64,359 objects in it. These are separated into eight databases (shown below) accessible through three keys on the keypad (M, STAR, and CNGC located on the right side of the keypad).

- 110 Messier objects

- 351 alignment stars: this list contains the 250 brightest stars, 100 doubles, and Sigma Octantis (the southern pole star).
- 15,928 SAO (Smithsonian Astrophysical Observatory) catalog stars including all stars brighter than 7th magnitude.
- 21,815 GCVS (General Catalog of Variable Stars): complete catalog.
- 8 planets

- 7,840 NGC (New General Catalog) objects including galaxies, diffuse and planetary nebula, and globular and open clusters: complete catalog
- 12,921 UGC (Uppsala General Catalog) galaxies as faint as 15th magnitude: complete catalog.
- 5,386 IC (Index Catalog) Objects: complete catalog.

A complete listing of the 351 alignment stars, and the Messier objects along with a partial listing of NGC objects can be found in the atlas supplements.

How to Use it

In order to use the object library, the telescope must first be aligned using the two-star alignment procedure discussed in handout 3. The more carefully you level your telescope and center your alignment stars the more accurate will be the pointing of the telescope.

One can directly access the library using the M, STAR, and CNGC keys along with the specific catalog number of the desired object. The Messier catalog is accessed by pressing the M key and then the appropriate M number for the desired object. The SAO

stars, the 250 brightest stars, interesting double stars, the GCVS, and the planets are all accessed with the STAR key. The NGC, IC, and UGC are all accessed with with the CNGC key. When either the STAR or CNGC key pressed, the display will show which of the above databases is currently active. The LX200 will remember the last database used.

1. Press M, STAR, or CNGC
2. If necessary, change the database by pressing enter without entering a number
3. Enter a the desired object catalog number and press ENTER
4. To move the telescope press GOTO

Setting the Zenith Limit (strongly recommended)

To avoid hitting the base of the telescope with the CCD when performing a GOTO option, one can set a limit on how close the telescope can slew towards the zenith.

1. select PARAMETERS from the OBJECT LIBRARY menu
2. select LOWER from the PARAMETERS menu
3. enter the limit in degrees from the zenith (start with 10°) and press ENTER

Using the Hi-Precision Pointing Option

With the hi-precision setting activated, and an accurate alignment, the LX200 is capable of a pointing accuracy of 1 arc minute (for comparison, the 6.4 mm eyepiece has a FOV of about 10 arc minutes and the CCD has one of about 8x11 arc minutes). Technically, in order to use the hi-precision pointing option it is helpful to use an illuminated reticle eyepiece. But you can also use the CCD or equivalently a 6.4 mm eyepiece.

It is not at all necessary that you use this option. In fact, we suggest that you leave if off most of the time. It may come in handy if you are trying to find a very dim object that you can't see in the eyepiece but intend to take a long exposure to capture it. This could be very a frustrating experience if you are not sure it is in the CCD FOV. Turning on this option will not guarantee that you will avoid this frustration but with an accurate alignment, it may make it less likely.

To activate Hi-Precision pointing do the following:
1. Select TELESCOPE from the TELESCOPE/OBJECT LIBRARY menu
2. Scroll and select hi-precision (option #9) by pressing ENTER.
3. When selected HI-PRECISION will change to upper case letters.

When HP is active, the LX200 will perform a GOTO slightly differently. The LX200 will find and slew to the nearest alignment star and prompt you to center the star (on the CCD or using a reticle eyepiece) and then press GOTO.

GOTO for Objects not in the Library

If you would like to point to an object that is not in the library such as a comet or an asteroid, you will need accurate coordinates. Remember that solar system objects move daily through the sky so you need to find coordinates for them either using an ephemeris or Voyager (for the brighter asteroids). It is best to find them for a time that is within an hour of when you want to observe it. In the following procedure you input the coordinates to which you would like the telescope to point.

1. Press and depress MODE until coordinates in RA and DEC are displayed (these are the coordinates where the telescope is currently pointing).
2. Press the GOTO button (next to MODE, upper right corner of keypad).
3. After a double beep, enter the new RA and press ENTER
4. Enter the new DEC and press ENTER (if you need to enter a minus DEC setting, move the blinking cursor over the + sign using the W key and then press NEXT to change + to -, PREV will change – to +).

The telescope will now slew to your desired coordinates. If your object is not there…check your coordinates!

Matching Coordinates (compensating for inaccurate alignment)

If, after executing a GOTO operation, you find that your desired object is not well centered in the eyepiece (possibly due to poor leveling or centering of the alignment stars), you can fudge a bit to compensate for this without having to redo the whole alignment procedure (but just in an area of sky near where the telescope is currently pointing). The following procedure will allow the next GOTO execution to be better centered provided that it is not too far away from the object you used to match coordinates.

1. Center the object in the eyepiece
2. Press and hold ENTER until the display reads "Coordinates Matched"