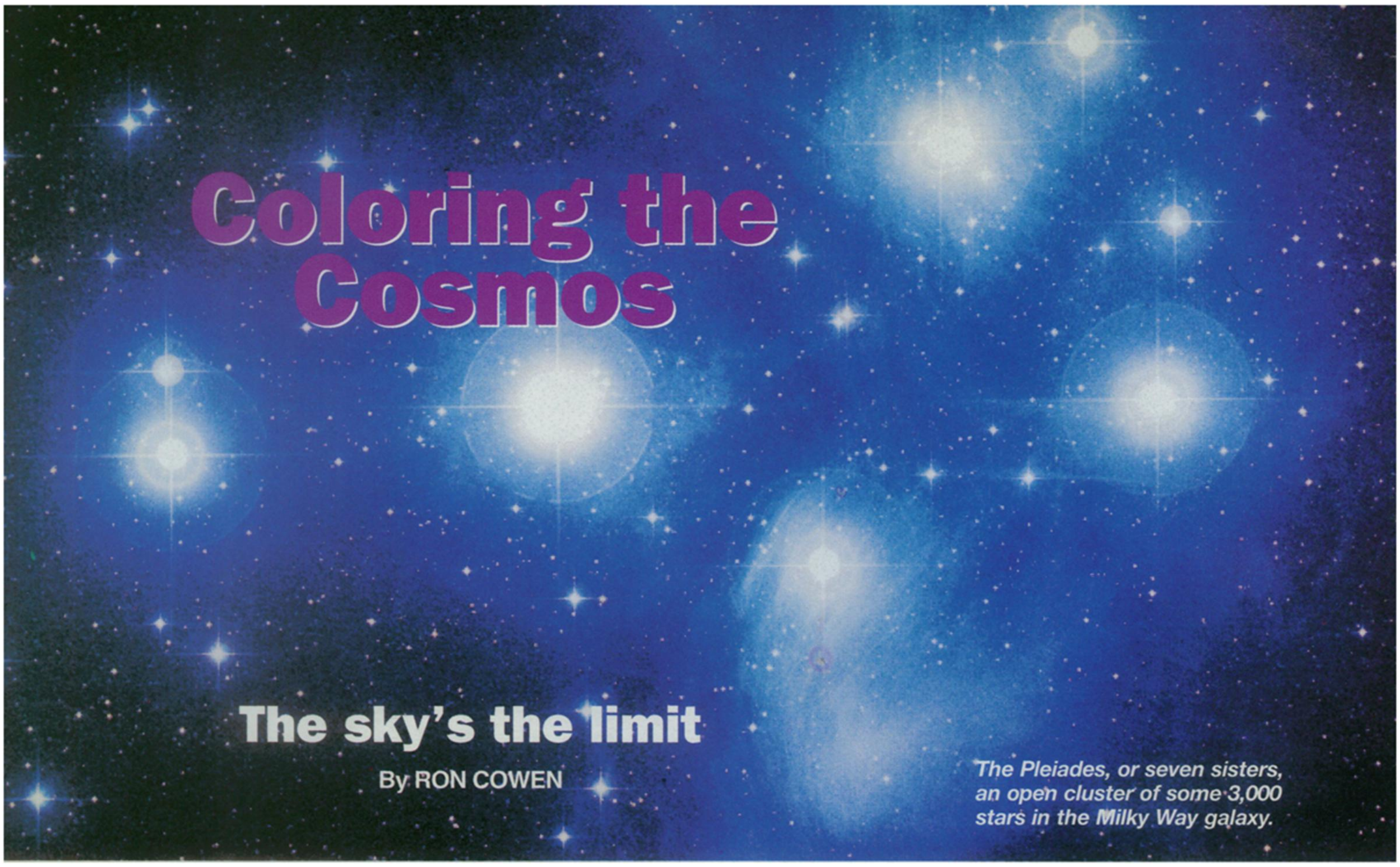
Coloring the Cosmos

The sky's the limit

By RON COWEN



The Pleiades, or seven sisters, an open cluster of some 3,000 stars in the Milky Way galaxy.

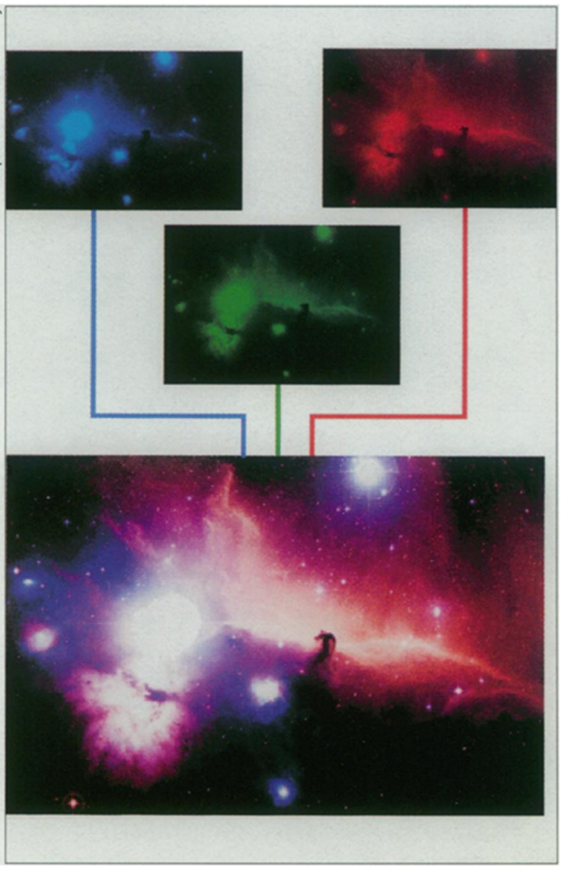
Come one, come all, on a tour of the universe! Fly over the byways of the nearby Andromeda galaxy, zooming in on spiral arms studded with stars. Take a peek at dark dust lanes and ruddy-hued islands of gas in the Tarantula nebula. Marvel at the Horsehead nebula, silhouetted against a background of gas and dust aglow in blues, reds, and purples. Get up-close and personal with the stars in the Pleiades cluster, their white light bathed in a halo of royal blue.

You don't have to board a rocket to see these and other true-color views of the cosmos. If the efforts of British astronomer Harvey T. MacGillivray continue to bear fruit, multihued portraits of almost the entire sky may be available on CD-ROMs by the turn of the century.

Earlier this year, MacGillivray, a researcher at the Royal Observatory in Edinburgh, decided to paint the sky red—as well as blue, green, and every hue in between. Rather than laboriously photographing small patches of the night sky at a variety of wavelengths, MacGillivray relies on a computer and two huge archives of photographic plates taken at red and blue wavelengths.

Astronomers have traditionally imaged the sky using red and blue filters, because the brightness contrast from one end of the visible spectrum to the other can help distinguish many kinds of celestial objects. In order to produce a full-color image of the sky, however, MacGillivray has to extend the range of hues by carefully constructing a mock-up of a green image from the red and blue ones.

All photos © MacGillivray



MacGillivray scans and digitally combines red, blue, and green images to create nearly true-color views of celestial objects, in this case the Milky Way's Horsehead nebula, located in the Orion constellation.

Using sophisticated software to align and digitize images of the same patch of sky in the three hues, he produces a computer-generated picture that closely matches the sky's true colors. Unlike photographs, the digital images can be easily manipulated, he notes.

"To zoom in on the center of an image, I don't have to go into the darkroom and enlarge it," MacGillivray says. "The survey plates provide both wide-field and narrow-field views, and I can pan around a celestial object as well as zoom in to highlight intriguing structures."

True-color images, he adds, can accentuate faint objects, which tend to be overlooked in black and white. More generally, "I'm hoping that the images will stimulate astronomers to examine familiar objects on the sky in a new light. Putting together a digital map of a fairly large chunk of the sky opens up new avenues [of exploration]."

Astronomer David F. Malin of the Anglo-Australian Observatory near

Epping, Australia, has made a spectacular, though smaller, set of true-color celestial photographs using the traditional method of combining red, blue, and green images in the darkroom (SN: 8/8/92, p. 88). "I must say I am very impressed," Malin said recently, after examining some of MacGillivray's computer-generated pictures. "These images reveal the power of using digital methods and I believe there is a great future in this. There is no reason in principle why the whole sky could not be recorded in color."

At present, MacGillivray gets his supply of photographic plates from two sources. For pictures of the southern sky, he uses a nearly complete set of survey images taken by the 1.2-meter U.K. Schmidt telescope in Coonabarabran, Australia. For pictures of the northern sky, he relies on photographic plates from the first Palomar Sky Survey, performed in the 1950s using a 1.2-meter telescope atop Mount Palomar in California. MacGillivray hopes soon to obtain images from the second Palomar Sky Survey, an ongoing study that began in the early 1990s and uses finer grained, more sensitive emulsions.

His ultimate goal, MacGillivray says, is to create digitized color images of a large fraction of the sky in 2 to 3 years and make them available on CD-ROMs. In the meantime, he says, "I'm taking it one step at a time," using the Royal Observatory's high-speed scanning machine, SuperCosmos, to digitize some of the more familiar regions of the sky, in particular the rich star fields and glowing gas clouds that populate the Milky Way.

Some 4,000 images are required to survey one hemisphere of the night sky down to extremely faint light levels. Each photographic plate measures about 14 inches square and records a patch of sky about 13 times as wide as the moon.

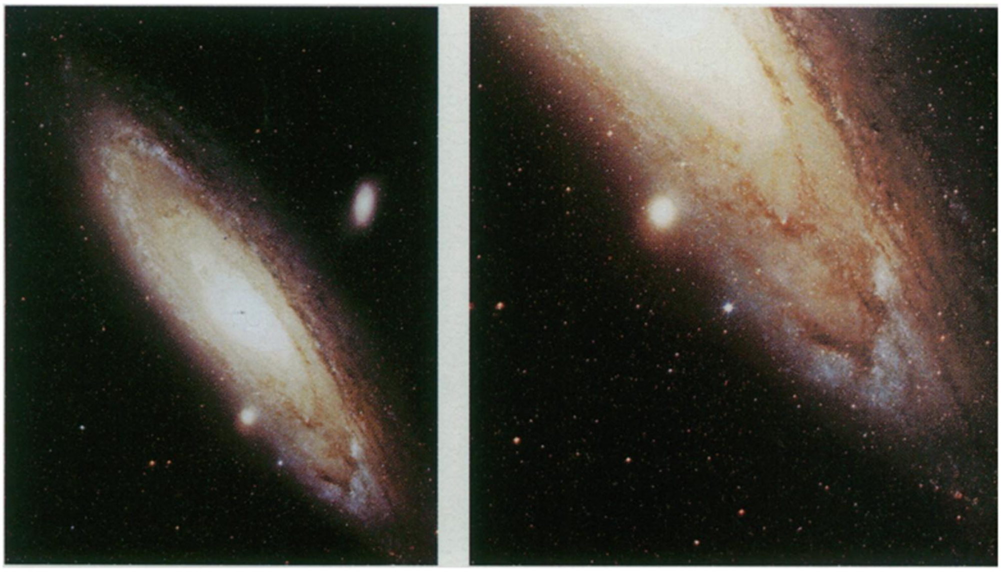
In about 2 hours, SuperCosmos converts every plate to a digital image containing 2,500 dots per linear inch. At this resolution, the diameter of the moon would cover some 2,700 dots. Each scan of a plate generates 1 billion picture elements of information, or about 2 gigabytes of data.

MacGillivray presented some of the pictures last August in Baltimore at an International Astronomical Union conference on multiwavelength astronomy.

The gallery of pictures displayed on these pages includes some of those images, as well as many never before displayed.

"We want people to see for themselves the magic of the night sky," says MacGillivray. "We're aiming at both professional astronomers who want to understand the physics, for example, of supernovas and gas clouds and amateurs who like to explore the sky in the comfort of their armchair." □

Two familiar bodies in the nearby Large Magellanic Cloud galaxy: the Tarantula nebula (left) and the famous exploded star, supernova 1987A (right).



Andromeda, our nearest spiral galaxy neighbor (left), and a close-up of the galaxy's southern half (right).

The spiral galaxy M33.