

Introduction

A WONDER LIKE NO OTHER

In her book *The Edge of the Sea* (1955), conservationist and author Rachel Carson referred to the countless grains of sand on a beach as both “beautiful” and “mysterious.” Each grain, she wrote, “is the result of processes that go back into the shadowy beginnings of life, or of the earth itself.”

Instead of sand, Carson might have been writing about stars, since they, too, are countless and the result of processes that extend back to the beginning of the universe. Astronomers, both amateur and professional, are often keenly aware of the enormity of their subject, although approaching it from the scientific perspective can sometimes make it a clinical exercise. Still, we are compelled to occasionally set aside our wired-up telescopes bristling with lenses, filter arrays, cameras, autoguiders, and hand controls, and simply gaze up at the universe *in situ*, as it were. It’s as if we have a need to take it directly into our eyes without intervening optical apparatuses, where we may internalize it as a song, a poem, or ineffable meditation. When I asked a friend at a recent star party what she felt when she looked up at the stars, I was struck by her reply: “I feel a wonder like no other.”

That is well said. Such sentiments express how we as compilers of *Annals of the Deep Sky* often feel — a singular wonder not only at the physical scale of the universe (and our smallness in it), but also its beauty and mystery. These attributes, after all, are what attract us to chasing stellar flickers and shadows between the stars, to pursue and celebrate what we may not be able to understand, but can certainly appreci-

ate. Stars and galaxies, like grains of beach sand, each have their own evolutionary story that can be traced back to the primordial universe. Toward that end, we are pleased to present for your consideration volume 6, which abounds in through-the-looking-glass examples of stars and deep-sky objects.

Take Alpha Chamaeleontis for example, a star that is not what it appears. Its spectrum resembles an old giant, but its luminosity and temperature indicate that it's a younger dwarf. Epsilon Cha is also enigmatic in that it not only harbors an unknown number of companions, but it also may be a member of an entire association of comoving stars.

Consider another denizen of Chamaeleon, NGC 2915. Optical observations show it to be a modest-size galaxy with a nucleus that exhibits coarse star streams. Radio observations, however, reveal that the galaxy is immersed in a vast pool of neutral hydrogen with a radius at least a dozen times that of the visible disk.

Curiouser and curiouser are the objects we find in the other constellations featured in this volume. The Circinus Galaxy (ESO 97-13) exhibits both Seyfert 1 and Seyfert 2 characteristics (broad and narrow emission lines), while its ratio of infrared to nonthermal radio luminosity resembles that of the starburst galaxy M82 in Ursa Major. It apparently harbors an active galactic nucleus cloaked in a dusty torus that has produced a bipolar radio lobe.

Columba, too, has its cabinet of curiosities. The star Mu Columbae appears to be a runaway that originated in a double-star system in Orion some 2.5 million years ago. Its former stellar "partner" now resides in Auriga as AE Aurigae, 65° (1,600 light-years) to the north. Ensnared in the constellation's southwestern corner, the bright globular cluster NGC 1851 may have a secret identity: its huge halo suggests that it may have once been a dwarf galaxy. How a globular cluster or dwarf galaxy can retain such a large halo remains a mystery. And just looking at the image of another galaxy in that constellation, NGC 2188, one wonders how it came to look like a bar in a barred galaxy, but without a surrounding disk.

It was once theorized that this galaxy was not a disk system, per se, but a spinning rod!

There is simply no end to stellar and nonstellar curios in Coma Berenices, beginning with its alpha star Diadem, a close binary that is seen virtually edge-on. Because the components are so close in brightness, making it difficult to differentiate the primary from the secondary, it took years before a period was determined. Then we have FK Comae Berenices, which rotates at a dizzying speed of 160 kilometers per second. It is known as a “flip-flop” yellow giant because its concentrated active region periodically flips from one longitude to its opposite, where it remains for a little over 6 years before returning to its original longitude. The star may also be the product of a partially coalesced binary system. In any case, FK is not your typical rotational variable star.

Coma’s Galactic *Wunderkammer* features such objects as NGC 5053, a globular cluster that may have been plucked by our galaxy from the Sagittarius dwarf spheroidal galaxy, and M53, a first-generation globular cluster, i.e., one of the oldest known in our galaxy: age, 12.7 billion years.

There are simply too many galactic oddities to mention here, but we will cite M64, a.k.a. the Black Eye Galaxy. It exhibits a well-defined inner ring from which spiral arms spring in a counterclockwise direction. But it also possesses an outer pseudoring from which two low-contrast spiral arms unwind in a *clockwise* direction. Add to this M85, a peculiar luminous lenticular outlier of the Virgo cluster. It has apparently interacted with its barred-spiral neighbor, NGC 4394, the result being an unusual swirly spiral structure in the outer regions of M85. And, of course, we have to include NGC 4676 AB (Arp 242), known as the Mice for their double-tailed structure, the result of a close interaction that will lead to their eventual merger and reincarnation as an elliptical galaxy hundreds of millions of years hence. Other galaxies, such as NGC 4565 (the Needle Galaxy), M95 (with its prominent bar), the grand design spiral M100, and the two supergiant central elliptical galaxies in the Coma Cluster, NGC 4889 and NGC 4874, are just beautiful systems to study observationally or image.

And let's not forget little Corona Australis, the Southern Crown, which despite its southerly location can be seen in the southerly latitudes of the Northern Hemisphere. This little jewel hosts a very old globular cluster (NGC 6541) and a binary galaxy (NGC 6768), with overlapping halos. Also interspersed among the stars of Corona Australis is the Corona Australis Molecular Cloud. Good things do come in small packages!

The Navajo people traditionally greet each day with a morning prayer that evokes their spiritual attachment with everyone and with Mother Earth. There are many variations of this prayer, but the one I like best encapsulates the simplicity, and continual pursuit, of beauty in the universe.

With beauty may I walk.

With beauty before me, may I walk.

With beauty behind me, may I walk.

With beauty below me, may I walk.

With beauty above me, may I walk.

With beauty all around me, may I walk.

Enough said. We hope readers enjoy this volume of *Annals*. Perhaps it will provide new inspiration when looking up at the stars.