Binocular Universe: Some Crown Jewels

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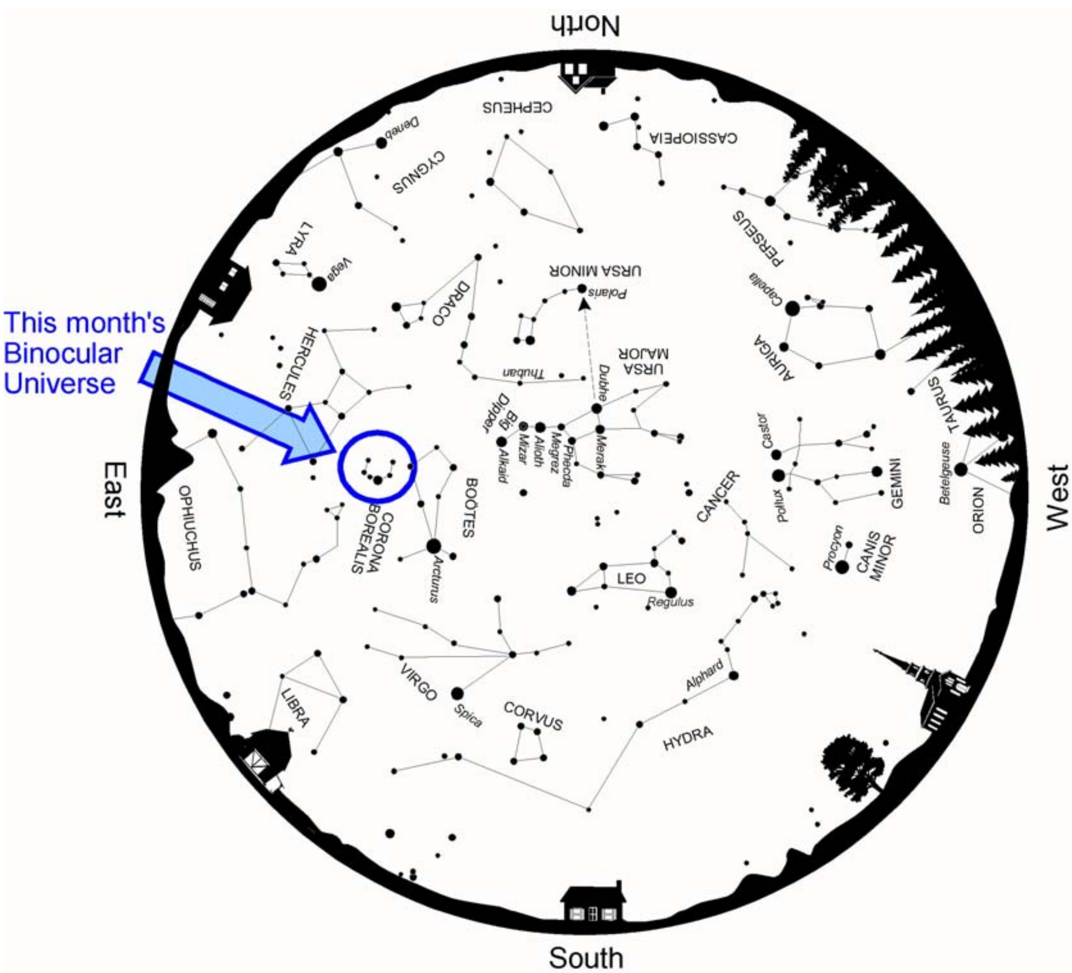
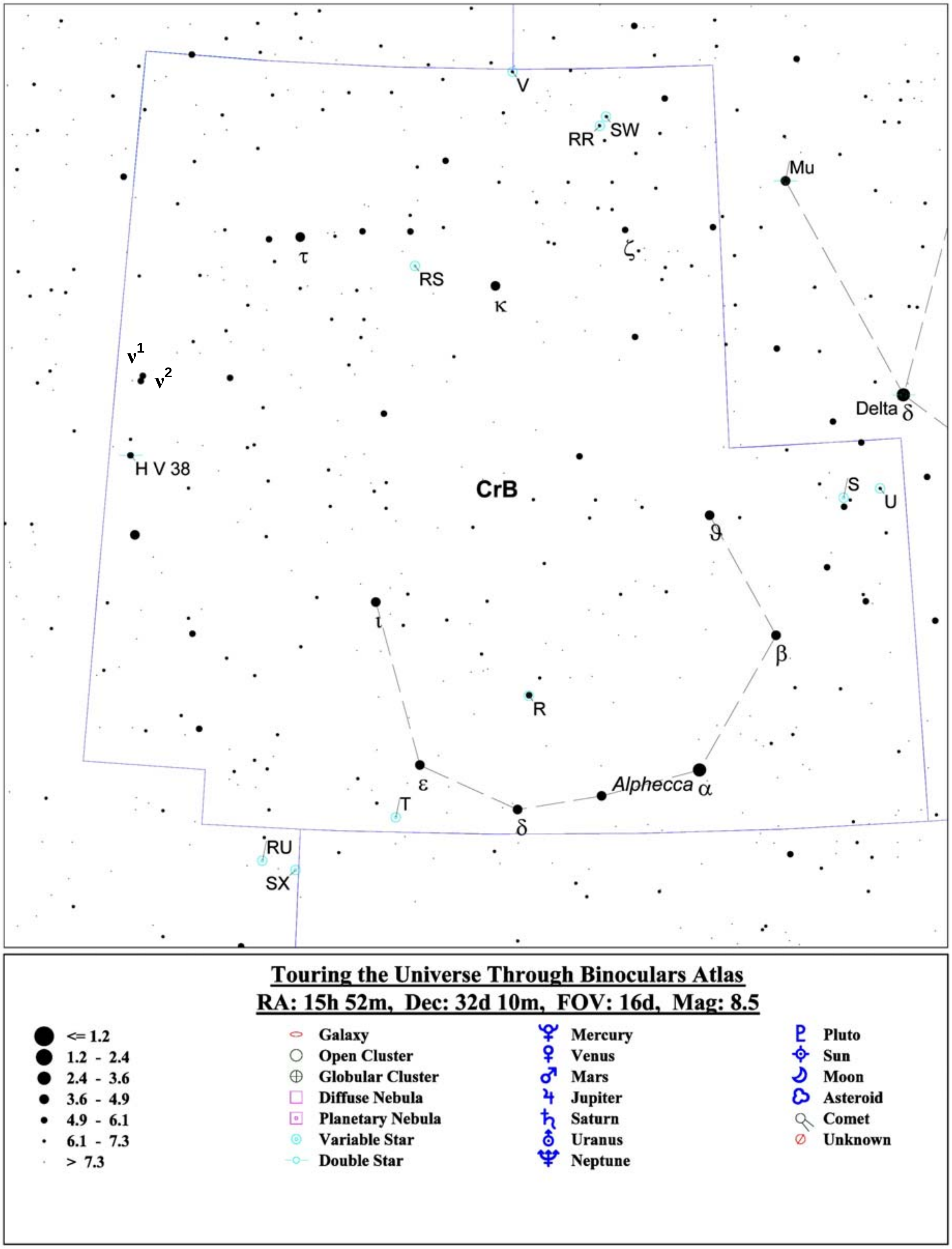
If you're like me, then you probably noticed certain star patterns even before you became "an astronomer." One of mine was Corona Borealis. I remember looking up at this semicircular pattern of six stars and thinking that the sky was smiling at me.



Above: Spring 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

Corona Borealis has been portrayed as many things over the course of history. It all depended on one's point of view. For instance, my celestial smile was interpreted as a boomerang by Australian Aborigines. To the Cheyenne Native Americans, the stars were huts set in a camp circle. To Welsh stargazers, the stars were *Caer Arianrhod*, "the Castle of the Silver Circle," while to some Arabic cultures, they were "the bowl of the poor people." Still others saw a wreath.

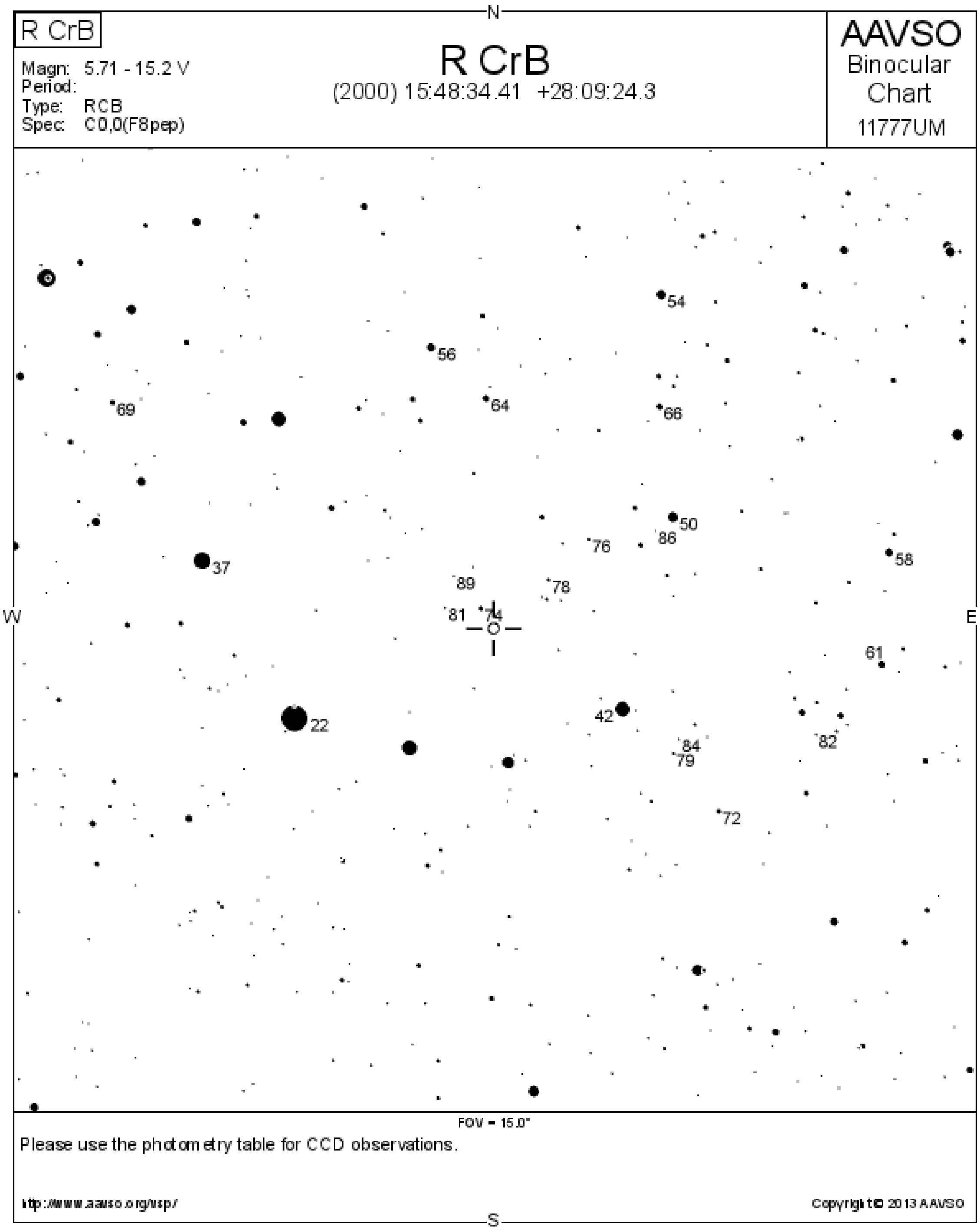
History records that the second century AD astronomer Ptolemy was first to portray them as Corona Borealis, the Northern Crown. And not just any crown, mind you, but the crown worn by Ariadne, the daughter of Minos of Crete, during her wedding to the god Dionysus. After the ceremony, her crown was placed in the sky for all to see.

Although only one of its crown jewels shines as brightly as second magnitude, the constellation's distinctive shape lets it stand out among this season's constellations. And while none of the Crown's nonstellar deep-sky denizens breaks the binocular barrier, it does hold many interesting stars for us to seek out.

Centered among the Crown's stellar jewels is one of the sky's most unusual variable stars, **R Coronae Borealis**. This odd star usually shines around 6th magnitude, looking like just another point of light. But every now and then, suddenly and unpredictably, its brightness plummets to magnitude 13 or 14 in a matter of ten days to two weeks. Many liken its behavior to a "reverse nova." As Margaret W. Mayall, late director of the American Association of Variable Star Observers, once wrote, R Coronae Borealis is "one of the most interesting and most peculiar of all variables, and is often called the 'ideal' irregular variable. Its times of minima are distributed absolutely at random, according to the laws of pure chance." These unannounced descents usually last for several months, although some have continued for years. Then, just as unpredictably as it faded, R will ascend from the depths of obscurity back to its "normal" brilliance, often in irregular steps.

Discovered in 1795 by British amateur astronomer Edward Pigott, R Cor Bor, as it's often nicknamed, is the prototype of a class of spectral F and G yellow supergiant stars that are unusually rich in carbon. Although these stars are similar to our own Sun in terms of surface temperature, they differ in many important ways. Studies show that occasionally these stars expel a carbon-rich cloud of celestial soot that surrounds the star. In the process, the star's light-producing photosphere is partially blocked, causing the star's brightness to fall off. What mechanism produces this sooty exhaust remains a mystery, although astronomer Geoffrey Clayton has come up with a leading theory behind the behavior. He describes it as the Dust Puff Theory. Writing in the March 1996 <u>Publication of the Astronomical Society of the Pacific</u>, Clayton theorizes that the sooty cloud comes from the star itself as it undergoes internal pulsation. Material is thrown off from the star and slowly drifts away. As it moves outward, its temperature falls until it reaches the condensation temperature of carbon. As the opaque cloud of carbon forms, the star itself is partially blocked from view. Eventually, radiation pressure from the star dissipates the cloud, returning the photosphere to view.

If you are interested in following R Cor Bor, the chart below, from the American Association of Variable Star Observers' on-line Variable Star Plotter, shows R and its surroundings. Compare its magnitude to the neighboring stars and watch for the next drop in brightness. Objects like R Coronae Borealis prove that our universe is dynamic, violent, and changeable. And the greatest part of that is you only need a modest pair of binoculars to see our active universe at work right from your own backyard.



T Coronae Borealis is another odd variable found within the Northern Crown. For the most part, this star leads an unspectacular life at 10th magnitude. But all this has changed abruptly on at least two occasions in the past when T unexpectedly erupted to about 2nd or 3rd magnitude. On May 12, 1866, it peaked at magnitude 2.0. The star fell to magnitude 9.5 in less than a month, and settled back to 10th magnitude in about 250 days. Eighty years later, it flared again to 3rd magnitude. Once again, it soon faded to 10th magnitude, and has remained there ever since.

T Coronae Borealis is an example of a recurrent nova. In this binary system, a red giant star is bound gravitationally to a white dwarf companion. As the two continue their orbital dance, the white dwarf's intense gravitational field pulls material off of the red giant. When the amount of transferred hydrogen reaches a high enough level, a nuclear detonation is triggered, exploding the material off of the white dwarf and causing the system to burst in brightness. Will T Coronae Borealis burst again, and if so, when? If we play the odds, then perhaps around 2026. But, of course, it could be sooner. Who knows, it could happen tonight!

For double-star fans, the Crown holds a couple of targets worth scoping out. Let's first visit **Nu Coronae Borealis**, set near the constellation’s eastern border. Here, we find two nearly twin 5th-magnitude suns separated by about 6 arc-minutes. That’s just wide enough to be resolvable without any optical aid at all, making them a great naked-eye test as long as light pollution doesn’t wipe them out. They form a striking couple through just about any pair of binoculars.

Studies show that the “Nus” are a little more than 500 light years away; the eastern star, red giant Nu-1, is 555 light years, while orange giant Nu-2 is a little closer at 545 light years. While nearly the same distance, and even though they are about the same age, it turns out that the Nus do not form a true binary system. We know this from studying their motions; one is going one way and the other is going another way in their travels through the Milky Way. As the saying goes, “close only counts in horseshoes and hand grenades,” but apparently not with these two stars.

And finally, for those who have 70-mm and larger binoculars, try your luck with the true binary system **H V 38**, just to Nu’s south. H V 38, from William Herschel’s catalog of binary stars, was originally assigned to Hercules as **23 Herculis**, but now finds itself with Corona Borealis. Large glasses are needed for the best view, although the two component stars may be separately resolved using smaller binoculars under dark skies. Look for a 9th- magnitude secondary star next to the system’s 6th-magnitude primary sun. They are separated by about 35" of arc, with each shining pearly white.

Looking for still more crown jewels? Here are some additional targets within this month’s Binocular Universe.

Object	Con	Type	R.A. (2000)	Dec	Mag	Size/Sep/ Period	Notes
Delta	Boo	**	15 15.5	+33 19	3.5,8.7	105"	79°(1976);9559
Mu	Boo	**	15 24.5	+37 23	4.3,6.5	108"	*TUB page 98* 171°(1956);9626
U	CrB	Vr	15 18.2	+31 39	7.7-8.8	3.452 days	Eclipsing Binary
S	CrB	Vr	15 21.4	+31 32	5.8-14.1	360.26 days	*TUB page 131-132* Long Period Variable
SW	CrB	Vr	15 40.8	+38 43	7.8-8.5	100 days	Semi-Regular
RR	CrB	Vr	15 41.4	+38 33	8.4-10.1	60.8 days	Semi-Regular
R	CrB	Vr	15 48.6	+28 9	5.7-14.8		*TUB page 132* Irregular; R CrB prototype
V	CrB	Vr	15 49.5	+39 34	6.9-12.6	357.63 days	Long Period Variable
RS	CrB	Vr	15 58.5	+36 1	8.7-11.6p	332.2 days	Semi-Regular
T	CrB	Vr	15 59.5	+25 55	2.0-10.8	29000 days?	*TUB page 132* Recurrent nova (1946)
H V 38	CrB	**	16 22.9	+32 20	6.3,8.8	34.7"	*TUB page 132* 19°(1914);10031
SX	Her	Vr	16 7.5	+24 55	8.6-10.9p	102.90 days	Semi-Regular
RU	Her	Vr	16 10.2	+25 4	6.8-14.3	485.49 days	Long Period Variable

I'll be back next month to delve headlong into the summer sky. Until then, remember that two eyes are better than one.

About the Author:

Phil Harrington is the author of nine books on astronomy, including Star Ware and Star Watch. Visit his web site at www.philharrington.net