Binocular Universe:

Northern Exposure

March 2013

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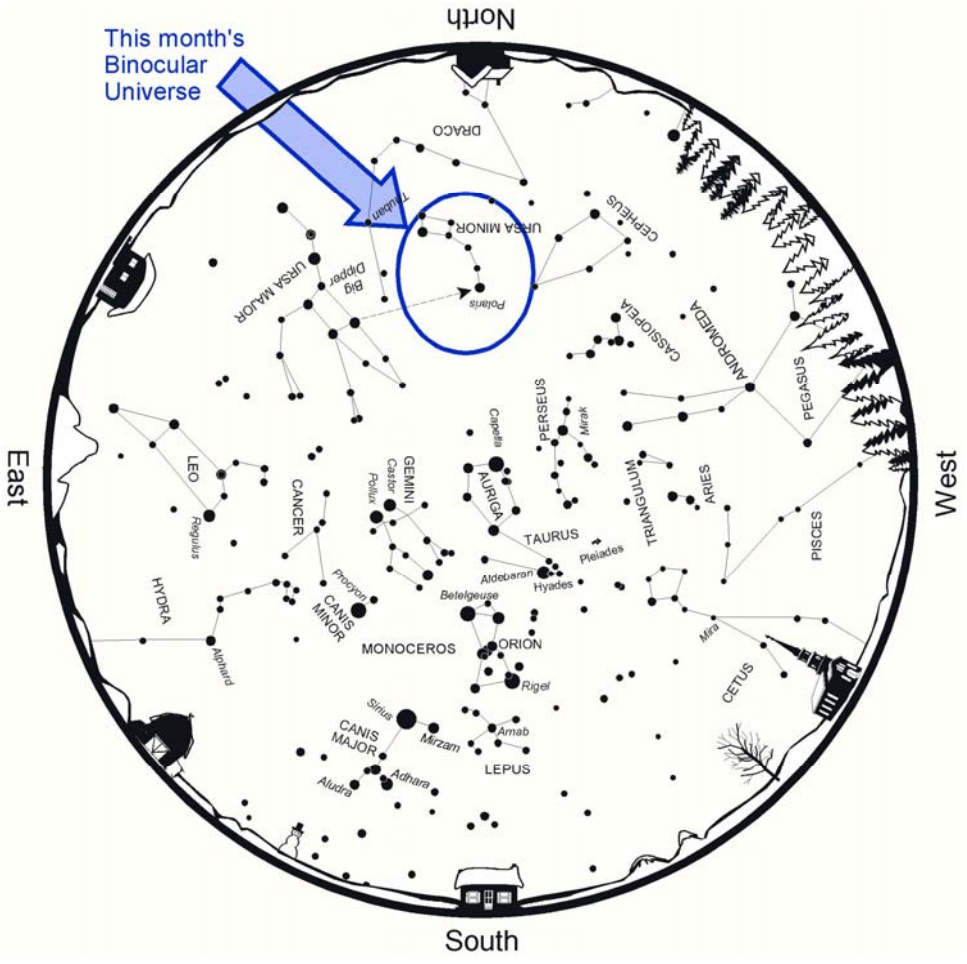
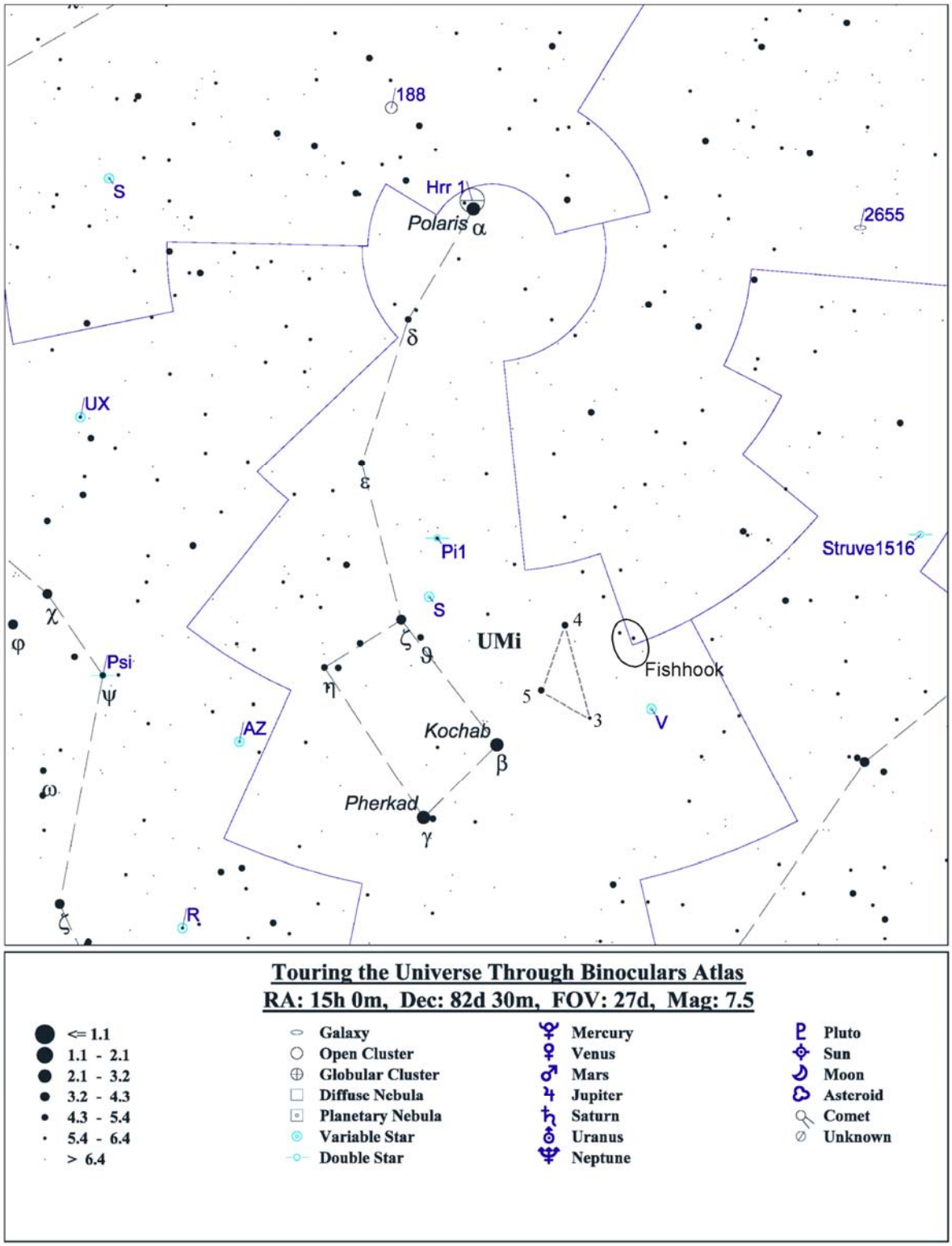
The northern circumpolar sky holds many binocular targets that we can enjoy throughout the year. This month, let's take aim at the constellation Ursa Minor, the Little Bear. You may know it better as the Little Dipper, an asterism made up of the seven brightest stars in the Little Bear.



Above: Winter star map from Star Watch by Phil Harrington.



Above: Finder chart for this month's Binocular Universe.
Chart adapted from Touring the Universe through Binoculars Atlas (TUBA),
www.philharrington.net/tuba.htm

Call it what you will, this star group is most famous as the home of the North Star, **Polaris** [Alpha (α) Ursae Minoris]. Earth's rotational axis is aimed just three-quarters of a degree away from Polaris, causing it to trace out a very tiny circle around that invisible point every 24 hours. The North Celestial Pole is slowly moving closer to Polaris. It will continue to close to within 14 minutes of arc around the year 2105, when it will slowly start to pull away.

While Polaris is currently the pole star, the 26,000-year wobble of Earth's axis, called precession, causes the Celestial Pole's aim to trace a 47° circle in the sky. For instance, during the building of the pyramids nearly 4,600 years ago, the North Pole was aimed toward the star Thuban in Draco. Fast forward 5,200 years from now and the pole will be point near Alderamin in Cepheus.

Most of us at one time or another have heard someone misspeak by referring to Polaris as the brightest star in the night sky. One look its way will quickly dispel that myth, however. In fact, 2nd-magnitude Polaris is the 48th brightest star in the night sky.

If you find that disappointing, take heart that despite its dimness, there is more to Polaris than meets the eye. Polaris is a Cepheid variable star, an important class of star that has proven invaluable to our understanding of distances in the universe.

All Cepheid variables, including Polaris, are yellow giant stars that pulsate with precise regularity. Cepheids have a very well established relationship between their periods and their luminosity, or inherent brightness. The longer a Cepheid's period of variability, the greater its luminosity. By measuring a Cepheid's periodicity, we can also determine its luminosity, or it's "wattage" if you prefer. Once we know that as well as the star's apparent brightness, or magnitude, its distance can be calculated very precisely. From studies, Polaris, which takes 3.97 days to complete one cycle, is known to be 430 light years away. Unfortunately, it only changes in brightness by about 0.03 magnitudes. That's far too subtle to notice through binoculars.

The next night you're out with your binoculars, check out Polaris nonetheless. If you look carefully, you should see that it belongs to a circlet of faint stars. I first read about this asterism in Burnham's Celestial Handbook, where it is described as a heavenly **Engagement Ring**. It's plotted on the finder chart here as Hrr 1, a reference to it being the first of a dozen asterisms described in my book Touring the Universe through Binoculars. Judging by how bright Polaris is compared to the other stars, that's a lot of bling! Of course, in reality, these stars all lie at very different distances away from Earth, and so do not form a true cluster.

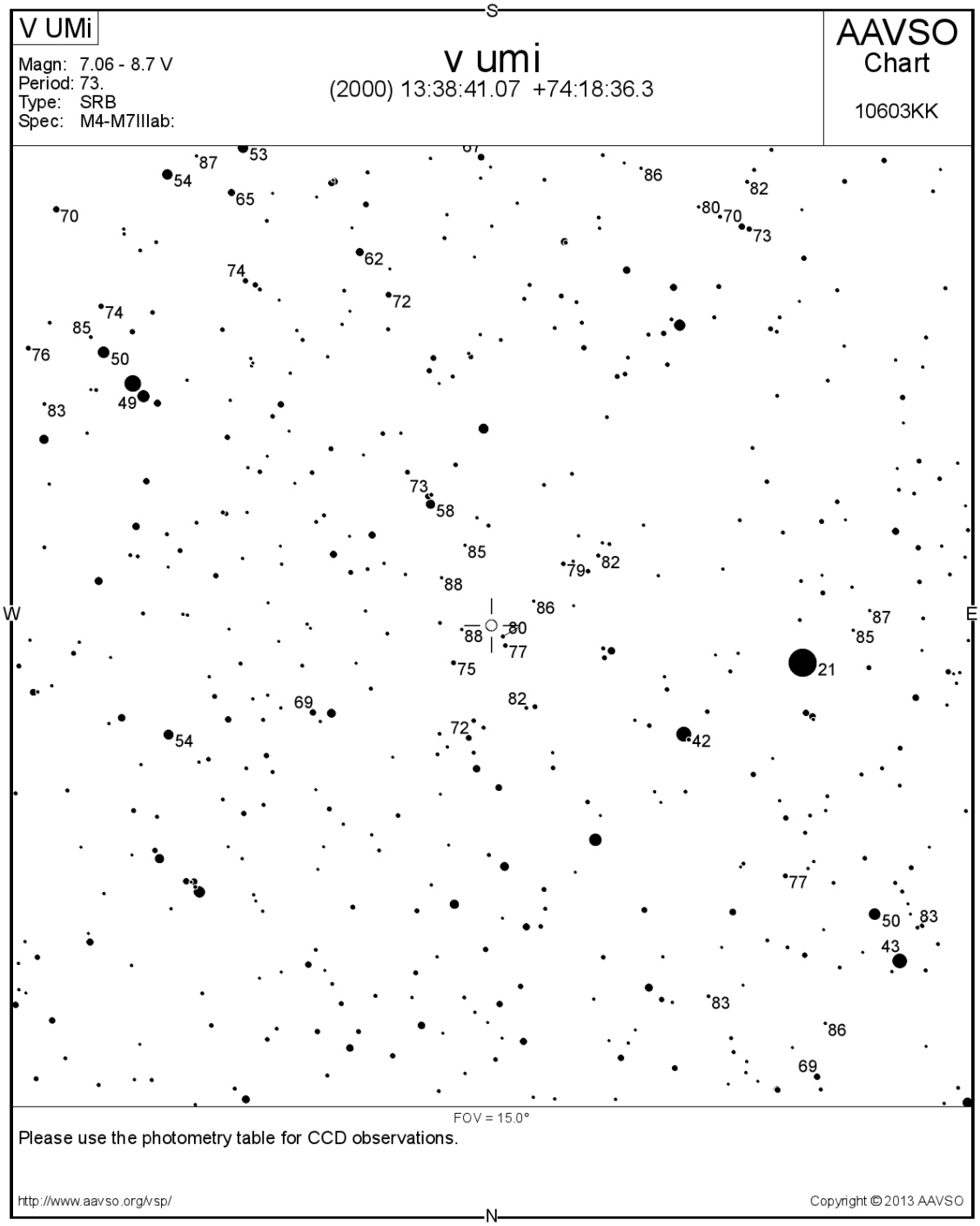
The second brightest star in Ursa Minor, **Kochab** [Beta (β) Ursae Minoris], is just a tenth of a magnitude fainter than Polaris. Both look yellowish through binoculars, but you may have to defocus their images slightly to enhance the delicate color.

Can you spot another yellowish star, 4th-magnitude **5 Ursae Minoris**, lying just to the right (west, as the chart is oriented) of Kochab? Together, they remind North Carolinian observer Tomm Lorenzin as "double caution lights."

Left: Yellowish Polaris highlights the Engagement Ring asterism in this sketch made by the author through 10x50 binoculars.

Dimmer 3 Ursae Minoris to the southwest of 5 Ursae Minoris and 4 Ursae Minoris to the northwest join in to form distinctive right triangle of stars. Using your averted vision, look just to the west of the line connecting 3 to 4. Can you see a hook-shaped group of 7th- and 8th-magnitude stars? In his book Observing the Night Sky with Binoculars, author Stephen O'Meara calls this hook-shaped asterism the **Fishhook**.

Next, we have **V Ursae Minoris**, a semi-regular variable star that is fun to monitor through binoculars. The American Association of Variable Star Observers (AAVSO) includes it as one of 153 variable stars in their Binocular Program. As they explain on their web site, most of the stars in this program are either long-period variables (like Mira in Cetus) or semi-regular stars, like V. Most of the stars in the program fluctuate between magnitudes 3 and 9.5, so can be monitored continuously through hand-held binoculars. As our example here, V UMi, as it is written in shorthand, usually flutters between magnitudes 7.1 and 8.7, with an average period of 73 days. Use the finder chart below from the American Association of Variable Star Observers, or if you'd prefer, generate your own custom version using the chart generator at http://www.aavso.org/vsp .



Finder chart for V Ursae Minoris, created with the AAVSO's chart-generator web site.

And finally, we jump the border into northern Cepheus for the open cluster **NGC 188**. Fair warning up front: this is a tough catch through binoculars, even with 70- and 80-mm giants. That's why I include it as "Big Binocular/Small Scope" challenge #64 in my book Cosmic Challenge. To try your own luck, head back to Polaris. NGC 188 lies only 4 degrees away. Under exceptional skies, some have reported seeing the cluster's gentle glow through 50-mm, and even smaller, binoculars. The

best I can claim, however, is spotting a very subtle hint through 16x70 binoculars under the dark Vermont skies from the Stellafane convention many years ago.

NGC 188 is unique in more ways than its unusual location. Looking at its individual stars reveals that its hottest main sequence star is spectral class F2, with many others rated as spectral classes G and K. That's in sharp contrast to what we find in most star clusters, which are made up of spectral type O, B, and A stars. All of these are far hotter and more massive. They live life in the fast lane, consuming their hydrogen fuel at a furious rate, only to evolve off the main sequence in several million years. Lower mass stars like our Sun and those in NGC 188 survive for billions of years, as they use up their hydrogen far more judiciously. Therefore, from these studies we know that NGC 188 is unusually old for an open cluster. Current estimates put it at 5 billion years old. That makes it the second oldest open star cluster north of the celestial equator. Only NGC 6791 in Lyra is older.

As you can see, there are plenty of binocular targets awaiting us in the north circumpolar sky. I have discussed only a few. The list below includes many more.

Object	Con	Type	R.A. (2000)	Dec	Mag	Size/Sep/ Period	Notes
2655	Cam	Gx	8 55.6	+78 13	10.1	5'x4'	SBa
188	Cep	OC	0 44.4	+85 20	8.1	15'	*TUB page 121-122*
U	Cep	Vr	1 2.3	+81 53	6.7-9.2	2.493 days	Eclipsing Binary
S	Cep	Vr	21 35.2	+78 37	7.4-12.9	486.84 days	Long Period Var; carbon
Struve1516	Dra	**	11 15.4	+73 28	7.6,8.1	36.2"	102°(1940);8100
OSS 123	Dra	**	13 27.1	+64 44	6.7,7.0	69"	147°(1924)
AG	Dra	Vr	16 1.7	+66 48	8.8-11.8p		*TUB page 149* Z And type
R	Dra	Vr	16 32.7	+66 45	6.7-13.0	245.47 days	*TUB page 149* Long Period Variable
AZ	Dra	Vr	16 40.7	+72 40	8.0-8.9p		Irregular
Psi	Dra	**	17 41.9	+72 9	4.9,6.1	30"	15°(19
6543	Dra	PN	17 58.6	+66 38	8.8p	18"	*TUB page 149*
UX	Dra	Vr	19 21.6	+76 34	5.9-7.1	168 days	Semi-Regular
Hrr 1	UMi	OC	2 32	+89 0		45'	*TUB page 250* "Diamond-Ring" asterism
V	UMi	Vr	13 38.7	+74 19	8.8-9.9p	72 days	Semi-Regular
U	UMi	Vr	14 17.3	+66 48	7.4-12.7	326.51 days	*TUB page 250* Long Period Variable
Pi1	UMi	**	15 29.2	+80 27	6.6,7.3	31"	80°(1959);9696
S	UMi	Vr	15 29.6	+78 38	7.7-12.9	326.25 days	*TUB page 250* Long Period Variable

Best of all, each can be found every night of the year, at least for most of us. So, wait for that special night! That's when you will find that, for northern exposure, two eyes are better than one.

About the Author:

Phil Harrington is the author of nine books on astronomy, including Touring the Universe through Binoculars and Cosmic Challenge. Visit his web site at www.philharrington.net