MEASURING TIME AND MOVEMENT IN THE NIGHT SKY

*(This article by **Bill Warren** appeared in the Feb. '02 issue of* The Observer.)

Question: Why do the stars and constellations move from east to west across the sky? They don't. The earth's counter-clockwise rotation on its axis makes them appear to move clockwise (E-W).

Although the stars are all moving in space, they are much too far away for us to see their actual movement relative to us except over long periods of time called *epochs* (e.g., epoch 1950.0 or epoch 200.0, as in the title of the superlative set of star charts, *Sky Atlas 2000.0.*

Question: If I looked at, say, M42 at 8:00 p.m. last night, how far west will it have moved by 8:00 p.m. tonight? Orion Nebula is in the same place tonight that it was last year on this date, and that's where it will be a year from now as well. Here's why:

The stars and constellations take one year – roughly 365-1/4 days – to circle the sky and return to where they are now. Since there are 360^{o} in a circle, it figures that a given star, constellation or deep-sky object will move roughly *one degree* west every 24 hours. M42 will be about 1^{o} – two Moon-widths – west of where it was last night at the same time.

In a month's time, it will have moved E-W about 30^{o}, depending on the month), or about 1/6 of the distance from horizon to horizon.

The Moon, on the other hand, takes 27 days, 7 hrs., 43 min. and 12 sec. to complete one orbit around the Earth. So the Moon will have moved about 13^{o} west of where it was last night at the same time.

Question: How fast do the stars and constellations appear to move across the sky at night? Since one 360^{o} rotation of Earth's axis takes 24 hours, the stars and constellations' apparent movements amount to 15^{o} per hour, or $1/4^{o}$ –15 arc-minutes – each 60 seconds.

Question: Why do objects move out of the telescopic field of view faster at higher magnifications? With all other factors being equal, increasing magnification magnifies the size of images while decreasing the size of the field of view. You're seeing a larger image in a smaller area.

Question: How can I determine the size of my field of view? Pick a bright star such as Aldebaran (Alpha Tauri, the Bull's right eye). Place it at the edge of your field of view, and time in seconds how long it takes for the star to move through the center of your field of view to the opposite edge. Dividing that time in seconds by 4 will give you the field of view in arc-minutes for that eyepiece. (One degree=60 arc-minutes [written 60'].)

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