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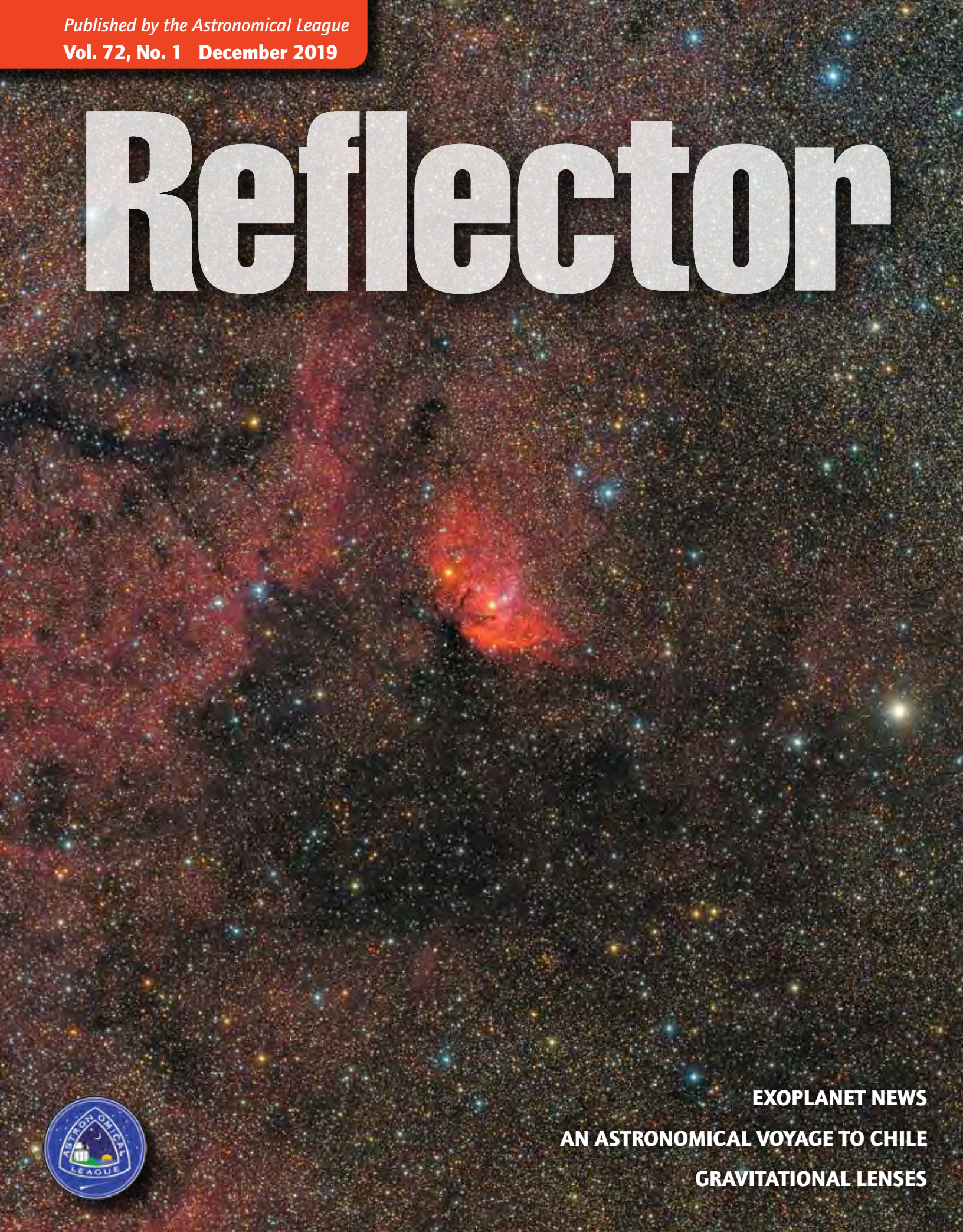
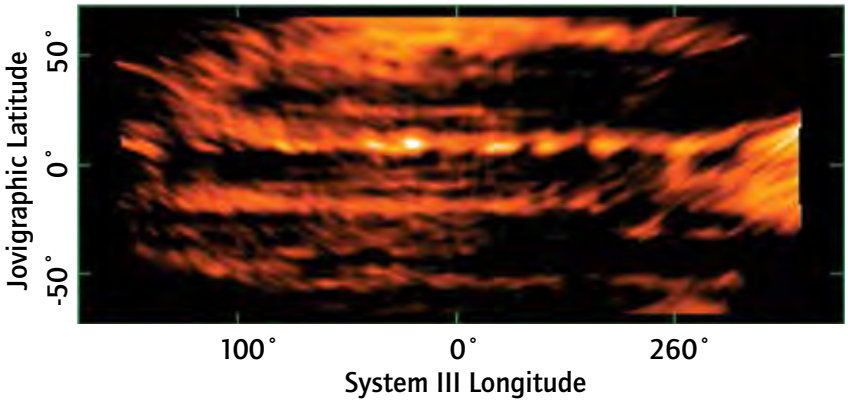
Reflector



EXOPLANET NEWS

AN ASTRONOMICAL VOYAGE TO CHILE

GRAVITATIONAL LENSES



Jupiter imaged in radio at a wavelength of 0.78 inches. This image took six hours of data to produce. The features are smeared in longitude by Jupiter's rapid rotation. The resulting image had the contribution from a 150 Kelvin oblate spheroid with limb darkening of the size and distance of Jupiter subtracted to bring out the hotter features on the cloud tops. Data for this image was taken with the Very Large Array in New Mexico on January 25, 1996, by Imke de Pater (UC Berkeley), and were further reduced and imaged by Chermelle Engel (University of Melbourne) and Bob Sault (ATNF).

travelling much slower than light as they spiral around Jupiter's magnetic lines of force.

Jupiter's radio signals were first discovered in 1955 by astronomers Bernard Burke and Kenneth Franklin, who had set up a 96-acre antenna array in a rural field twenty miles northwest of Washington, D.C. They detected bursts of radio noise that returned four minutes earlier every night. This showed that the bursts were coming from a celestial object, and Burke and Franklin eventually identified Jupiter as the source. This was the first discovery of radio signals from a planet other than Earth.

Similar radio signals come from Saturn and its rings. The signals are fainter and harder to record than Jupiter's. Uranus and its rings can also be observed from Earth with powerful modern radio telescopes like the Atacama Large Millimeter-submillimeter Array. Neptune's radio signal has only been detected by the Voyager spacecraft as it flew past the planet.

Jupiter's cyclotron-maser radiation can be observed by an amateur astronomer with a simple radio telescope. Project Jove is a NASA educational citizen-scientist project to observe the radio emissions from Jupiter, the Sun, and galactic sources.

Project Jove provides plans, kits, and information about putting the amateur radio telescope together. If you are interested in getting involved, you can visit the Project Jove site at *radiojove.gsfc.nasa.gov/index.html*. Other sources for amateur radio telescopes that can observe Jupiter include the Thrush Observatory *(thrushobservatory.org/radio.htm)*, Radio-Sky Publishing *(www.radiosky.com/rjcentral.html)*, the British Astronomical Association *(www.britastro.org/radio/RadioSources/jupiter.html)*, and Jon Wallace and Richard Flagg *(www.radio-astronomy.org/pdf/qex/radio-jove-proof.pdf)*.

While we just see the sky in visible light, our instruments can detect the myriad sources of radio and other electromagnetic radiation reaching us from objects from across the cosmos.

—Berton Stevens

Deep-Sky Objects

A BRIGHT NEBULA IN PERSEUS

The Milky Way galaxy is filled with myriad large clouds of gas. A majority of the gas, perhaps 90 percent, consists of ionized or neutral hydrogen. If a cloud (or nebula) absorbs a lot of ultraviolet light from stars embedded in it or near it, the gases heat up to very high temperature. Collisions among the high-temperature atoms cause them to jump to higher energy states. As the atoms cascade back to their ground state, they emit light at specific wavelengths.

The brightest visible light from hydrogen gas is a red wavelength at 656 nanometers (nm). We call this hydrogen alpha. The next brightest is hydrogen beta, an aqua-colored emission at 486 nm, followed by hydrogen gamma, blue light at 434 nm, and hydrogen delta, violet light at 410 nm. Nebulae that emit mostly hydrogen-alpha light appear red in photographs. Those that also emit large quantities of hydrogen-beta, -gamma and -delta light appear pink. Other gases account for emissions of other colors.

At the eyepiece, the colors are not so apparent. This is due to the human eye not being

capable of detecting colors from faint objects. But that doesn't detract from the thrill of spying great glows such as the Orion Nebula (M42), the Lagoon Nebula (M8), or the Ring Nebula (M57), to name a few!

The constellation Perseus is high overhead during winter evenings in mid-northern latitudes. The Milky Way blazes across Perseus, littering it with splendid star clusters, double stars, and nebulae. Perhaps the best-known nebula in Perseus is the California Nebula. This nebula spans nearly three degrees and has an integrated magnitude of 5. But the nebula is so spread out it cannot be seen with the unaided eye or taken in entirely at the eyepiece. So while panning across this nebula with a telescope, at best, the space between the stars will appear brighter than the dark background between stars elsewhere in Perseus away from the nebula.

A more interesting telescopic nebula in Perseus is NGC 1491 (also called LBN 704). NGC 1491 lies about one degree north-northwest of the 4.3-magnitude star Lambda Persei. It also lies 1.25 degrees northeast of the 5.3-magnitude star 43 Persei. These two stars and the nebula form a right triangle with the nebula at the right-angle corner. There is a 10th-magnitude star nine arcminutes north of the nebula and an 11.2-magnitude star embedded in the center of the nebula. The latter star is responsible for exciting the hydrogen gas within the nebula, giving it the red glow so common in emission nebulae photographs.

NGC 1491 is irregular in shape and roughly three arcminutes in size. The nebula is easily captured in 11- to 14-inch telescopes from dark-sky sites. Those using 8-inch telescopes will more readily see the nebula using an ultra-high contrast (UHC) filter or oxygen (O) III filter. These filters will help bring out the fan shape of the nebula seen in photographs.

The accompanying image of NGC 1491 was taken with a 10-inch Newtonian telescope using an SBIG ST-2000XCM CCD camera (the image is shown here cropped). The exposure was 70 minutes. In the image, north is up and east to the left. The brightest portions of the nebula surround the 11.2-magnitude star and approximate what can be seen in amateur telescopes. The aforementioned 10th-magnitude star lies near the top center of the image. Near the bottom right corner of the image lies an optical double star. The brighter of the pair is magnitude 9.9 and the fainter is magnitude 11.2.

The faint nebulosity trailing off to the south and east of NGC 1491 in the image is part of a much larger nebular region catalogued as LBN 705 and 706. LBN stands for Lynds Bright Nebula, a catalog of nebulae compiled by astronomer Beverly Lynds in the 1960s.

Perseus is not just a constellation in which to explore fabulous star clusters. With the proper equipment, some pretty fascinating nebulae can also be spied.

—Dr. James R. Dire
Kauai Educational Association for Science and Astronomy

Call for Award Nominations

YOUTH AWARDS

It's time to start thinking about who might be nominated for several youth-based awards: the 2020 National Young Astronomer Award, the Horkheimer/Smith and Horkheimer/D'Auria Youth Service Awards, the Horkheimer/ Parker Youth Imaging Awards, and Horkheimer/O'Meara Journalism Awards.

If you know of a young person who has been involved in an astronomy-related research project or a club service activity or who would like to write about astronomy, now is an excellent opportunity to apply. Or perhaps they have done imaging. There are plenty of programs to nominate that young person for. See our website awards page, *astroleague.org/al/awards/awards.html*, for details.

The deadline for the National Young Astronomer Award and the Horkheimer awards is March 31, 2020. So, encourage your candidates to complete their projects now and find the application on the AL website. Club officers, please nominate these younger members from your club. Remember, they are the future of astronomy.

ASTRONOMY DAY

Astronomy Day presents an opportunity to increase science awareness in your local community. This can be the spark that motivates people both young and older to take a look at the offerings of your society, all simply by personally introducing people to the wonders encountered in amateur astronomy. Look on the AL website, *www.astroleague.org,* for these helpful Astronomy Day materials: the Astronomy Day Handbook and outreach downloads. Astronomy Day will be held on May 2 and September 26, 2020. Showcase your group's special AD activities and apply for the awards by contacting Gary Tomlinson at *gtomlins@sbcglobal.net*.

MABEL STERNS AWARD

The newsletter editor performs the primary function of informing astronomy club members about what is happening in their club. Often the editor is forced to become quite creative in filling the allotted space for each issue when the call for articles does not quite fill up the publication. In acknowledgement of the important role of the newsletter editor, the Astronomical League established the Mabel Sterns Newsletter Award in 1988 to recognize these essential people.

The award is named in honor of the first newsletter editor of the League, Mabel Sterns, who served in that capacity from 1948 to1952. To qualify, club presidents should email a copy of the designated issue of the club's newsletter as a PDF file to *sternsnewsletter@astroleague.org,* along with a cover letter of recommendation (also as a PDF) that includes the postal address of the nominee. In addition, a photo of the newsletter editor, preferably in an astronomical setting, should be sent electronically in JPEG format to the same email address. All items are due by March 31, 2020. The names of both the newsletter editor and the nominating club officer must appear on the general membership roster of the League. The deadline is March 31, 2020.

ASTRONOMICS SKETCHING AWARD

We are happy to say that the art of sketching seems to be creating more interest in astronomy. Sketching the impression of a celestial scene allows an observer to see more detail and to better enjoy our amazing avocation.

The League's Astronomics Sketching Award provides cash awards for first place ($250), second place ($125), and third place ($75). Spectific details can be found at *astroleague.org/al/*