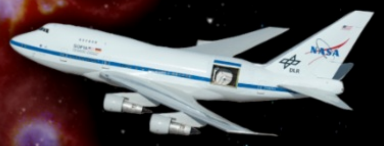
SOFIA Science Newsletter



December 2021

In this issue:

Science Spotlight

Magnetic Chaos Hidden Within the Whirlpool Galaxy

Thanks to the High-resolution Airborne Wideband Camera (HAWC+) on SOFIA, a team led by A. Borlaff has been able to finally observe the morphology of the magnetic field inside the molecular gas of M51 -- the Whirlpool galaxy. HAWC+ is able to map the magnetic fields deep in the cold, dark molecular clouds.

The magnetic field lines in the inner region of the Whirlpool galaxy show a regular spiral structure, but field lines in the molecular clouds decouple from those of the diffuse gas in the outskirts. The results also show that magnetic field lines are more turbulent in the densest regions of the gaseous galactic disk. Star formation processes, like supernovae or stellar winds, tend to increase the gas turbulence in actively star-forming regions, distorting the magnetic field lines. This was previously observed in the Milky Way, but has been extremely difficult to detect in other galaxies.

These observations suggest that there is a tight connection between star formation, spiral density waves, and the nature of galactic magnetic fields. Read more.

Magnetic field streamlines detected by SOFIA are shown over an image of the Whirlpool galaxy from NASA's Hubble Space Telescope. For the first time, SOFIA's infrared view shows that the magnetic fields in the outer arms do not follow the galaxy's spiral shape and are instead distorted. (NASA, the SOFIA science team, A. Borlaff; NASA, ESA, S. Beckwith (STScI) and the Hubble Heritage Team (STScI/AURA))

SOFIA Conference

Our Galactic Ecosystem: Opportunities and Diagnostics in the Infrared and Beyond: February 28 - March 4, 2022

How does interstellar material cycle between atomic and molecular clouds, and how does its chemical composition (and particularly the abundance of hydride molecules) reflect the environment in which it is found? What is the role of feedback (from young and old stars) on the interstellar medium (ISM)? What is the role of magnetic fields in the evolution of the ISM and star formation?

SOFIA is the only general access guest observatory in the far infrared (30-300 μm), providing unique access to this wavelength regime including tracers of atomic and molecular lines and FIR polarization. This conference will allow in-person discussions of the results and future opportunities in studying galactic ecosystem using FIR methods, from SOFIA and other platforms. A goal will be to explore synergy with other observatories, including JWST and ALMA, and with theory.

Registration is now open on the conference website. Registration fees include room and board at the UCLA Lake Arrowhead Lodge, in the majestic mountains of the San Bernardino National Forest.

Update: In response to inquiries we have changed the process for abstract selection. We will now accept abstracts without an initial associated registration. However, only in-

person presentation of contributed talks or posters will be considered. Hence abstracts acceptances will be withdrawn from the conference program at the late registration deadline if unaccompanied by a registration. Submit an abstract here.

Cycle 10 Calls for Proposals: Updates and Resources

SOFIA Cycle 10 Calls for Proposals are open, with a deadline of **January 28, 2022, 21:00 PST** (January 29, 2022 4:00 UTC). A total of approximatively 650 hours of observing time is offered, along with ~$7.5M of funding for eligible proposers.

Note that during Cycle 10, SOFIA plans to carry out three Southern deployments: a long deployment scheduled approximately June through September 2023 (GREAT and HAWC+), and two short deployments in November 2022 (FIFI-LS) and March 2023 (EXES).

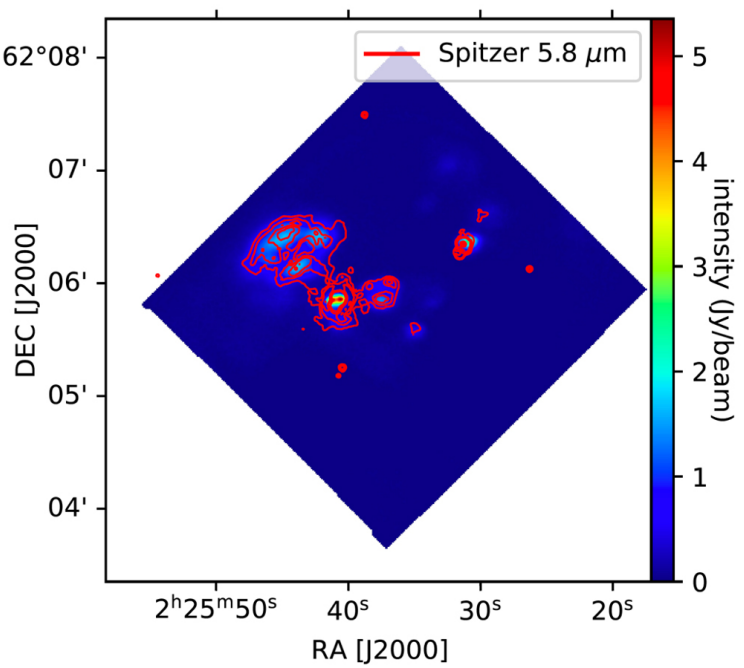
Detailed information about the Cycle 10 calls can be found here. A formal update was released on December 10, including a newly open opportunity for j**oint proposals with IRTF.**

An information session on Cycle 10 Calls will be offered at the 2022 Winter AAS meeting (Monday January 10, 10:30-11:00 am Mountain Time), and will be available online for virtual attendees. More resources and guidance, including video tutorials about the typical pitfalls in observing time estimates, are available here.

The Hot Dust Distribution in Galactic Regions of Stellar Feedback

When high-mass stars are formed in the densest regions of molecular clouds they start heating and dispersing the cloud. The disruption of clouds by stellar feedback plays a central role in galaxy evolution and the associated dust heating results in dust emission in the mid-infrared that affects the spectral energy distribution (SED) of observed galaxies. Directly observing and resolving this heated dust in galactic HII regions is thus important to understand the impact of stellar feedback and how it shapes galactic SEDs.

Studying the bright galactic HII regions with Spitzer or WISE can be challenging because the brightest regions are heavily saturated. The FORCAST receiver on SOFIA does however allow observing these regions. Observations at 19.7 μm were carried out for the diverse emblematic HII regions DR21, M42 and W3 (and at 37.1 μm for DR21) as part of the S-DDT program 76_0002. Other regions (W51 & M17) in the Milky Way were also covered as part of an observing program presented in Lim et al. 2019; 2020. Combined with archival dust continuum observations at longer and shorter wavelengths from space telescopes this provides a rich dataset for these regions. All the FORCAST data towards these sources can be found on the SOFIA IRSA Archive.



The 19.7 μm emission towards the W3 HII region overlaid with the Spitzer IRAC 3 contours at 5.8 μm.

Good to Know

FIFI-LS Calibration: New Water Vapor Estimates

For spectral studies over the wavelength range covered by the FIFI-LS instrument (51–120 μm / 115–200 μm), a reliable estimate of atmospheric water vapor is necessary to accurately calibrate out telluric absorption features. Starting in 2020, zenithal precipitable water vapor (pwv) measurements are being added to the headers of FIFI-LS data. Pwv is measured at regular intervals during each flight by observing water features with FIFI-LS and modeling them with ATRAN software. The variation of the water vapor during the flight is then deduced by scaling satellite measurements from the European Centre for Medium-Range Weather Forecast (ECMWF) to the FIFI-LS measurements (see Fischer et al. and Iserlohe et al.).

Since the ratio between FIFI-LS measurements and satellite estimates is rather constant, water vapor values can also be derived for earlier data. Water vapor values are now being added to all archival FIFI-LS data using the WVZ_OBS header keyword, allowing users to re-process older FIFI-LS data with the recently released public pipeline. Archived data with new water vapor values will eventually be reprocessed by the SOFIA Science Center.

IRSTIG Splinter Session

IRSTIG Virtual Splinter Session: January 4th

The IR Science and technology interest group is organizing a virtual splinter session for the IRSTIG on January 4th from 1-2:30 pm Eastern. Note that this is before the AAS meeting gets underway! This event will be free and open to any community members. Registration for the AAS is not required.

The IRSTIG is soliciting flash talks from the community at large. Working on a balloon or probe mission concept? Thinking of an interesting IR science case? Working on new IR detectors? Anyone is welcome to sign-up to give a short talk using this Google form.

All flash talks will be 5 min in length with an additional 3 min for questions. This session is planned as a precursor to a larger workshop that will take place later in the spring. The input will be used to plan an impactful workshop that will bring us together as a community to advocate for IR science and technology going forward in light of the decadal recommendations.

Upcoming Events

Evolved Stars and their Circumstellar Environments Workshop
December 14-17, 2021

The upcoming online workshop 'Evolved Stars and their Circumstellar Environments', happening on **December 14-17**, will be an exciting platform for discussions about the current main questions in the field of evolved stars, and the next observational opportunities. The event will explore how theoretical and observational studies of evolved stellar objects can contribute to the understanding of a critical part of stellar evolution. It will feature discussions on synergies between infrared observations and other techniques, and how laboratory work can contribute to the advancement of the field. The full program, including invited and contributed talks as well as moderated dicussions, is available here.

SOFIA at the AAS Meeting
January 9-13, 2022

SOFIA science and opportunities will be all over the 239th AAS Meeting. including during our splinter session ('Mid and Far-IR observations: leveraging science across the spectrum'), special session ('The extreme ISM in the inner 200 pc of the Galaxy'), Town Hall, and Theater Presentations. More information on the Science Center website.

SOFIA School: February 2-4, 2022

This free virtual event is designed for anyone who uses or considers using mid- and far-IR data in their research. Through short lectures based on existing data and scientific results, attendees will be introduced to many of the scientific cases leveraged by such data. Detailed presentations on data analysis considerations specific to this wavelength range, such as atmospheric transmission correction, will be included. Practical examples on how to derive physical and chemical characterization of astronomical sources will be presented by authors of SOFIA papers. We encourage participation from astronomers at any career level: please register on the School website.

Join Science Talks Remotely: Colloquia and Tele-Talks

SOFIA Colloquia are held via WebEx on Wednesdays at 3:30 pm Pacific. See the complete schedule and connection information.

Upcoming Colloquia

- December 15: Sabrina Stierwalt (Occidental College)

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 am Pacific, noon Eastern. For information on how to participate, check the SOFIA Tele-Talk webpage.

Upcoming Tele-Talks

- January 19: Duncan Mifsud (University of Kent) & Sergio Ioppolo (Queen Mary University of London); Role of Terahertz and Far-IR for Prebiotic Molecules
- January 26: Ronan Higgins (University of Cologne); Large Scale Spectral Mapping
- February 16: Dennis Lee (Northwestern University); Magnetic Field and Cloud Structure in L1688

See full list of Tele-Talks.

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