

Astronomy®

The world's best-selling astronomy magazine

Explore the BEST deep-sky gems

p. 40

- Orion Nebula
- Andromeda Galaxy
- Ring Nebula and more!

How to observe Pluto

p. 46

» **PLUS**

Catch a cool
Venus-Mars
meetup p. 50

The story of
premium mirror
makers p. 52

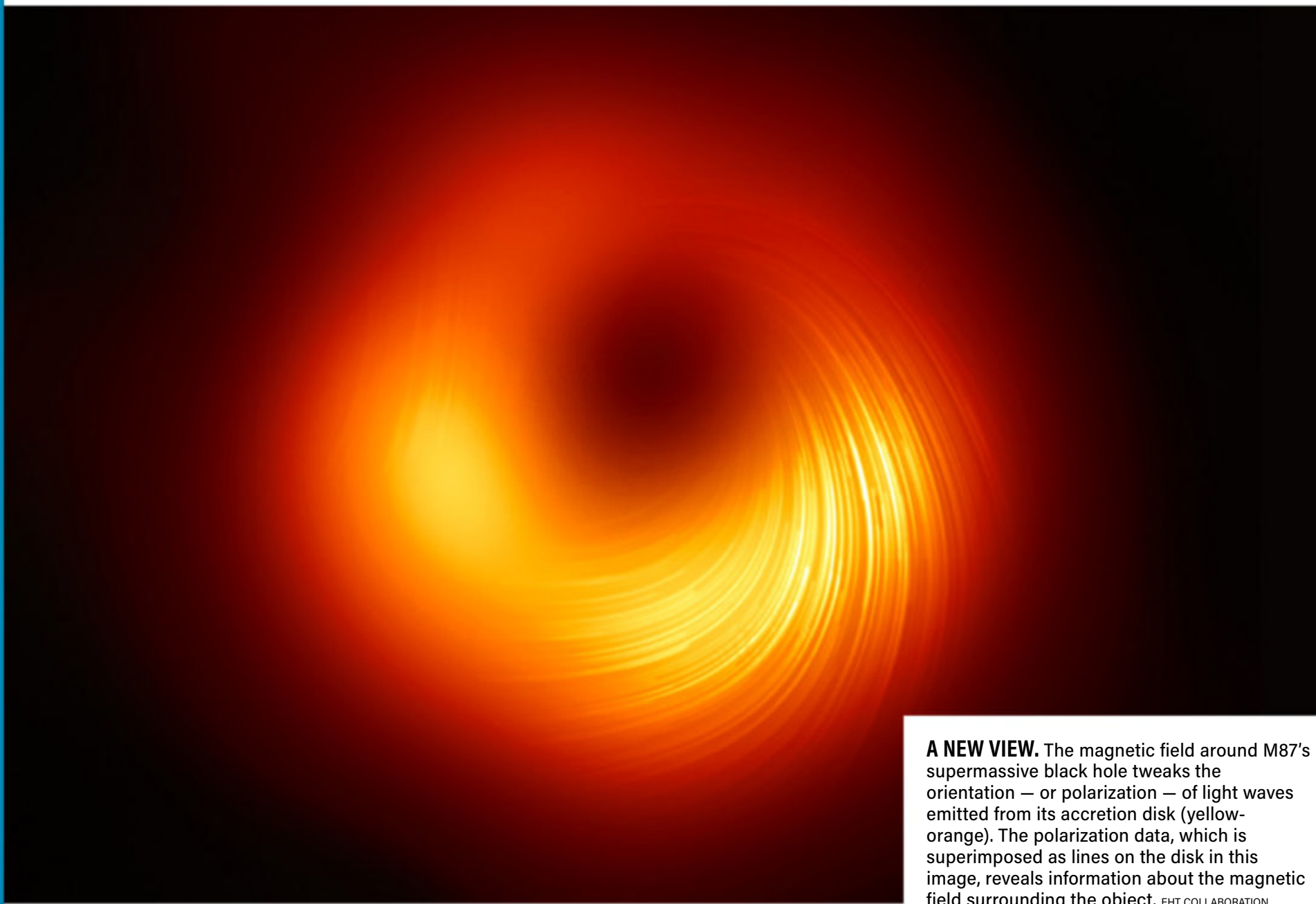
Bob Berman
on the third
dimension p. 13

www.Astronomy.com

**BONUS
ONLINE
CONTENT
CODE p. 4**

EVENT HORIZON TELESCOPE MAPS A BLACK HOLE'S MAGNETIC FIELD

New images of M87's supermassive black hole hint at how it fires its massive galaxy-spanning jets.



A NEW VIEW. The magnetic field around M87's supermassive black hole tweaks the orientation — or polarization — of light waves emitted from its accretion disk (yellow-orange). The polarization data, which is superimposed as lines on the disk in this image, reveals information about the magnetic field surrounding the object. EHT COLLABORATION

» Deep inside the elliptical galaxy M87 lurks a supermassive black hole with 6.5 billion times the mass of our Sun. In April 2019, this black hole became the first to have its shadow directly imaged, thanks to the Event Horizon Telescope (EHT) collaboration.

On March 24, 2021, the same collaboration released updated views of M87 that reveal a complex magnetic field around the black hole; astronomers believe the field could power

the black hole's 5,000-light-year-long jet. The images accompany two papers published the same day in *The Astrophysical Journal Letters*, while a third related study has also been accepted for publication in *The Astrophysical Journal Letters*.

GETTING ORIENTED

When light passes near a strong magnetic field, its tug leaves an unmistakable mark. Like iron filings

that align themselves and reveal the invisible magnetic field lines of a bar magnet, light waves “line up” — or become polarized — in the presence of magnetic fields. This can reveal clues about the field's structure and strength. And that's what the EHT collaboration has seen.

One new image shows the polarization of light coming from the accretion disk of hot material surrounding and flowing into M87's black hole. At

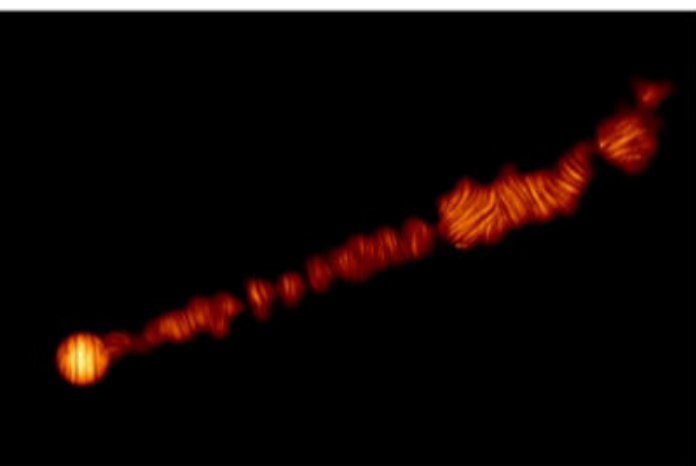


ESA/HUBBLE & NASA, M. GUERRERO; ACKNOWLEDGMENT: JUDY SCHMIDT

A born-again star

Revivals don't just happen in tents. They can also happen in deep space — like at the heart of Abell 78, an unusual planetary nebula imaged here by the Hubble Space Telescope and the Pan-STARRS telescope in Hawaii. Located about 5,000 light-years away in the constellation Cygnus, this sight was produced by a star that, in its death throes, blew its outer layers of gas into space. Most stars of similar mass settle into their graves quietly, producing no further nuclear reactions. But Abell 78 accumulated enough material in its outer layers to reignite nuclear fusion, triggering a second outburst that plowed into the initial halo, shocking it and creating the nebula's bright, complex inner structure. Abell 78 is one of only a handful of known so-called "born-again planetary nebulae." — MARK ZASTROW

least part of this ring is significantly polarized, which tells astronomers the disk contains highly magnetized gas. The team estimates the black hole's magnetic field strength is between 1 and 30 Gauss, or roughly two to 50 times stronger than Earth's magnetic field. And just outside the black hole's event horizon, or point of no return, researchers found the magnetic field is



ON THE MOVE. Data from the Atacama Large Millimeter/submillimeter Array — one of many radio telescopes that make up EHT — show the polarization of light in a section of the jet issuing from M87's black hole. The lines indicate the orientation of light waves in the jet, which evolves as material travels away from the object (located at left). ALMA (ESO/NAOJ/NRAO), GODDI ET AL.

so strong it pushes some material away — even as most flows inward, forever disappearing inside the black hole.

JET SETTING

This ability of the magnetic field to serve as a gatekeeper, preventing at least some material from falling in, could explain how M87's black hole spews jets of material stretching thousands of light-years beyond the galaxy. Astronomers have long believed that magnetic fields play a crucial role in launching jets, but they are just now getting a detailed look at how exactly that process might occur. Such close-up views will help researchers better tweak their models of how matter and magnetic fields behave extremely close to black holes.

Although no EHT observations were made in 2019 or 2020, the collaboration plans to resume observing this year, with even more facilities linked into its network, which creates a virtual, planet-spanning dish. The world is eagerly waiting to see what it will show us next. — ALISON KLESMAN

QUICK TAKES

APOPHIS WILL PASS

Astronomers have used radar to more precisely map the orbit of the near-Earth asteroid Apophis, once deemed at risk of colliding with Earth. The new observations reveal it will not impact our planet for at least 100 years.

TWO-FACED

The rocky world LHS 3844b may be covered in erupting volcanoes — but only on one side. The dayside of this tidally locked planet is roughly 1,800 degrees Fahrenheit (1,000 degrees Celsius) hotter than its nightside. Simulations suggest this difference could cause magma to billow to the surface in one hemisphere, but not the other.

LUNAR PACT

China and Russia have signed a memorandum of understanding to jointly build a lunar space station. Whether on the surface or in lunar orbit, the station will allow researchers to test the technologies necessary for long-term human and robotic exploration of the Moon.

NEW VEGA

Astronomers have found evidence that the nearby star Vega hosts a giant planet so close that a single orbit (or year) takes just 2.5 Earth days. If confirmed, the world might also rank as the second hottest known, with a surface temperature averaging some 5,400 F (3,000 C).

SIDESTEPPING SATELLITES

SpaceX and NASA have formally agreed to coordinate and share information with each other to avoid collisions between SpaceX's satellites and NASA spacecraft. The agreement specifies SpaceX will cede the right of way to NASA craft.

TUG ON A BUG

Physicists have measured the smallest gravitational force yet. The team recorded how a pendulum twisted about as they moved a tiny gold sphere about the mass of a ladybug to and fro, minutely changing the local gravitational field.

— JAKE PARKS