R E G U L U S

THE NEWSLETTER OF THE

ROYAL ASTRONOMICAL SOCIETY OF CANADA - KINGSTON CENTRE

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THE MOVEMENT OF THE NORTH CELESTIAL POLE

Recently in the Science section of a newspaper there was a report on the movement of the earth's North Magnetic Pole and it has occurred to me that there are certain comparisons that astronomers could make if they followed the report detailed in that article. They could quite easily make comparisons between the shifting geomagnetic north pole and the movement of the North Celestial Pole with which they should be familiar.

The pole to which our compasses point was, for many decades, located at or near one of the islands in the southern part of the Canadian High Arctic. It moved about somewhat and the updating of the country's topographical maps required changes to the imformation which explained for a particular map the differences between the true or "pole" north and the magnetic or "compass" north. Three changes were usually slight - almost insignificant from year to year for maps of most areas of the country. Then a dramatic change occurred; within the past couple of decades the geomagnetic north pole has shifted dramatically, rapidly, and in a way that is far different from its previous movements. A glimpse at the map showing its location over the past two or three decades might lead one to believe that it had suddenly sprung to life and had discovered a mind of its own which it was determined to follow. One might even ask if it had suddenly decided to migrate to another country for it has taken rapid leaps in a north-north-westerly direction and finds itself located not among the southerly islands but among the far north-westerly islands of the High Arctic.

What a contrast to this is the movement of the North Celestial Pole, the point in the heavens about which the whole 'dome of the sky' turns in its diurnal motion! This "true north of the sky" which our ancestors have watched for thousands of years has been moving but ever so slowly, methodically, and inexorably. Astronomers are more fortunate than the geographers who hope to plot the shifting magnetic poles, for the celestial map makers can label with complete confidence the position of the pole for countless eons in the past as well as for untold millennia in the future.

The movement of the great "reckoning point" of the sky is all because of the wobbling of the earth as it spins on its axis. Most amateur astronomers are familiar with the effects (or some of them) of this wobbling, namely what is called the precession of the equinox and the fact that Right Ascensions and Declinations of stars are given for a certain date and these coordinates slowly change over the years. As the earth wobbles the point in the sky to which the axis (or line through the earth from pole to pole) points migrates around the sky in a circle of radius 23½ degrees, centred on a point called the North Ecliptic Pole. The effects of the earth's wobbling seem to be realized very slowly by comparison to human scales. It takes 25,800 years for the pole to complete one circle among some of the northern constellations. At this rate it takes 170 years for it to move one degree, and so, many generations may pass before observers using only unaided eyesight would even be expected to notice the pole's movement.

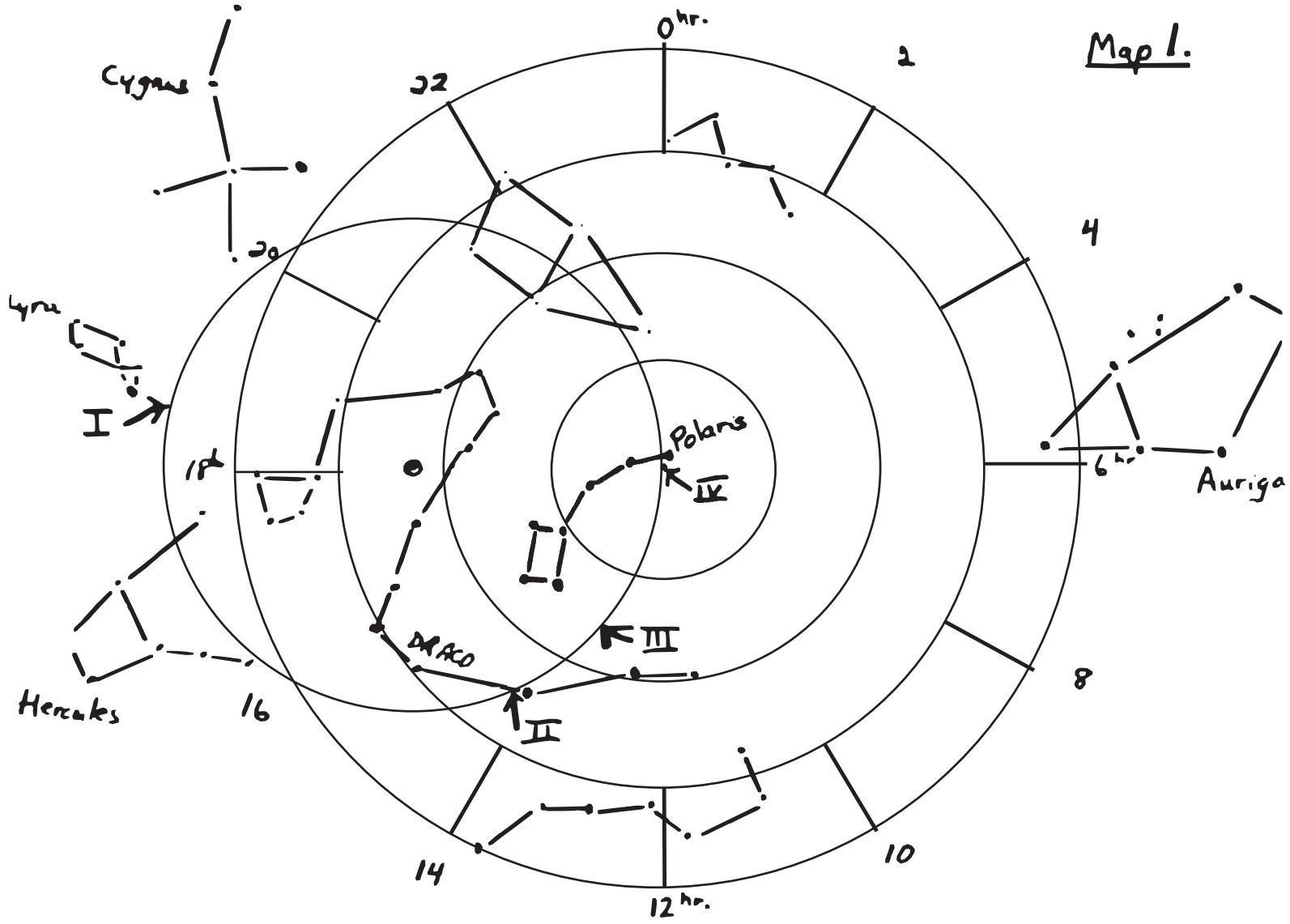
We now know that precession and its various effects are all the result of the earth's not being a perfect sphere, but rather a spheroid with a slight equatorial bulge and the fact that the earth is spinning not in the plane of the solar system but rather inclined 23½° to this plane. The sun may try to pull the bulged earth into line but because the earth is so occupied with its spinning on its inclined axis, it does not immediately obey the sun's force on its bulge but can only go into a slow wobble about the point that would have represented a perfect correspondence with the sun's pull.

Our ancestors long ago were able to observe several of the effects of this "wobbling" and slowly to realize the causes. It was observed that some stars seen along the southern horizon in one area of the sky could no longer be seen. In the second century B.C., the great Greek astronomer, Hipparchus, noticed that the coordinates of all the stars he measured were different from the figures obtained by the Babylonian astronomers before him, and he reasoned that those figures could not all be wrong. The map coordinates themselves, in effect, must have moved or the spin-axis of the earth must have moved. The earth must be "wobbling". For the Sumerians whose civilization flourished before 3000 B.C., the Pole Star was Thuban in the constellation Draco, and this was the North Star, also, to the builders of the Egyptian pyramids. (Before that in the dim, unrecorded past, men may have used Vega as the guiding star of the north and later cave-dwellers could have used several of the stars of the constellation Hercules.) In the age of Homer, the Pole Star was Kochab, Ursae Minoris though it was actually several degrees from the Pole. Evidently some Greek sailors continued a tradition of an earlier period, for Thales urged them to steer by the Little Bear rather than stars further south which had previously been in the area of the Pole.

In our age we are very fortunate in the northern hemisphere for the North Celestial Pole is now very close to the bright star, Polaris. In fact, not for thousands of years has the Pole been so close to any star of reasonable brightness, and Polaris is the only bright star to which it comes so close. The Pole is now less than one degree, in fact, about 50',from Polaris. In terms of the northern constellations, it is moving away from the cup of the Big Dipper and toward the area of the sky occupied by Cepheus and Cassiopeia, and in terms of Right Ascension, it is shifting towards the $0^{hr.}$ line which extends from the pole and away from the direction of the $12^{hr.}$ line.

Knowing the precise position of the North Celestial Pole is important when one is accurately aligning his telescope. For this reason and in order to illustrate what has been said about the movement of the pole, I have included a map showing the movement of the pole relative to Polaris and other stars.

Let us keep in mind, when we look to the north for our bearings, how fortunate we are in the present era that the Celestial Pole is so close to a very bright star that locating both of them should be a very easy matter. Keeping in mind some of the information on the accompanying map should enable us to move instantly from Polaris to the Pole and to say with assurance when we look through our telescopes that we can locate it precisely.

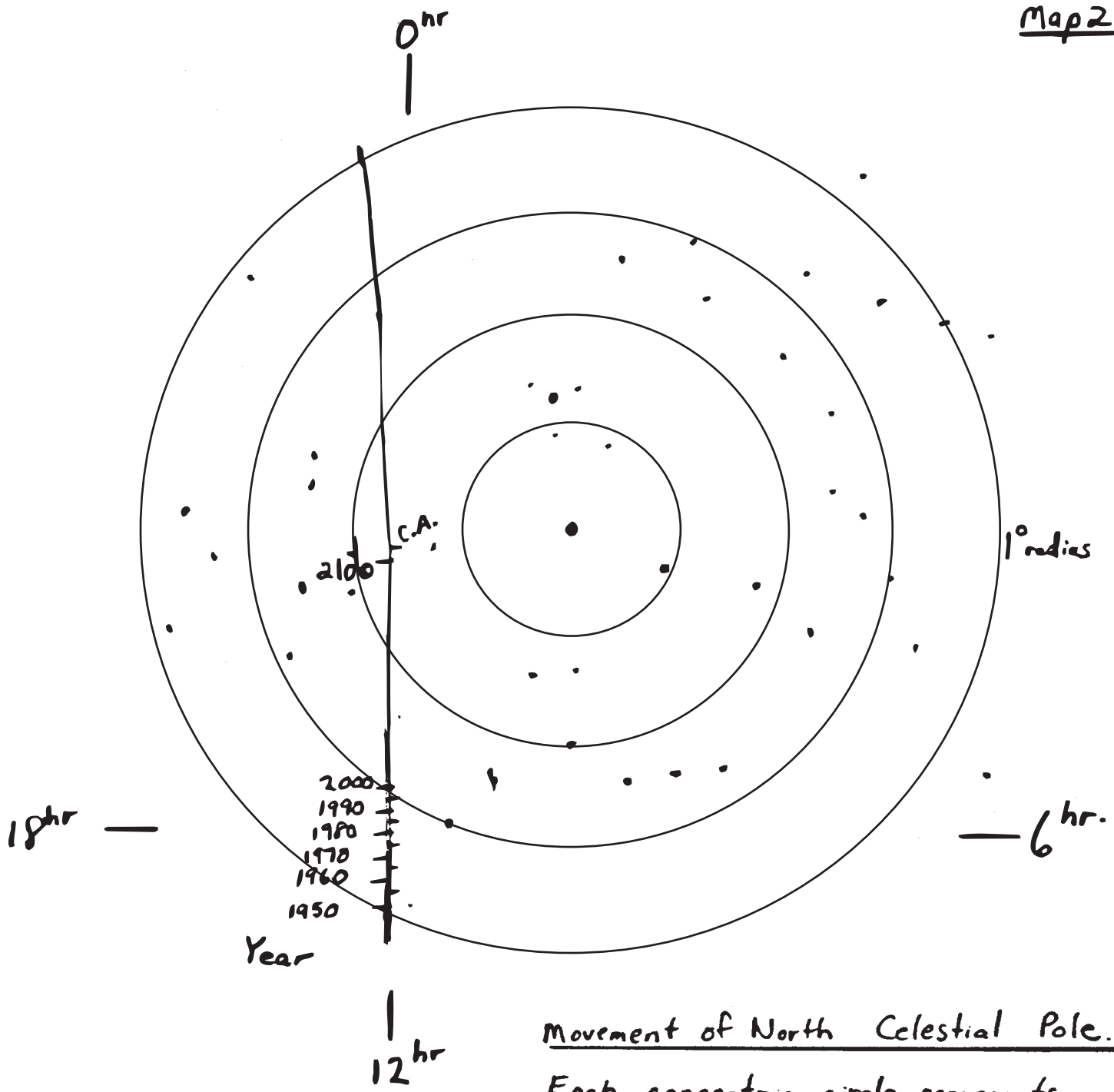


Movement of North Celestial Pole

The concentric circles represent 80°, 70°, 60°, and 50° N. Declination.
The circled dot is the N. Ecliptic Pole, in Draco.

I = the N. C. Pole near Vega in 12,000 BC.
II = the N. C. Pole near Thuban in 3,000 B.C.
III = The N. C. Pole near Kokab in 1,000 B.C.
IV = The N. C. Pole near Polaris in 2,000 A.D

Map 2.



The star field shown is that within one degree of the star, Polaris

Movement of North Celestial Pole.

Each concentric circle represents an increasing radius of $\frac{1}{4}°$ measured from the star Polaris.

The slightly curved line is the path of the North Celestial Pole.

Hours of R.A. are from the Pole's 1980 position.

The Pole's closest approach to Polaris is in 2105 A.D. (marked C.A.)

Stars marked are from the Atlas Borealis

2nd brightest is above Polaris about $\frac{1}{4}°$

Most stars are 8, 9, and 10th magnitude.

FOR YOUR COMPENDIUM OF ESOTERIC FACTS

Here is another fact concerning the brightness of celestial objects. Be sure to use it when a friend tells you that he has seen a waxing moon at or near first quarter that was almost as bright as the full moon. The fact is that the first quarter moon can never be nearly as bright as the full moon; it can never be more than about 1/11th as bright as the full moon! Not until less than 2 ½ days before full moon does the moon become even half as bright as it is at the moment of full moon.

It can then be seen that the moon's apparent brightness as viewed from earth and as compared to that at full moon, increases very slowly during the early part of the synodic month and very rapidly in the last little while before the full phase. The converse is true after the full phase is reached.

REPORTS AND OTHER ITEMS

1. We are thrilled to hear that Dr. Douglas, our Honorary President, had a successful eclipse trip to India, and enjoyed clear skies and a beautiful eclipse. We look forward to hearing more about the trip.

2. At our meeting of April 3rd we were pleased to see some good photographs taken by Angelika on her recent trip to Tucson, Arizona, the "astronomy capital of the world". She enjoyed her trip and saw first-hand many of the sites and instruments others have seen only in pictures.

3. If the weather cooperates, April should be a good month for meteor observers. What are called the April Fireballs may be observed at any time in the last half of the month but should particularly be looked for between April 23 and 26th. The moon is past first quarter, and so there is a part of the night which is moonless after moonset but this display is one that you can watch for even before the moon sets. This "shower" is one that has occasionally produced very bright fireballs and bolides. The night to watch for the Lyrid shower this year is April 21-22, the night of the first quarter moon, but after the moon sets there should be an opportunity to see or even photograph a few members of this ancient shower.

4. Observing the occultation of Aldebaran by the moon on April 17th is out of the question because moonset occurs before the event takes place. We can only envy our friends on the west coast or in places like Tucson. However, if we can spot the 3-day old moon before it sets that evening we may enjoy the spectacle of the bright red star very close to the moon's dark side.

5. We congratulate Dr. Roy Bishop of the Halifax Centre for the successful work he has done in bringing to light new facts relating to the telescope once thought to have been constructed by Sir Isaac Newton in 1671. The March issue of "Sky and Telescope" carried a report of Dr. Bishop's work, and I suggest that our members read it.

6. We would be interested in hearing from any of our members who may have plans for Attending the General Assembly this year in Halifax. The dates are June 27th to June 30th.

CLEAR SKIES AND GOOD OBSERVING!