3.4   Why compasses don't point north

The setup procedures for all computerized telescopes assume that you know which way is north. In altazimuth mode, any error that you make will be corrected as soon as you align on a star. In equatorial mode, however, the polar axis must point exactly north for smooth, accurate tracking; we'll return to this in the next chapter.

The proper way to find true north is to sight on the star Polaris. Sometimes, however, you have to use a compass for initial orientation, and in parts of the world — especially Canada and the American West — compasses are surprisingly inaccurate.

The reason, of course, is that a compass points toward the north *magnetic* pole, not the pole of the Earth's axis. The two poles are not in the same place. What's worse, the north magnetic pole is a complex structure, not a single point, and moves around significantly from year to year.

The discrepancy between magnetic north and true north is called **magnetic deviation, magnetic declination,** or **compass correction** and is shown (for North America and Britain) in Figure 3.5. Clearly, if you try to find Polaris with a compass in Seattle, and you are not aware that your compass points 20° east of true north, your attempts to match the compass with the sky will be frustrating.

The good news is that *if you can find Polaris, you need not bother with any of this*. Polaris is always within 0.8° of true north.

3.5   Setting up the telescope

Detailed setup procedures for specific telescopes are given in Part II, but in general, here's how you set up a computerized telescope on an altazimuth mount:

(1) Level the tripod. Don't waste too much time on this, since exact leveling should not be necessary if you are going to align on two stars. I have personally found that Meade ETX-90 and Celestron NexStar 5 telescopes work well on tripod heads that are as much as 5° from level.

But some NexStar 4 and 5 owners report that their telescopes *are* affected to errors in leveling and initial positioning, even after a two-star alignment, perhaps because of a firmware bug. If in doubt, do your own experiments.

Precise leveling is necessary in "one-star" and "zero-star" alignment modes. Also, leveling is important if you do not know the sky and are relying on the telescope to find its alignment stars without your help.

(2) Check the finder. Verify that the finder crosshairs indicate the center of the field of the main telescope; if not, adjust the finder by sighting distant land objects.

(3) Put the telescope in the "home" position as specified in its instructions (generally, pointing at the horizon, due south for LX200s, due north for NexStars and Autostars).

Again, great accuracy is not required unless you are performing a "zero-star" daytime alignment or are requiring the telescope to find the alignment stars accurately by itself. However, a large error may cause the telescope to report "bad alignment" because the computer thinks you have used the wrong stars.

(4) Choose an alignment mode. Depending on the telescope, there are generally several options:

- "Easy" or "auto" alignment, in which the telescope picks two stars and slews to their approximate positions, then waits for you to center each one;

- "Two-star" alignment on two stars that you choose;

- "One-star" alignment on one star that you choose;

- "Zero-star" alignment, in which the telescope relies entirely on the site data, tripod leveling, and precise home position.

"Easy" or "auto" alignment is usually best, but don't let it play tricks on you. The telescope doesn't go to the exact position of the alignment star, only the general area. (Accuracy depends on tripod leveling and placement in the initial home position.) A common pitfall is to center

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Castor (α Geminorum) when the telescope has chosen Pollux (β Geminorum).

One-star alignment is rarely a good choice; it relies on perfect leveling of the tripod and accurate site data. Normally, if you can find one star, you can find two and get much better results.

Zero-star alignment exists only unofficially; manufacturers do not recommend it, but it is sometimes the best you can do. You can improvise a "zero-star" alignment by doing a one- or two-star alignment and telling the computer that each star is centered, without looking to see whether it really is. Zero-star alignment is sometimes useful for observing planets in the daytime but not much else. Expect pointing errors of several degrees until you can find bright stars or planets and sync on them. First-magnitude stars are visible with a medium-power telescope even in daylight.

(5) Center each star in the field when told to do so, then tell the computer that the star is centered. The more accurately you can center the star, the better, since small errors will be magnified as the telescope swings across the sky.

There — your telescope is set up and you can start observing. To confirm that it's working properly, start by going to one or two bright stars that you can identify.

> *Hint:* Always perform a "sanity check" on the alignment (or any other computer function) before relying on it. Tell it to go to one or two stars that you can easily identify, and make sure it does so. Make sure the telescope can find familiar objects before you ask it to find unfamiliar ones.

3.6   Choosing alignment stars

Of all the stars in the sky, which two should you align on? Actually, there are many pairs of stars that will work equally well, but here are some guidelines:

- The two stars should be on opposite sides of the zenith, at least 120°