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SOFIA Science Newsletter

June 2023

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Observatory News

Thank You for Flying with Us

This will be the 101st and last e-newsletter of the SOFIA mission. Over our more than 13 years of outreach to the science community we have reported on everything from the first aircraft flight tests to the amazing science discoveries being made right up to the last flight. Even though SOFIA is no longer flying, thanks to its open-access data archive at IRSA, fascinating science results are expected to continue. If you wish to stay on top of these latest results, we encourage you to follow SOFIA along with all of the other NASA science missions at the NASA Universe Facebook and Twitter accounts. Although this is the last e-newsletter, over the next few months everyone on this mailing list will continue to receive SOFIA Tele-Talk invitations and updates detailing the transitions of our community services.

Reminder of SOFIA DCS Website Reduced Services and Shutdown

If you were awarded time on SOFIA and have misplaced your proposals, you have a limited time remaining to download them from the DCS website. After **July 15, 2023** proposals will be removed from the website, as we reduce services prior to the September 2023 shutdown of the website. Now would be a good time to check if there is anything else you may want to download from the DCS before it's gone, like AORs or the most recent version of the SSPOT software.

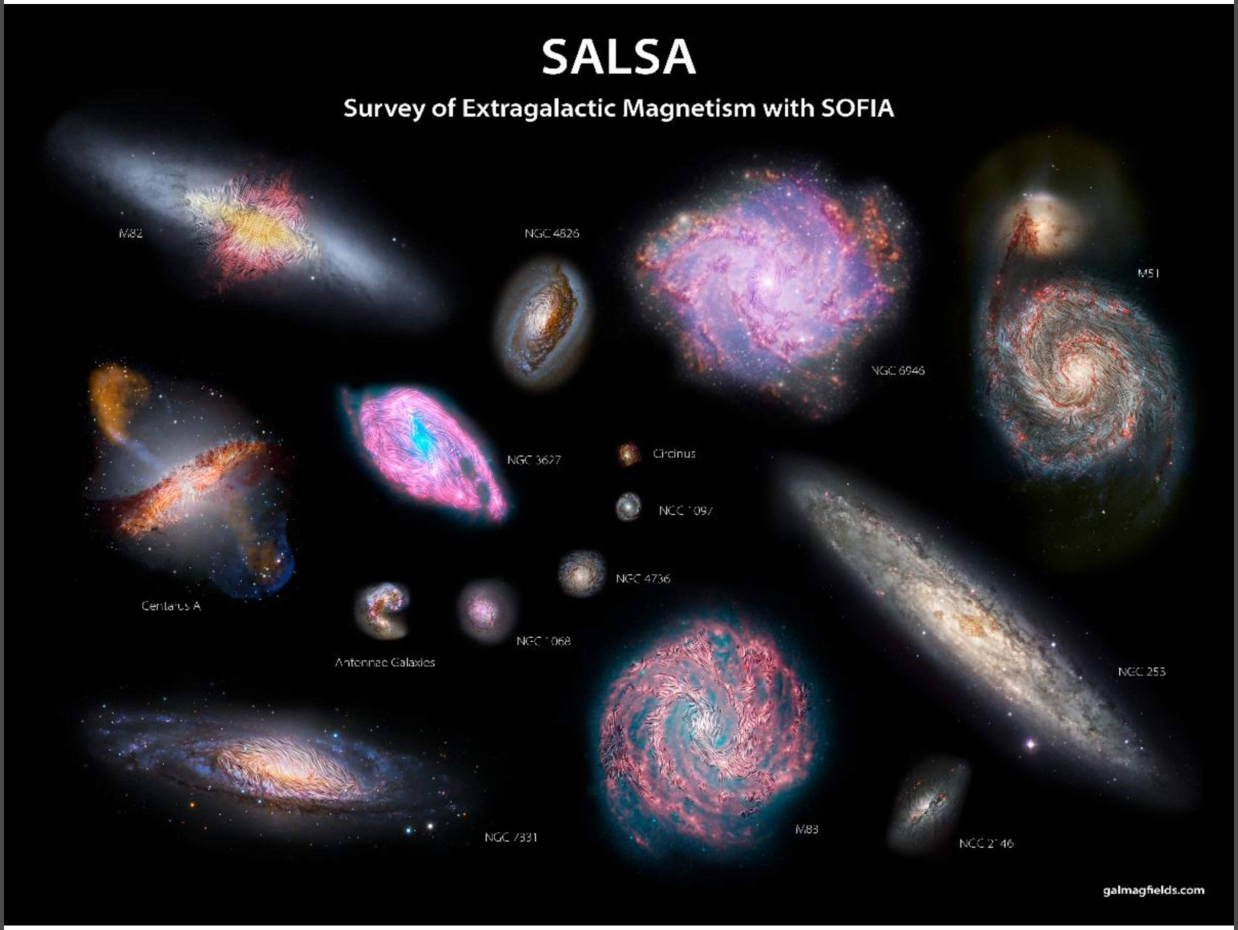
Science Spotlight

SALSA -- Magnetic Fields in Galaxies

Magnetic fields are intrinsically difficult to detect. While their field lines lurk between the stars and gas clouds that comprise galaxies, they do not emit any light on their own. Like in Earth’s atmosphere where dense clouds tend to bring more rain, molecular clouds form more stars than diffuse phases of the gas. Magnetic fields are amplified inside these dense clouds - where most stars are formed and where optical telescopes (like Hubble Space Telescope) cannot reach. So astronomers need to use specialized telescopes to detect their effects.

One of these instruments is the High-resolution Airborne Wideband Camera (HAWC+) on board SOFIA. Its sensitivity to the far-infrared region of the electromagnetic spectrum allows HAWC+ to observe the effects of magnetic fields deep in the cold, dark molecular clouds. HAWC+ observed the far-infrared, polarized light emitted by magnetically aligned dust grains.

An international team of scientists working on a project called SALSA (Survey on extragALactic magnetiSm with SOFIA) has used HAWC+ to observe 15 galaxies in the neighborhood of the Milky Way. They mapped the far-infrared magnetic fields and compared their structures with those obtained in the radio with the Very Large Array in New Mexico and the Effelsberg telescope in Germany, both of which are sensitive to the less dense gas of the galaxies. Read more here.

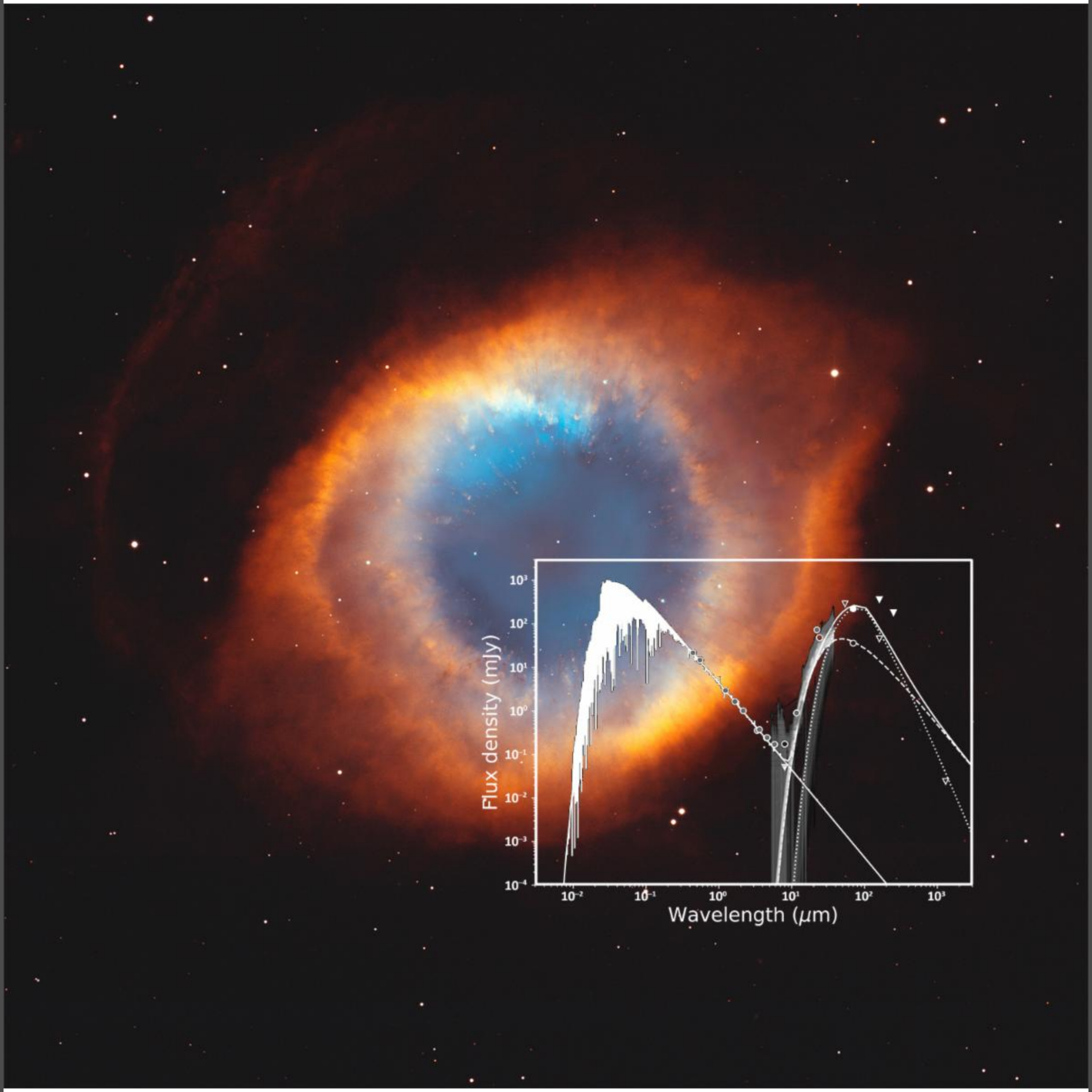


The magnetic fields of M51, M82, M83, NGC 253, NGC 1068, NGC 1097, NGC 2146, NGC 3627, NGC 4736, NGC 4826, NGC 6946, NGC 7331, Antennae galaxies, Centaurus A, and Circinus obtained by SALSA (Survey of extragALactic magnetiSm with SOFIA). Objects are shown in relative angular sizes based on HAWC+ detection radius. Credits: M51: (NASA, the SOFIA science team, A. Borlaff; NASA, ESA, S. Beckwith (STScI) and the Hubble Heritage Team (STScI/AURA)); M82: NASA/SOFIA/E. Lopez-Rodriguez; NASA/Spitzer/J. Moustakas et al.; M83: NASA/JPL-Caltech/E. Lopez-Rodriguez; NGC 253: ESO/A.S. Borlaff; NGC 1068: NASA/SOFIA; NASA/JPL-Caltech/Roma Tre Univ.; NGC 1097: NASA, the SOFIA science team, E. Lopez-Rodriguez et al.; ESO/Prieto et al.; NGC 2146: ESA/Hubble & NASA/E. Lopez-Rodriguez; NGC 3627: NASA/JPL-Caltech/R. Kennicutt (University of Arizona) and the SINGS Team/E. Lopez-Rodriguez; NGC 4736: ESA/Hubble & NASA/A.S. Borlaff; NGC 4826: ESA/Hubble & NASA, J. Lee and the PHANGS-HST Team, Acknowledgement: Judy Schmidt/A.S. Borlaff; NGC 6946: ESA/Hubble/NASA/JPL-Caltech/L.Proudfit/A.S. Borlaff; NGC 7331: Adam Block/Mount Lemmon SkyCenter/University of Arizona/E. Lopez-Rodriguez; Antennae galaxies: ESA/Hubble & NASA/E. Lopez-Rodriguez; Centaurus A: Optical: European Southern Observatory (ESO) Wide Field Imager; Submillimeter: Max Planck Institute for Radio Astronomy/ESO/Atacama Pathfinder Experiment (APEX)/A.Weiss et al.; X-ray and Infrared: NASA/Chandra/R. Kraft; JPL-Caltech/J. Keene; SOFIA; Circinus:Andrew S. Wilson (University of Maryland); Patrick L. Shopbell (Caltech); Chris Simpson (Subaru Telescope); Thaisa Storchi-Bergmann and F. K. B. Barbosa (UFRGS, Brazil); and Martin J. Ward (University of Leicester, U.K.) and NASA/ESA/A.S. Borlaff. Poster design: NASA/SOFIA/L. Proudfit.

Disruption of a Planetary System

The survival of planetary systems after their host stars evolve off the main sequence is not well-constrained by observations. Many young white dwarf systems exhibit infrared excess emission and/or spectral absorption lines associated with a reservoir of dust or planetesimals. However, most white dwarfs are too cool to heat any circumstellar material to detectable levels of emission.

The Helix Nebula is one of the nearest planetary nebulae to the Sun (d ~ 200 pc). Observations at mid- and far-infrared wavelengths have revealed bright excess emission associated with its young, central white dwarf, WD 2226-210, but the origin of this excess is ambiguous. It could be the results of a remnant planetesimal belt, a cloud of comets, or material shed by the star during the post-asymptotic giant branch phase. In this work, far-infrared imaging at 53 µm from SOFIA/FORCAST was combined with mid-infrared Spitzer, far-infrared Herschel, and millimeter ALMA observations to investigate this excess. Read more on the science center website and the SOFIA blog.



The spectral energy distribution of WD 2226-210 superposed on an image of the Helix Nebula from Hubble Space Telescope. The plot combines optical, infrared, and millimeter photometry, the Spitzer mid-infrared spectrum, and upper limits from WISE, Spitzer, SOFIA, Herschel, and ALMA. Models of the white dwarf photosphere (solid) and IR excess showing good fits to the data detections (circles) and upper limits (triangles). Credit: Helix Nebula image credit: NOIRLab; SED credit: J. P. Marshall.

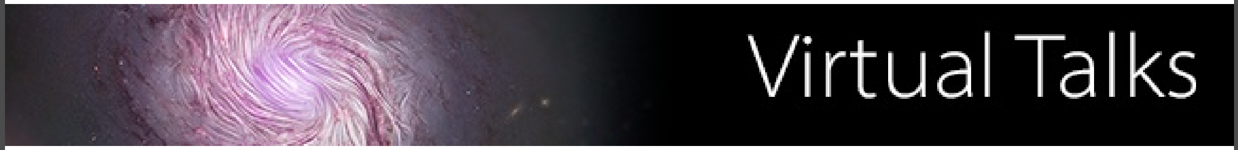
Despite Magnetic Fields' Best Efforts, Star Formation Continues in 30 Doradus

New research from the Stratospheric Observatory for Infrared Astronomy (SOFIA) has shown that the magnetic fields in 30 Doradus — a region of ionized hydrogen at the heart of the Large Magellanic Cloud, also called the Tarantula Nebula — could be the key to its surprising behavior.

Most of the energy in 30 Doradus comes from the massive star cluster near its center, R136, which is responsible for multiple giant expanding shells of matter. But in this region near the nebula's core, within about 25 parsecs of R136, things are a bit weird. The gas pressure here is lower than it should be near R136's intense stellar radiation, and the area's mass is smaller than expected for the system to be able to remain stable.

Using SOFIA's High-resolution Airborne Wideband Camera Plus (HAWC+), astronomers studied the interplay between magnetic fields and gravity in 30 Doradus. Magnetic fields, it turns out, are the region's secret ingredient. Read more here.

30 Doradus, also known as the Tarantula Nebula, is a region in the Large Magellanic Cloud. Streamlines show the magnetic field morphology from SOFIA HAWC+ polarization maps. These are superposed on a composite image captured by European Southern Observatory's Very Large Telescope and the Visible and Ifrared Survey Telescope for Astronomy. Credit: Background: ESO, M.-R. Cioni/VISTA Magellanic Cloud survey. Acknowledgment: Cambridge Astronomical Survey Unit. Streamlines: NASA/SOFIA



Join Science Talks Remotely: Tele-Talks

Tele-Talks are scientific presentations given via phone, with slides distributed ahead of time. The talks are held approximately twice a month on Wednesdays at 9:00 a.m. Pacific, noon Eastern. For information on how to participate, check the SOFIA Tele-Talk webpage.

Upcoming Tele-Talks

- June 21: Mark Heyer (UMass); Searching for Converging Flows of Atomic Gas onto a Molecular Cloud

- July 5: Wanggi Lim (IPAC); Giant H II Region Survey: DR7 and K3-50
- July 26; Valentin Le Gouellec (ESO); polarization in the Orion bar
- August 16: Ngân Lê (Nicolaus Copernicus University); Far-infrared line emission from the outer Galaxy cluster Gy 3–7

Please direct questions and comments to the SOFIA Science Center help desk: sofia_help@sofia.usra.edu.