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ASIAA

Submillimeter Array Newsletter

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FROM THE DIRECTOR

Dear SMA Newsletter readers,

In February 2023, Ray Blundell stepped down as Director of the Submillimeter Array. Many of you have known Ray throughout the years, even prior to October of 2005 when he took over as Director. Ray was instrumental in setting up the submillimeter receiver laboratory at the CfA. Ray and the receiver lab, pioneered terahertz astronomy by setting up the Radio Laboratory Telescope in Chile which was the first ground-based radio telescope designed for operation at frequencies above 1 THz. Instrumentation developed by the lab played a key role in bringing the SMA project to fruition, making it the first imaging array operating at submillimeter wavelengths. The SMA was an extremely productive facility during his tenure. In fact, just recently, we surpassed a cumulative total of 1000 papers published in peer reviewed journals using SMA data.

Through the years, we have benefited from his leadership, vision, and passion for the world of radio astronomy and interferometry. There have been a steady stream of students, interns, postdoctoral fellows and others who are continuing this tradition of excellence. He was particularly driven by pursuits which would enable us to maintain strong leadership in both submillimeter astronomy and instrument development. The current wSMA receiver development is a direct result of his initiatives.

We are grateful for Ray and all he has done for the SMA. We wish him the best in his future endeavors.

I have now been sitting in Ray's office, as interim-Director for the SMA since February, though I have yet to move over to his desk. This has been a challenging period for me as I've come to learn details of the inner workings of the SMA and strive to keep the SMA moving forward with the same intent many of you have over the years. Fortunately, the SMA is chock full of talented and competent people whom I've come to rely on to maintain day-to-day activities and smooth operations. For this, I am grateful.

As promised in the previous Newsletter, 2023 has shaped up to be an exciting and productive year on many fronts:

The prototype wSMA cryostat, shipped to the SMA in January, housing a full complement of wSMA receiver, is being tested in the summit lab on Mauna Kea. Plans are being made to install this cryostat into an SMA antenna in the coming months. The two wSMA cryostats under contract are delayed but will now be built with larger cold heads for improved cooling performance and anticipated delivery to Cambridge, MA in January 2024.

The SMA was very well represented at the two-day retreat for CfA scientific and engineering staff in February. A large number of SMA staff members presented summaries of their white papers and we are already reaping fruits as initial FY23 IR&D funding was made available for studies to develop millimeter and submillimeter wave solar observing capability at the SMA. Engineering efforts – which began in earnest in April 2023, are expected to be completed at the end of August 2023, to study the shielding required to sufficiently harden the antenna structure, and provide detailed costing estimates.

FY24 IR&D proposals were submitted to advance the chopper drive system of the SMA. We are reigniting the telescope drive system controls study to identify alternatives to an aged system. We are also picking up the investigation of the transporter drive, another aged system. The overall intent is to prepare the SMA for another decade, and beyond, of productive use.

Enjoy the remainder of this newsletter as it highlights scientific advancements of the SMA team.

Tim Norton

CMZOOM PAPER III: SPECTRAL LINE DATA RELEASE

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The central ~500 pc of our Galaxy – the 'Central Molecular Zone' (CMZ) – provides a unique insight into the environmental dependence of the processes that govern star formation (Morris & Serabyn 1996; Longmore et al. 2013; Henshaw et al. 2022). The conditions found within the CMZ – in particular the Mach number, densities, and temperatures of the gas, as well as the thermal and turbulent gas pressures – are far more extreme than those found in the Galactic disc, more closely resembling high-redshift galaxies (Kruijssen & Longmore 2013). A key goal of CMZ research is to understand why the star formation rate in this largest reservoir of dense gas in the Milky Way lies one to two orders of magnitude lower than predicted from standard star-formation relations.

The SMA Legacy Survey, *CMZoom* (Battersby et al. 2020), has played an important role addressing this question. Combining the SMA's large primary beam to efficiently map large spatial areas (see Fig. 1), with the SMA's wide-band correlator to simultaneously map many spectral lines with good continuum sensitivity, *CMZoom* filled a key unexplored part of CMZ observational parameter space. By targeting all dense gas above a column density of N(H_2) ≥10^{23} cm^{-2}, *CMZoom* provided the first sub-pc spatial resolution survey able to resolve the physical, kinematic and chemical structure within dense molecular gas clouds expected to form stars throughout the CMZ.

A detailed overview of the *CMZoom* survey and the continuum data release was provided by Battersby et al. (2020, hereafter 'Paper I '). Paper I found that while CMZ gas clouds have much larger average column densities than clouds in the Galactic disc, the fraction of a cloud that is contained within the compact substructures (i.e. overdensities) that may form or are currently forming stars, is significantly lower in the CMZ. This showed that identifying and understanding the processes that inhibit the formation of compact substructures in molecular gas clouds is vital in explaining the current dearth of star formation within the CMZ (Longmore et al. 2013; Kruijssen et al. 2014; Barnes et al. 2017; Henshaw et al. 2022).

In *CMZoom* 'Paper II', Hatchfield et al. (2022) provided catalogues of the *CMZoom* compact continuum substructures, and used detailed completeness testing to demonstrate that *CMZoom* is complete to all the potential sites of ongoing and future high-mass star formation in the CMZ. They used the measured mass and density of these substructures, combined with different commonly held assumptions about how quickly and efficiently clouds convert their gas into stars, to make the first estimate of the plausible range of star formation rates that the CMZ will experience over the next few Myr. The lower limit of these estimates suggested that the CMZ's star formation rate over the next few Myr would be ~0.08Msun/yr, so remaining close to the value it has had for the last few tens of Myr (Barnes et al 2017). However, the

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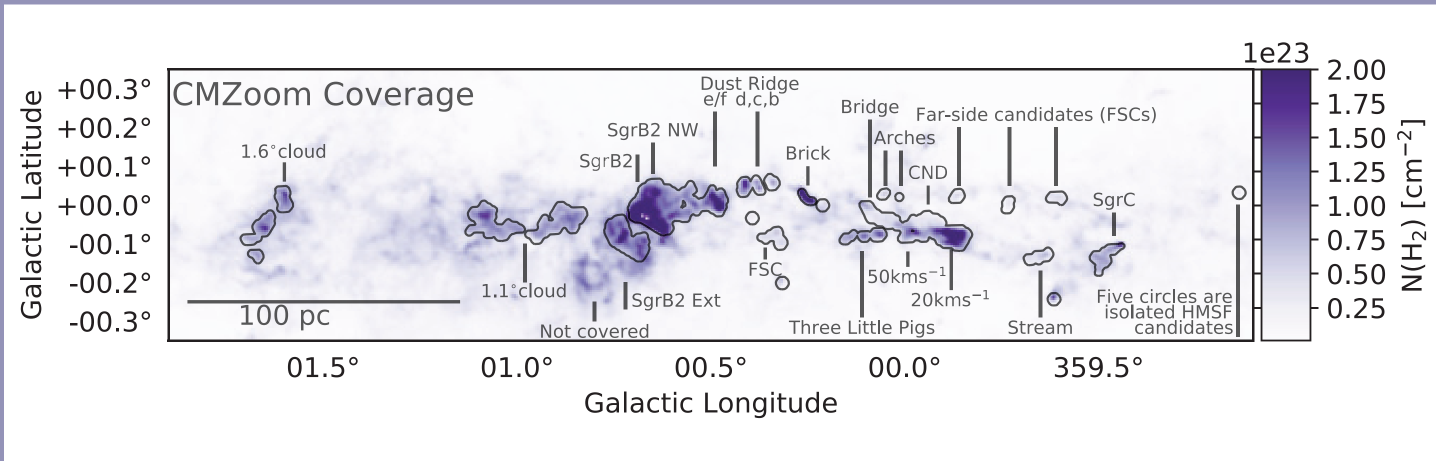

Figure 1: The Central Molecular Zone as seen in molecular gas column density, $N(H_2)$, derived from the Herschel cold dust continuum (Molinari et al. 2010; Battersby et al. in prep.) in units of cm^{-2} is shown in the colorscale, with the *CMZoom* coverage shown as gray contours. The figure shows colloquial names or notes on each observed region, as they are referred to in Battersby et al. (2020). Within the inner 5° (longitude) x 1° (latitude) of the Galaxy, *CMZoom* is complete above a column density threshold of 10^{23} cm^{-2}, with the exception of the cloud to the SE of Sgr B2 and isolated bright pixels, and with the addition of a few clouds as noted in Battersby et al. (2020). CMZoom covered 974 individual mosaic pointings over about 550 hours on the SMA.

upper limit of 2.2 Msun yr^{-1} suggested that the CMZ may be about to undergo a major starburst episode in the next few Myr. The large potential range in star formation rate was dominated by the uncertainty in how quickly and efficiently the *CMZoom* compact continuum sources would convert their gas into stars. Distinguishing between these scenarios has wide-reaching implications for our understanding of the mass flows and energy cycles in the Galactic Center, linking the interplay between star formation, stellar feedback and the feeding of the supermassive black hole.

In *CMZoom* 'Paper III', Callanan et al., (2023) presented the spectral line component of the survey and used the physical, kinematic and chemical properties of the gas derived from the measured properties of the line emission to try and distinguish between these two scenarios. The *CMZoom* spectral set-up capitalised on the SMA's large bandwidth to target a large number of dense gas tracers (CO isotopologues, multiple H_2CO transitions) as well as key shock tracers (SiO, SO, OCS) and compact hot core tracers (CH_3OH, CH_3CN). Extracting scientifically useful information, such as line velocities, velocity dispersions and peak intensities from so many spectral lines over such a large area was a major task that required a substantial degree of automation. Spectra for each compact continuum source identified in Paper II were produced by averaging all emission per channel over the mask produced for that leaf within the robust dendrogram catalogue in Paper II. These spectra were then fit using SCOUSEPY's stand-alone fitter functionality (Henshaw et al. 2016a , 2019, Barnes et al. 2021). After detailed investigation of all the spectral line data, the 218.2 GHz transition of H_2CO was identified as the optimal line to determine the kinematic properties for the *CMZoom* compact continuum sources, due to its prevalence throughout the survey, and typically being a bright line with a Gaussian profile and a single velocity component.

With a reliable measurement of the gas kinematics, Paper III then attempted to quantify the star formation potential of each *CMZoom* compact continuum source to remove the uncertainty in how quickly and efficiently they would convert their gas into stars. Using the H_2CO velocity dispersion to derive the virial ratio, α, showed that only six out of 103 high-mass *CMZoom* compact continuum sources are bound by their self-gravity. Across the whole survey, 94–96 per cent of sources are gravitationally unbound when only considering kinetic energy support against self-gravity. This has a potentially profound impact on our interpretation of the future star formation potential both of these sources and across the CMZ as a whole – if most *CMZoom* compact continuum sources are transient and destined never to form stars, this would rule out the imminent starburst scenario and suggest that the star formation rate will remain constant over the next few Myr.

To determine whether the *CMZoom* compact continuum sources are transient overdensities or longer-lived structures requires adapting the standard virial analysis to incorporate the environment surrounding each source. Previous work on a small sample of CMZ gas clouds found that while continuum sources are gravitationally unbound according to virial metrics comparing the gravitational potential and kinetic en-

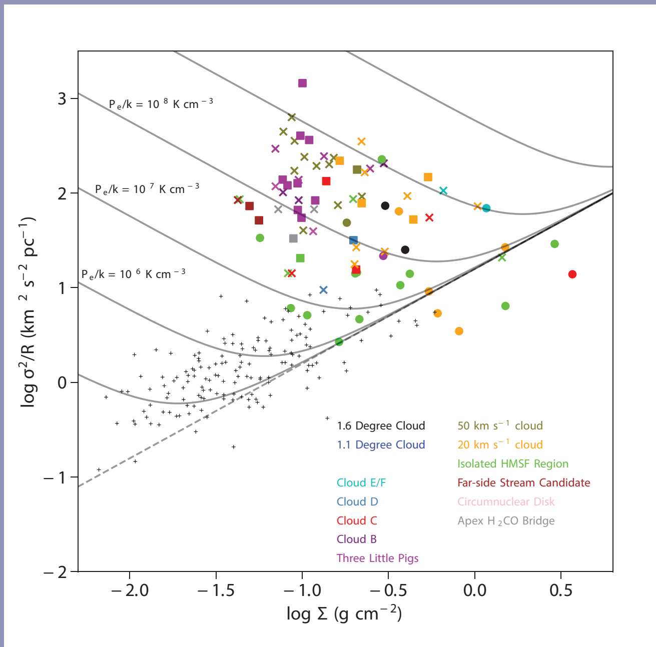

Figure 2: Gas surface density (Σ) as a function of velocity dispersion (σ) squared divided by radius (R), used as a physically meaningful normalisation of the virial relation. Galactic Ring Survey clouds (Field, Blackman & Keto 2011) are shown by black plus symbols. Markers in other colours indicate sources in different clouds throughout the CMZ. The dashed line represents virial equilibrium assuming no external pressure (P_e), and the curved lines represent objects in hydrostatic equilibrium at the stated pressure. While few of the CMZoom sources would be self-gravitating with $P_e = 0$, at the observed CMZ pressures of $P_e = 10^8$ K cm^{-3}, the majority of these sources would be in hydrostatic equilibrium. Circles and squares indicate sources that have associated star formation tracers and crosses indicate sources with no star formation tracer association. All sources, except for one isolated high-mass star forming core (which lies outside the CMZ), that lie below or close to Pe = 0 (shown by the dashed line) are found to be star forming. The fraction of sources that are star forming drops off quickly against increased pressure or distance above this line.

ergies, the intense pressure inferred within the CMZ is sufficient to keep these sources in hydrostatic equilibrium (Walker et al., 2018, Barnes et al., 2019).

Fig. 2 shows the gas surface density of *CMZoom* compact continuum sources in the survey on the x-axis, as a function of the H_2CO velocity dispersion (σ) squared divided by radius (R) on the y-axis, which is used as a physically meaningful normalisation of the virial relation. The black curved lines show where sources would be in hydrostatic equilibrium if confined by the external pressures that are stated next to each line. The black-dashed line represents the simple virial condition where there is no confining external pressure. Given the gas pressure in the CMZ of 10^{7-9} K cm^{-3} (Bally et al., 1988, Kruijssen et al. 2014), Fig. 2 shows that while only a small number of the *CMZoom* compact continuum sources are gravitationally bound according to standard virial analysis, the intense pressures found within the CMZ are capable of keeping a large fraction of these sources in hydrostatic equilibrium, so they may still be long-lived structures.

To understand what further role the kinematic state of the gas plays in setting the star formation potential of the compact continuum sources required repeating the analysis including star formation indicators to separate star-forming and non-star-forming sources. The *CMZoom* spectral set-up was selected to target a number of classic proto-stellar outflow tracers (SiO [Schilke et al. 1997 ; Gueth, Guilloteau & Bachiller 1998 ; Codella et al. 2007 ; Tafalla et al. 2015], and CO [Beuther, Schilke & Stanke 2003]) which are unambiguous tracers of star formation activity. Perhaps surprisingly, *CMZoom*'s first systematic, sub-pc-scale search for high-mass proto-stellar outflows within the CMZ detected only three proto-stellar outflows. This rules out the existence of a wide-spread population of high-mass stars in the process of forming that may have been missed by previous observations, e.g. due to having low luminosity or weak/no cm-continuum emission.

Combining the proto-stellar outflow detections with standard star formation indicators (masers and mid-IR point sources) and repeating the analysis in Fig. 2, we find that all CMZ sources below the black-dashed line (i.e. all sources with $\alpha \leq 1$ that are bound by their own self gravity), are associated with a star formation tracer. Fig. 3 shows that for sources above this line, as the distance perpendicular to the black-dashed line increases (i.e., the farther a source lies from virial equilibrium) the fraction of sources with star formation tracers drops steeply. We conclude that the external pressure plays an important role in determining how long-lived structures are, but how close a source is to being gravitationally bound provides a more accurate indication of its star formation activity.

In summary, combining the improved measurement of compact continuum source properties with a more accurate estimate of how quickly and efficiently they will convert their gas into stars, Paper III shows it is unlikely that the CMZ is about to undergo a major starburst-like episode in the next few Myr.

Finally, *CMZoom*'s versatile dataset has the potential for discovery outside of the originally intended survey goals. In Paper III we sought to find evidence of intermediate mass black holes (IMBHs) interacting with the dense gas detected in the *CMZoom* survey. IMBHs are considered to be the missing link between stellar-mass black holes and supermassive black holes (SMBHs), with multiple merging events of smaller

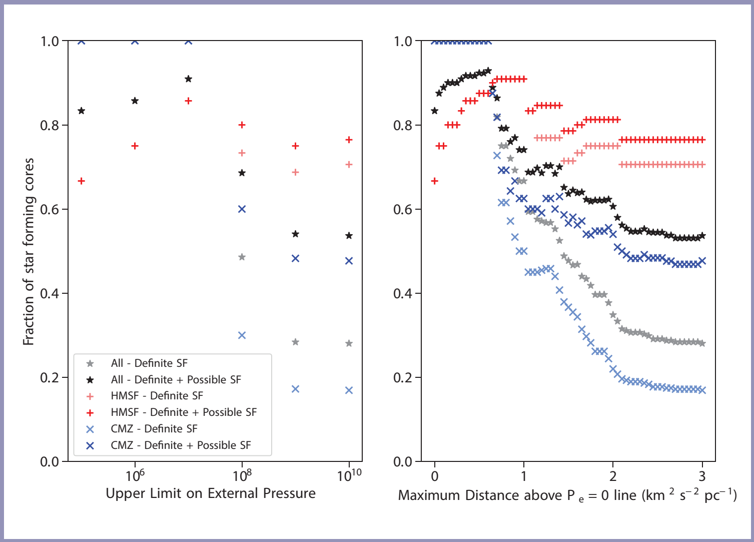

Figure 3: Fraction of *CMZoom* compact continuum sources that are star forming as a function of the upper limit on the external pressure P/k in units of K/cm^3 [left] or maximum distance above the P_e = 0 line [right]. Grey markers indicate all sources with robust star formation tracers. Black markers show all sources with robust or possible star formation tracers. Light red markers indicate isolated high-mass star forming sources which are located outside the CMZ that have robust star formation tracers. Dark red markers show these isolated HMSF sources with robust or potential star formation tracers. Finally, light blue markers indicate CMZ sources that have robust star formation tracers and dark blue shows CMZ sources with robust or possible star formation tracers. All sources below a maximum external pressure of 10^7 K cm^{-3} have associated star formation tracer activity. As the maximum distance above the P_e = 0 increases (i.e., the farther a source lies from gravitational potential energy balancing the gas kinetic energy) the fraction of sources with star formation tracers drops steeply.

'seed' IMBHs growing to form SMBHs (Takekawa et al. 2021). However, the existence of IMBHs has yet to be confirmed. Several IMBH candidates have been identified in the CMZ via the observation of 'high-velocity compact clouds', or HVCCs. These are dense gas clouds (< 5 pc) with high brightness temperatures and large velocity dispersions (σ> 50 km s^{-1}) (Oka et al. 1998, 2012; Tokuyama et al. 2019), and have been interpreted as the signpost of an IMBH passing through a gas cloud and interacting with the gas. As the first sub-pc-scale resolution survey of the dense gas across the whole CMZ, *CMZoom* is ideally placed to find such HVCCs. However, despite having sufficient resolution and sensitivity to easily detect HVCCs, we find no spectral components with velocity dispersions ≥20 km s^{-1} throughout the data, so can rule out the presence of HVCC's or IMBH's with properties like those in Oka et al. (2016) within the *CMZoom* survey region.

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A DISK WIND DRIVING THE ROTATING MOLECULAR OUTFLOW IN CB 26

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Rotating molecular outflows and protostellar jets are present in the early phases of the star formation process. They are though to play an essential role in reducing the angular momentum from the protostar-disk system (e.g., Blandford & Payne 1982) since it is proposed that these objects could be ejected directly from the accretion disks (e.g., Pudritz & Norman 1986). In addition, molecular outflows limit the mass of the protostar-disk system (Shu et al. 1993). Since molecular outflows are a mixture of the entrained material of the molecular cloud and a stellar or disk wind (e.g., Shu et al. 1991 and López-Vázquez et al. 2019), they can induce changes in the chemical composition of their host cloud (e.g., Bachiller 1996).

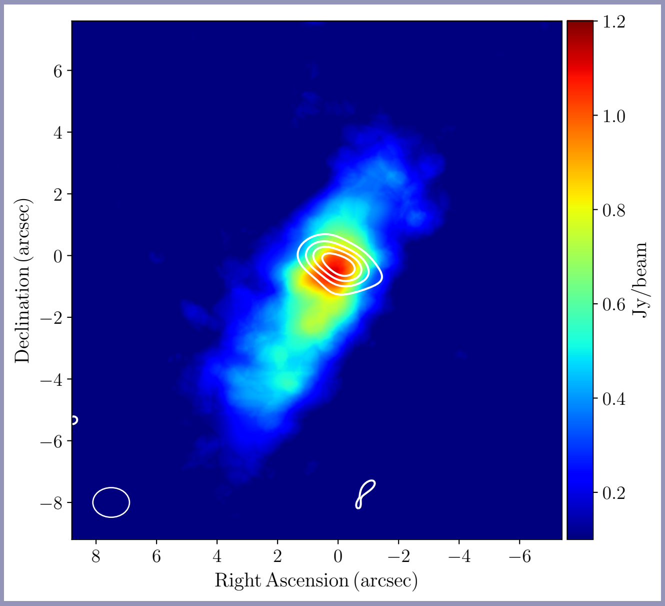

Figure 1: Moment zero of the ^{12}CO (J = 2–1) emission line from the molecular outflow. The color scale bar on the right side shows the intensity in Jansky per beam. The synthesized beam of the image is shown in the lower left corner. The white contours show the continuum emission from the disk and are 16.5, 33.0, 49.5, and 66.0 mJy.

CB 26 is a Class I young stellar object (Stecklum et al. 2004) located at 10 north of the Taurus Auriga dark cloud at a distance of 140 ± 20 pc (Launhardt et al. 2009), with a dynamical mass of the central star of M_*= 0.55 ± 0.1 $M_\odot$, an estimated age of about 1 Myr (Zhang et al. 2021)., and a luminosity of $L_* \geq 0.5$ $L_\odot$ (Stecklum et al. 2004). The molecular outflow associated with CB 26 has an outward velocity of ~10–12 km s^{-1} along the southwest–northeast direction (Pety et al. 2006), with a diameter of 2000 au (Launhardt et al. 2009). We conducted a kinematic study of the molecular outflow associated with the young star CB 26 using the ^{12}CO (J = 2–1) molecular line observations from the Submillimeter Array (SMA) with an angular resolution of 1″.2×0″.96.

Figure 1 shows the moment zero map of the ^{12}CO (J = 2–1) emission line overlaid in white contours on the 1.36 mm continuum map. This continuum emission traces the edge-on disk surrounding the young source CB 26 (e.g., Stecklum et al. 2004). The ^{12}CO (J = 2–1) emission extends further out than the continuum emission along the southeast–northwest direction. The extent of the molecular outflow is around ~1600 au, and the width is ~600 au. For the continuum emission, a Gaussian fit to the CB 26 disk resulted in a deconvolved size of 196 ± 31×42 ± 29 au with a P.A. of 59° ± 3°, and an integrated flux of 161 ± 8 mJy together with a peak flux of 82 mJy $beam^{-1}$.

The first moment or the intensity-weighted velocity map of the ^{12} CO (J = 2–1) emission is presented in Figure 2. The east side of the molecular outflow presents blueshifted velocities, while

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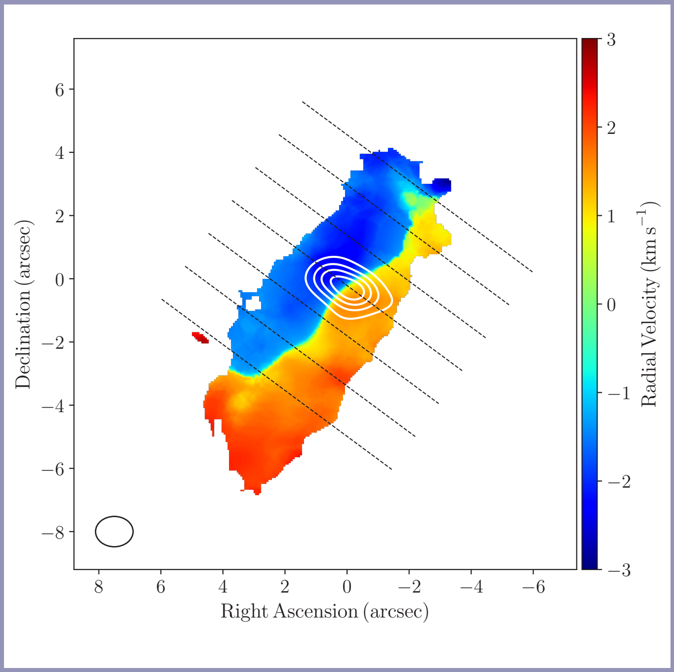

Figure 2: The first moment or the intensity-weighted velocity of the ^{12}CO (J = 2–1) emission line from the molecular outflow.

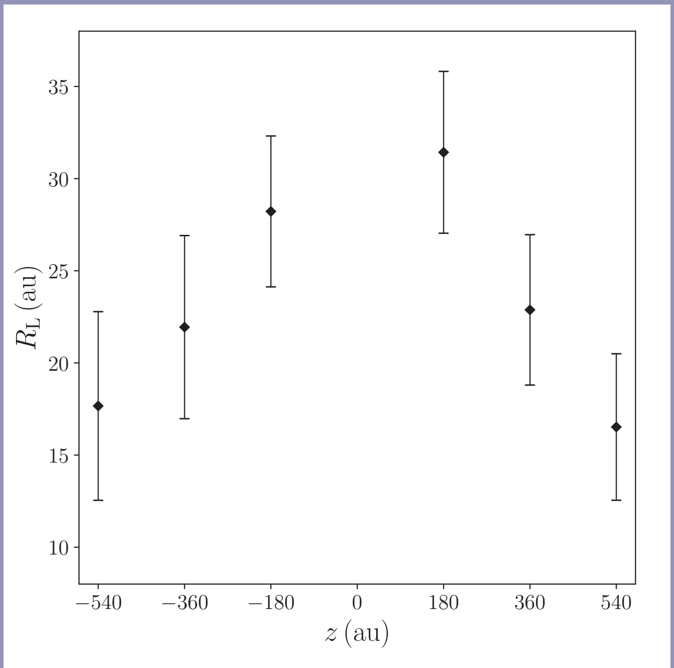

Figure 3: The launching radii R_L as a function of the height z. These radii are calculated by solving Equation (4) of Anderson et al. (2003). The error bars are derived from the Gaussian fit.

the west side presents redshifted velocities. This difference in velocities is proposed as rotation around the outflow axis (Launhardt et al. 2009). The rotation signature is in the range of ~1–3 km s^{-1}. Additionally, we made a kinematic study of the different physical properties such as the cylindrical radius *R* (~180–280 au), the expansion velocity v_{exp} (~2–4 km s^{-1}), and we also obtain the opening angle $\theta_{opening}$ (~9°–32°), and the specific angular momentum *j* (~200–700 au km s^{-1}).

Assuming local thermodynamic equilibrium and that the ^{12}CO (J = 2–1) molecular emission is optically thick, following the formalism of Zapata et al. (2014), we obtain a lower limit of the mass of the outflow of $M_{outflow}$ ~ 5 ± 1.5 × 10^{-5} $M_\odot$. In additoin, assuming that the dust emission is optically thin, using the relationship of Hildebrand (1983), and taking a typical ratio between the gas and dust in the ISM of 100, we obtain a total mass for the disk of 0.031 ± 0.015 $M_\odot$.

A possible origin of the molecular outflow is that this object is launched through magnetocentrifugal processes from a rotating protostellar disk and is then accelerated and collimated by magneto-hydrodynamic forces. Under this scenario, we can calculate the launching radius using the equation (4) of Anderson et al. (2003). For this object, the toroidal velocity corresponds to the rotation velocity v_{rot}, while the outward velocity of the molecular outflow is $v_p = 10$ km s^{-1} (Launhardt et al. 2009), the outflow inclination angle is i = 5° ± 4°; thus, the corrected outward velocity is $v_z = v_r/\cos i$ ~ 10.04 ± 0.06 km s^{-1}, and the poloidal velocity is $v_p = \sqrt{v_z^2 + v_{exp}^2}$. We assume a mass of the central star of M = 0.6 $M_\odot$. The different launching radii are shown in Figure 3, and these radii (in a range of~15–35 au) decrease with the height.

The source has an outflow mass of $M_{outflow}$ ~ 5 ± 1.5 × 10^{-5} $M_\odot$. For a corrected outward velocity and a projected size of 540 au, we estimate the kinematic time. With these values, we obtain the outflow mass-loss rate, the linear momentum rate, and the angular momentum rate. All these observational characteristics argue in favor of a disk wind in the CB 26 outflow. The disk wind in this case has enough mass to account for the mass rates.

In conclusion, we present the sensitive ^{12}CO (J = 2–1) molecular line and 1.3 mm continuum observations from the Submillimeter Array (SMA) of the bipolar outflow associated with the young star located in the Bok globule known as CB 26. We measured the different kinematic and physical properties such as the cylindrical radius, and the expansion and rotation velocities. In addition, we estimated the other properties such as the opening angle, the specific angular momentum, and the launching radii. Finally, estimations of the outflow linear momentum rate and outflow angular momentum rate seem to be well explained by the presence of a disk wind in CB 26.

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AN SMA SURVEY OF CHEMISTRY IN DISKS AROUND HERBIG AeBe STARS

Jamila Pegues,[1,2,A] Karin I. Öberg,[2] Chunhua Qi,[2] Sean M. Andrews,[2] Jane Huang,[3,B] Charles J. Law,[2] Romane Le Gal,[2,4,5] Luca Matrà,[6] David J. Wilner[2]

Protoplanetary disks are disks of dust and gas around young stars that serve as the birthplaces of planetary systems. Protoplanetary disks around pre-main-sequence A- and B-type stars (also known as 'Herbig AeBe disks') are ideal sites for studying where giant planets form (e.g., Quanz 2015): compared to less massive stars, Herbig Ae stars are predicted to typically host more massive planets (e.g., Johnson et al. 2010), and at millimeter-wavelengths, they typically make larger and brighter observational targets than disks around less massive stars (see, e.g., empirical relationships in Andrews 2020 and references therein). And indeed, direct imaging of gas giant planets around A-type stars (e.g., Johnson et al. 2007; Carson et al. 2013), studies of the elemental abundances in photospheres of Herbig AeBe stars (Kama et al. 2015), and observations of complex Herbig AeBe disk dust substructure (e.g., Dong et al. 2018) have provided evidence that giant planets form within these warm, bright disks.

The chemical makeup of these giant planets is ultimately seeded by the gaseous and icy molecular distributions found within their precursor protoplanetary disks. Beyond CO, however, few Herbig AeBe disks have been studied in their chemistry at millimeter wavelengths. Notable millimeter surveys so far include Öberg et al. (2010, 2011), which studied one Herbig Ae disk (MWC 480) and three F-star disks. Otherwise, only a small handful of Herbig AeBe disks have been relatively well characterized in their millimeter-wavelength chemistry. Those disks are AB Aur, HD 163296, and MWC 480 (e.g., Bergner et al. 2019; Loomis et al. 2020; Pegues et al. 2020; and many more). Additionally, Oph IRS 48 has been studied in a mixture of commonly and uncommonly targeted molecules (e.g., van der Marel et al. 2021; Booth et al. 2021; Brunken et al. 2022), while HD 169142, HD 100546, HD 97048, and HD 36112 have been studied in ~1-3 molecules (e.g., Macías et al. 2017; Booth et al. 2019, 2023; Guilloteau et al. 2013).

Some studies have compared their observations between Herbig Ae disks and disks around less massive stars (altogether known as 'T Tauri disks'; e.g., Guzmán et al. 2015; Le Gal et al. 2019; Loomis et al. 2020; Pegues et al. 2020). Collectively, these studies have noted tentative differences for the carbon, nitrogen, oxygen, and sulfur-bearing molecular inventories across the two disk types. These studies have hypothesized that the tentative differences are ultimately caused by the differences in the disks' host stars, with the Herbig AeBe disks expected to be larger, hotter, and more highly irradiated in ultraviolet continuum. These studies, however, have each contained only one or two Herbig Ae disks, and so the true nature and extent of these differences between T Tauri and Herbig AeBe disk chemistry is still unclear.

In this Newsletter, we discuss some of the work of Pegues et al. 2023, which presents a molecular line survey of five Herbig AeBe disks observed across the ~213-268 GHz range using the Submillimeter Array (SMA). With the SMA (Ho et al. 2004), we leverage both the wide spectral range and high spectral resolution to efficiently explore a large suite of molecular lines, and to provide a foundation for follow up of these lines at higher spatial resolution in the future.

Our five Herbig AeBe disk targets (HD 34282, HD 36112, HD 38120, HD 142666, and HD 144432) were chosen because they had been previously detected in at least one CO emission line (e.g., Dent et al. 2005), and were not well-characterized in their millimeter-wavelength chemistry. Notably, these five disks have lower CO luminosities compared to the Herbig

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Ae disks well-characterized in their chemistry so far (i.e., AB Aur, HD 163296, and MWC 480; see Dent et al. 2005), allowing us to investigate a larger and more representative sample of Herbig AeBe disks.

Our observational setup (discussed fully in Pegues et al. 2023) allowed us to target ten critical molecular lines: ^{12}CO 2-1, ^{13}CO 2-1, $C^{18}O$ 2-1, HCO^+ 3-2, CS 5-4, HCN 3-2, C_2H 3-2, DCN 3-2, DCO^+ 3-2, and H_2CO 3-2. These lines can be used to trace characteristics of disk structure and chemistry, including disk gas mass, cold and deuterated chemistry, ionization, and more. These lines have also been commonly observed in previous surveys of mainly T Tauri disks.

As a part of the Pegues et al. 2023 study, we combined the disk chemistry of our sample with a compilation of T Tauri and Herbig AeBe disk chemistry studies from across the literature, shown in Figure 1 (see Pegues et al. 2023 for the full reference list). We highlight the results of that portion of the study here. For other details of the original study, including an in-depth and individual analysis of our five target disks, we refer the reader to Pegues et al. 2023.

Figure 2 provides an overview of the ten molecular lines observed within the compilation. We can see that for most molecular lines, such as the CO 2-1 isotopologues, HCN 3-2, and C_2H 3-2, the fluxes are positively correlated with the mm continuum fluxes. The CS 5-4 and DCO^+ 3-2 lines may be exceptions, as few detections and upper limits are known/published for these lines below host star masses of ~0.5 solar masses.

We first highlight results for the gas tracers, the CO 2-1 isotopologues, in the disk compilation. Figure 3 (top row) plots line flux ratios for the CO 2-1 isotopologues as a function of mm continuum flux across the disk compilation. After H_2, CO is the second most abundant gas-phase molecule in protoplanetary disks. We expect ^{12}CO 2-1 emission, and to a lesser extent ^{13}CO 2-1 emission, to be optically thick and to trace the temperature and extent of their emitting layers. We expect $C^{18}O$ 2-1 emission, on the other hand, to be generally optically thin and to generally trace the disk gas mass (e.g., Law et al. 2021b; Zhang et al. 2021). Models have predicted that CO depletion should be most efficient in colder disks (Bosman et al. 2018), implying that the warm Herbig AeBe disks should be more abundant in CO than in T Tauri disks. Notably Zhang et al. (2021) recently found evidence for this in the Herbig Ae disks HD 163296 and MWC 480, where they measured larger

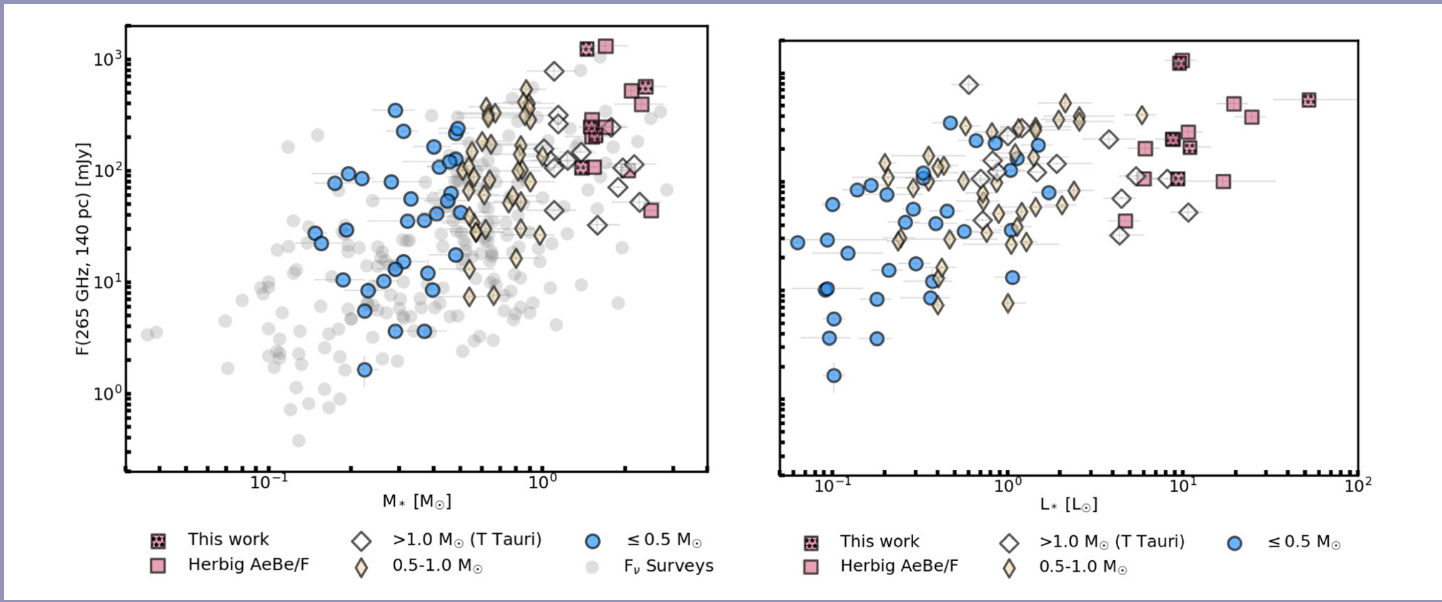

Figure 1: Scaled mm continuum fluxes for Herbig AeBe disks from this work (dotted red squares) as a function of stellar mass (left) and stellar luminosity (right). The literature sample of Herbig AeBe/F disks (blank red squares) and T Tauri disks with stellar masses greater than 1.0 solar masses (thick white diamonds), 0.5-1.0 solar masses (thin light gold diamonds), and less than or equal to 0.5 solar masses (blue circles) are shown for comparison (see Pegues et al. 2023 for the full list of references). All mm continuum fluxes have been scaled to (1) 265 GHz (~1.1 mm) using $F_\nu \propto \nu^{2.2}$ (see Andrews 2020), where F_ν is the mm continuum flux at frequency ν, and to (2) 140 pc. Whenever the error in the mm continuum flux, stellar luminosity, or stellar mass is not reported in the literature, we assume that the error is 15%, 20%, or 20%, respectively, of the given value. In the left panel, detected disks from mm continuum surveys of the Chamaeleon I, Lupus, and Taurus star-forming regions (see Pegues et al. 2023 for the references) are additionally shown in the background as pale gray circles.

CO gas masses and higher CO-derived gas-to-dust ratios for those two disks compared to T Tauri disks in their sample.

In Figure 3 (top row), we see that the combined subset of Herbig AeBe disks, along with their cousin F-star disks, appear in the lowest regimes of the overall scatter for all the CO 2-1 isotopologue flux ratios computed. In particular, the ^{12}CO 2-1 and ^{13}CO 2-1 flux ratios appear closest to unity for the Herbig AeBe/F disks. Given that these lines are likely optically thick, this trend may be evidence that these lines are emitting from layers that are overall warmer (and therefore more numerically similar) in temperature. This finding would be consistent with Law et al. (2021b, 2022b), which derived altogether generally warmer CO temperature profiles from observations of Herbig AeBe disks compared to T Tauri disks.

The Herbig AeBe/F disks also have the largest $C^{18}O$ 2-1 fluxes relative to mm continuum flux in Figure 2. From our combined discussion here, we can thus infer that the Herbig AeBe/F disks are generally most abundant in CO relative to disk mass, consistent with Zhang et al. (2021).

We next highlight results for the ion chemistry tracer, HCO^+ 3-2, in the disk compilation. Figure 3 (middle row) plots flux ratios constructed from HCO^+ 3-2 and the CO 2-1 isotopologues relative to mm continuum flux. Theory and observa-

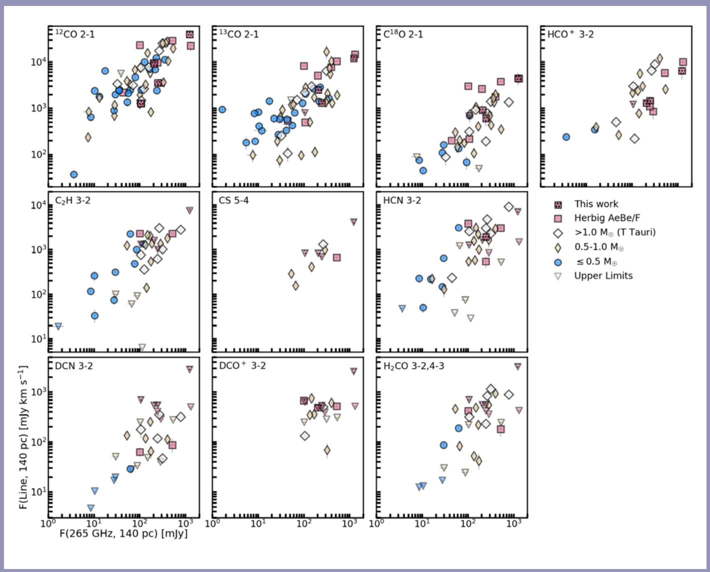

Figure 2: Molecular line fluxes as a function of mm continuum fluxes for Herbig AeBe disks from this work (dotted red squares). The literature sample of Herbig AeBe/F disks (blank red squares) and T Tauri disks with stellar masses greater than 1.0 solar masses (thick white diamonds), 0.5-1.0 solar masses (thin light gold diamonds), and less than or equal to 0.5 solar masses (blue circles) are shown for comparison (see Pegues et al. 2023 for the full list of references). 3σ upper limits are shown as faint downward-pointing triangles. All mm continuum fluxes have been scaled to 265 GHz using $F\nu \propto \nu^{2.2}$ (Andrews 2020) for flux $F\nu$ and frequency ν. Both mm continuum and molecular line fluxes have been scaled to 140 pc. Whenever flux errors for a disk are not reported in the literature, we assume that the error is 15% (for the mm continuum) or 20% (for the molecular lines) of the given value.

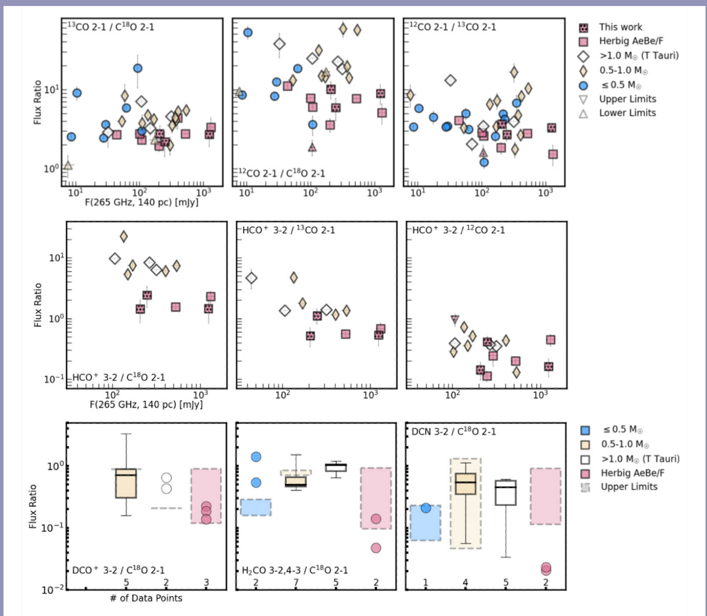

Figure 3: Top and middle rows: CO 2–1 isotopologue (top row) and HCO^+ 3-2 (middle row) line flux ratios as a function of mm continuum flux for Herbig Ae disks from this work (dotted red squares). The literature sample of Herbig AeBe/F disks (blank red squares) and T Tauri disks with stellar masses greater than 1.0 solar masses (thick white diamonds), 0.5-1.0 solar masses (thin light gold diamonds), and less than or equal to 0.5 solar masses (blue circles) are shown for comparison (see Pegues et al. 2023 for the full list of references). 3σ upper limits are shown as triangles and point in the direction of the limit. Points are not shown when both line fluxes are upper limits. Bottom row: Boxplot summaries of line flux ratios involving DCO^+ 3-2, H_2CO 3-2, 4-3, and DCN 3-2 for the combined samples, using the same color scheme as above. The boxplots contain detected fluxes only. Dashed boxes illustrate the span of any upper limits. The numbers of data points included in the boxplots are written along the x-axis. When less than 4, individual data points are drawn instead. The box portions of the boxplots illustrate the 25th, 50th, and 75th percentiles, while the whiskers span all data.

tions suggest that HCO^+ is one of the simplest molecular ions in protoplanetary disks, and that it is sensitive to the presence/absence of X-ray radiation (e.g., Aikawa & Herbst 2001). Models predict that HCO^+ is the most dominant ion relative to H_3^+ within the warm, CO-rich regions of the disk (Aikawa et al. 2015). These expectations suggest that HCO^+ should be most prominent in the warm upper layers of disks, where CO is most abundant and where the disk material is most vulnerable to X-ray radiation from the host star (Aikawa et al. 2021).

In Figure 3 (middle row), the existing data above >0.5 solar masses suggests that the HCO^+ 3-2 fluxes relative to the CO 2-1 isotopologues are distinctly offset for Herbig AeBe/F disks relative to T Tauri disks. Noting also the HCO^+ 3-2 fluxes in Figure 2, the trends suggest a general decrease in HCO^+ 3-2 fluxes for Herbig AeBe/F disks relative to T Tauri disks with existing data.

It is possible that the optically thick HCO^+ 3-2 and CO emission are tracing different emitting layers for the two disk types. T Tauri disk models have predicted that HCO^+ and CO are vertically cospatial (Aikawa et al. 2021), but it is not clear if this result applies to Herbig AeBe/F disks. Observationally, Paneque-Carreño et al. (2023) measured CO 2-1 and HCO^+ 1-0 vertical emission surfaces for the two Herbig Ae disks HD 163296 and MWC 480. They found that ^{12}CO 2-1 and HCO+ 1-0 were not emitting cospatially, with HCO^+ 1-0 instead coming from near the midplane. They further noted that the HCO^+ 1-0 emission was likely optically thin. It is thus unclear how well these results apply to the HCO^+ 3-2 emission in this work, given the differences in optical depth and excitation across the two HCO^+ line transitions.

Another possible explanation could be that Herbig AeBe/F disks are less ionized than their T Tauri disk counterparts, due to differences in the radiation fields of their host stars (see, e.g., Cohen 1984). This difference in ionization has been predicted from some disk models previously (e.g., Walsh et al. 2015), and may be causing lower abundances of HCO^+ in the Herbig AeBe/F disks. If so, this result would be consistent with the conclusions of Aikawa et al. (2021), a study that found relatively less abundant HCO^+ in the Herbig Ae disk MWC 480, which they attributed to a fainter X-ray field for this disk.

Finally, we highlight results for DCN 3-2, DCO^+ 3-2, and H_2CO 3-2 for the disk compilation. Each of these three molecules can trace different aspects of cold chemistry within protoplanetary disks (e.g., results and discussion by Aikawa & Herbst 2001; Huang et al. 2017; Hiraoka et al. 1994). Figure 3 (bottom row) plots the fluxes for these lines relative to the $C^{18}O$ 2-1 line fluxes. There are only a few existing detections of these ratios for Herbig AeBe/F disks. Notably, those detections fall below the median values seen for T Tauri disks. This result is consistent with the hypothesis that the warmer Herbig AeBe/F disks support relatively smaller regimes of cold chemistry. The result could alternatively or additionally be a byproduct of less CO depletion (and consequently more $C^{18}O$ 2-1 emission) in the Herbig AeBe/F disks.

In conclusion, the new SMA observations have allowed us to contribute significantly to the collective sample of Herbig AeBe disks so far surveyed in these critical millimeter-wavelength molecular tracers of disk chemistry. We have used the combined observations to draw tentative conclusions on Herbig AeBe/F disk chemistry relative to T Tauri disks. We stress, however, that the combined compilation still forms only a small subset of a much larger population. We therefore look forward to any future follow-up or new observations of disk chemistry, particularly for disks around Herbig AeBe stars, that could test these and other hypotheses over larger samples of the overarching protoplanetary disk population.

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LABORATORY PERFORMANCE OF wSMA RECEIVERS

Edward Tong for the wSMA team

The first wSMA cryostat is scheduled to be installed in an SMA antenna during the coming months. Each wSMA cryostat is equipped with a pair of receiver cartridges: the Low Band and High Band receivers, which are designed to provide sky coverage between 200 and 370 GHz. The construction of the receiver cartridges has previously been described in the July 2022 issue of this newsletter. Here we report on the laboratory performances of the first pair of receiver cartridges.

Each receiver cartridge carries a pair of Superconductor-Insulator-Superconductor (SIS) mixers for dual polarization operations. A photo of the High Band receiver cartridge is shown in Fig. 1. In this photo, the receiver optics assembly, which couples the receiver feedhorn to the incoming beam, is removed. The frontend assembly lies below the feedhorn. It carries the orthomode transducer which separates the incident signal into two linear polarizations. The SIS mixer blocks are located on the sides, one mixer responding to one polarization. For the High Band receiver, each mixer block is equipped with a magnetic field coil. For the Low Band receiver, a pair of small permanent magnet is used instead. Each mixer is connected, via a coaxial cable, to an isolator and Low Noise Amplifier assembly located below the 4 K plate.

In the initial testing phase, the Low-Band receiver will operate with a Local Oscillator (LO) tuned between 220 and 270 GHz; while the High-Band receiver will operate with LO frequency between 324 and 355 GHz. An upcoming upgrade to the silicon coupler chip design will allow the receivers to extend their coverage to lower frequencies. After the upgrade, the usable coverage of the High Band will be extended down to 270 GHz; while for the Low-Band receiver, it will support observations down to 200 GHz.

A plot of the receiver noise temperatures of the first pair of receiver cartridges is given in Fig. 2. The measured noise includes the wideband vacuum window and the cold infrared filter on the output optics path in the cryostat. These receiver temperatures are very competitive, especially for the High Band receiver, which offers significant improvement over the existing SMA receivers operating at 345 GHz.

The wSMA receiver also fulfill its mission to provide very wide instantaneous bandwidth. As seen from Fig. 3, the High Band receiver offers IF coverage from 4 to 19 GHz. The IF output

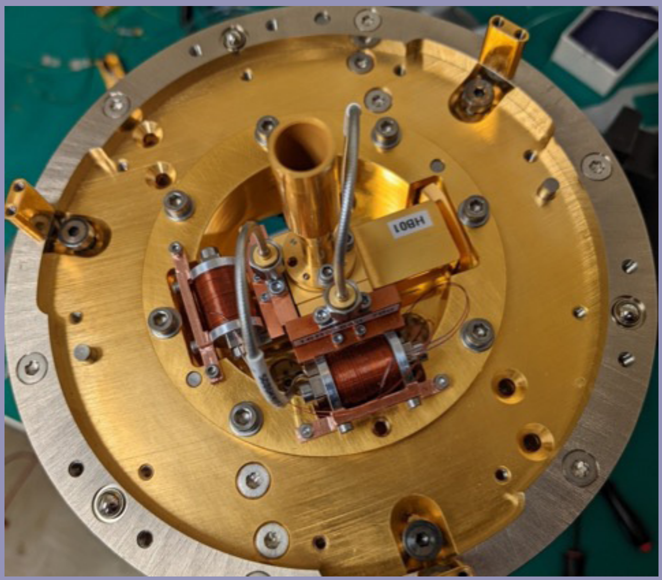


Figure 1: Top view of the wSMA High Band receiver cartridge showing the feedhorn and the frontend assembly, which separates the incident radiation into 2 linear polarizations. A pair of mixer blocks are attached to the sides of the frontend assembly: one mixer for each polarization. Each mixer is equipped with an electro-magnet.

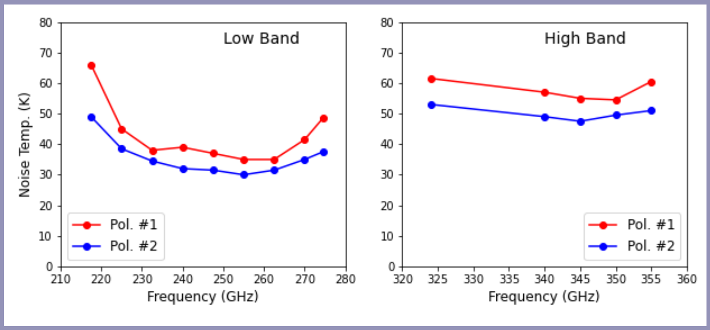


Figure 2: Measured Double-side-band noise temperature of the receivers in the laboratory as a function of Local Oscillator frequency. IF band extends from 6 – 14 GHz for the measurements.

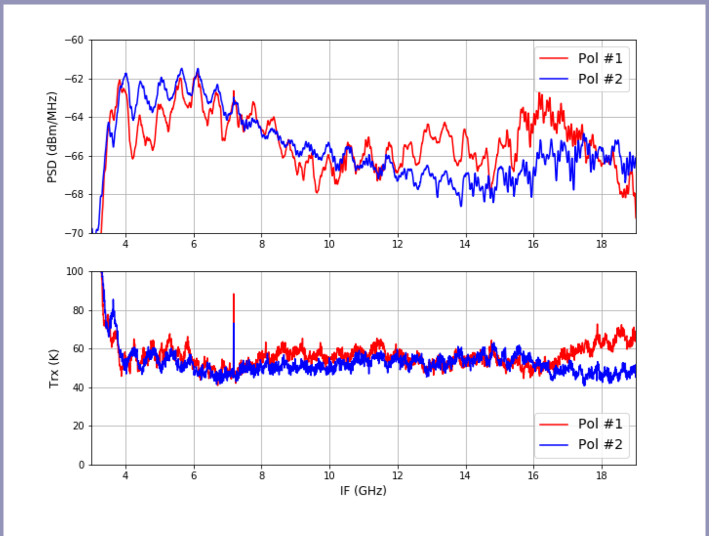


Figure 3: (Top) Output Power Spectral Density (PSD) of the High Band Receiver operating at a Local Oscillator frequency of 345 GHz. (Bottom) Corresponding Double-Side-Band Receiver Noise Temperature as a function of IF.

power spectra are reasonably flat, not exceeding 2 dB peak-peak over any 2 GHz wide band, except at IF close to 4 GHz. The spectral receiver noise temperature also stays flat up to 19 GHz. This is considerably wider than the bandwidth of the existing SMA correlator of 4-16 GHz. The wSMA receivers will pave the way for wider band operation.

A pair of fully populated wSMA receiver cartridges have been assembled and tested, showing good performances in the laboratory. It is scheduled to undergo on-sky tests when the wSMA cryostat will be installed in an SMA antenna over the summer.

RTDC UPDATE

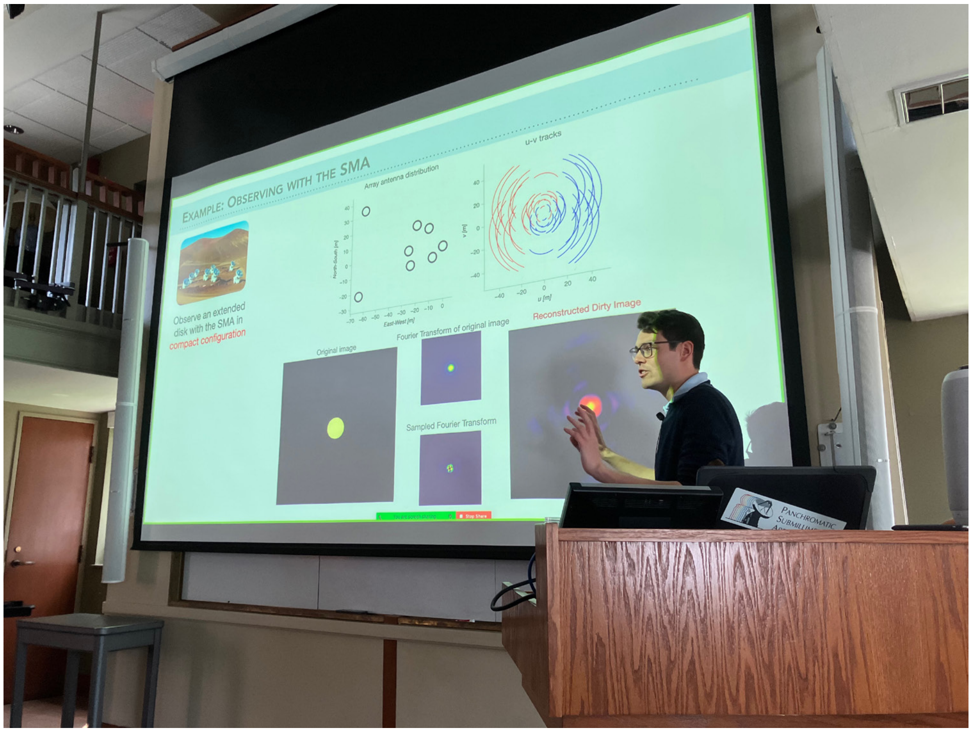
Holly Thomas

We are pleased to announce that the new archive will be released this summer. You can see the July 2022 newsletter **(https://lweb.cfa.harvard.edu/sma/Newsletters/pdfFiles/SMA_NewsJuly2022.pdf)** for full details. This release was delayed owing to ongoing pyuvdata development but we are excited to finally be able to offer our users this functionally. Once online, data back to 2019 will be available to request in CASA measurement set format. Initially we will be offering Tsys scaled measurement sets with an optional rechunking/rebinning factor. This will be followed towards the end of the year with optional flagging, and then with optional bandpass calibration.

Users should be aware that full polarization data taken with the SMA is not currently supported by CASA and will not be offered through pyuvdata. We are working on a dedicated package to integrate SMA full polarization data with the existing CASA routines which we hope to make available to users within a year.

Anyone wishing to use CASA to reduce SMA data is encouraged to visit the sma-data-reduction GitHub site at https://github.com/Smithsonian/sma-data-reduction/. Here you will find python scripts and a Jupyter notebook walking users through the reduction steps. There have been issues getting the flux scaling routines in CASA to work with some SMA calibrators. CASA's setjy task can fail for sources without CASA models or solar system objects with significant structure (see the RTDC website for more information). This GitHub repository contains CASA calibration scripts which include work-arounds for this problem. They can be found in the 'casa-reduction-pipeline' directory and are available with the option to create quality assurance plots in a weblog (check for the 'with_quicklooksma.py' extension). This feature will assist users in determining the quality of the flux fitting.

A new version of Data Catcher is scheduled for imminent release and users will see additional sub folders inside their data directories. These folders are paving the way for the inclusion of calibration tables and enhanced metadata. We hope to be announcing the availability of calibrated visibility files through the online archives in 2024.



2023 SUBMILLIMETER ARRAY INTERFEROMETRY SCHOOL

The Center for Astrophysics, in conjunction with the Academia Sinica Institute of Astronomy and Astrophysics and the University of Hawaii, held the Submillimeter Array Interferometry School from May 15 – 19, 2023. The school was conducted in-person at CfA in Cambridge, MA -- returning from the virtual-only format for the first time since 2020, with students from across the globe also joining remotely. The SMA Interferometry School aims to provide hands-on training in interferometry and submillimeter astronomy for advanced undergraduates, graduate students, post-docs and early career scientists. This year, students were trained through a mixture of live lecture sessions and hands-on, instructor-led data reduction sessions and tutorials. Each student was able to conduct observations with the SMA, reduce and analyze data as a group, and present a set of scientific results which were shown a the conclusion of the week-long workshop. The students produced several impressive results from a wide array of astronomical targets, including measurements of cataclysmic variables, distant quasars, and hot cores surrounding massive protostars. This years school hosted a total of 19 students from 15 different institutions and 10 different countries, with a further 40 persons joining for portions of the lecture sessions.

Lecture slides from the school can be found here:

Website: **https://www.cfa.harvard.edu/sma-school/program**

The organizing committee wishes to thank all those who helped to put on the school, especially Margaret Simonini and Muriel Hodges, who helped to provide administrative support. Those who are interested in participating in the SMA Interferometry School in the future are encouraged to contact **sma-school@cfa.harvard.edu** for further information.:

CALL FOR STANDARD OBSERVING PROPOSALS - 2023B SEMESTER

The next Call for Standard Observing Proposals for observations with the Submillimeter Array (SMA) is for the 2023B semester with observing period nominally **16 Nov 2023 – 5 May 2024** (subject to adjustment as needed).

We are still in the planning phase for 2023B, and the submission deadline has not been finalized, though we expect it to be in the 2nd half of September, 2023.

As soon as the deadline is finalized, we will alert all our past users and interested parties via email and on the SMA Observer Center (SMAOC) at **http://sma1.sma.hawaii.edu/call.html.** The full Call for Proposals, with details on time available and the proposal process, will be available at least four weeks prior to the deadline, also at the SMA Observer Center.

Details on the SMA capabilities and status can be found at **http://sma1.sma.hawaii.edu/status.html;** proposal creation and submission is also done through the SMAOC at **http://sma1.sma.hawaii.edu/proposing.html.** We are happy to answer any questions and provide assistance in proposal submission; simply email **sma-propose@cfa.harvard.edu** with any inquiries.

Sincerely,

Mark Gurwell, SAO Chair, SMA TAC

Ya-Wen Tang, ASIAA Chair, SMA TAC

PROPOSAL STATISTICS FOR 2023A

The three SMA partner institutions received a total of 51 proposals (SAO 39, ASIAA 11, UHawaii 1) and three SAO Large Scale proposals requesting observing time in the 2023A semester. Since the call, SAO has approved 2 DDT proposals. The 56 proposals were divided among science categories as follows:

CATEGORY	PROPOSALS
local galaxies, starbursts, AGN	11
high mass (OB) star formation, cores	10
protoplanetary, transition, debris disks	8
submm/hi-z galaxies	8
low/intermediate mass star formation, cores	5
other	5
GRB, SN, high energy	3
evolved stars, AGB, PPN	3
solar system	2
galactic center	1

The number of hours requested for 2023A was exceptionally large, totalling over 3325 hours, for an oversubscription of more than 4:1, and thus we were unable to allocate time to many worthy programs.

TRACK ALLOCATIONS BY WEATHER REQUIREMENT AND CONFIGURATION:

To best accomodate the highest ranked programs from each of the partners, it was determined that the configuration schedule would be: COM >> SUB >> EXT >> COM

PWV[1]	SAO	ASIAA	UH[2]	SAO Large Scale
< 4.0mm	21A + 34B	2A + 4B	0	28
< 2.5mm	28A + 19B	3A + 3B	6	16
< 1.0mm	0	6B	0	0
Total	**49A + 53B**	**5A + 13B**	**6**	**44**

Configuration	SAO	ASIAA	UH[2]	SAO Large Scale
Subcompact	19A + 7B	3A + 3B	0	0
Compact	22A + 19B	1A + 2B	0	24
Extended	4A + 12B	8B	0	0
Very Extended	4A + 15B	1A + 1B	0	0
Any	4A + 15B	5A + 13B	6	20
Total	**49A + 53B**	**9A + 10B**	**6**	**44**

(1) Precipitable water vapor required for the observations.

(2) UH does not list As and Bs.

TOP-RANKED 2023A SEMESTER PROPOSALS

The following is the listing of all SAO, ASIAA, and UH proposals with at least one A-rank track allocation along with accepted large scale projects.

EVOLVED STARS, AGB, PPN

2023A-S010 Paul Barrett (GWU): *Submillimeter Observations of the Magnetic Propellers in AE Aqr and AR Sco*

GRB, SN, HIGH ENERGY

2022B-S046 Edo Berger (CfA): *POETS: Pursuit of Extragalactic Transients with the SMA [SAO Large Scale]*

2023A-A010 Kuiyun Huang (CYCU): *Electro-magnetic wave candidate of IceCube Neutrino event*

HIGH MASS (OB) STAR FORMATION, CORES

2023A-A003 Han-Tsung Lee (ASIAA/NCU): *SDC13.198-0.135 - the infrared dark cloud with spiral magnetic field*

2023A-S009 Qizhou Zhang (CfA): *What drives the starburst in W49A?*

2023A-S011 Junhao Liu (EAO): *A dust polarization survey of massive dense cores in Cygnus-X*

2023A-S042 Keping Qiu (Nanjing U.): *DDT: Surveys of Clumps, Cores, and Condensations in Cygnus X*

LOCAL GALAXIES, STARBURSTS, AGN

2023A-S025 Eric Koch (CfA): *Measuring the dust and B-field structure in M33's massive GMCs*
2023A-S026 Jean Turner (UCLA): *CO(3-2) n the Dwarf Galaxy NGC 1569*
2023A-S032 Steven Willner (CfA): *Disentangling radiating particle properties and jet physics from M87 multi-wavelength variability*

OTHER

2023A-S033 Michael McCollough (CfA): *SMA Observations during XRISM and IXPE Observations of Cygnus X-3*
2023A-S041 Atilla Kovacs (CfA): *Resolved SZ imaging of galaxy cluster cores with the SMA*
2023A-S043 Michael McCollough (CfA): *DDT: GRS 1915+105 observations coordinated with JWST*

PROTOPLANETARY, TRANSITION, DEBRIS DISKS

2022B-S047 Karin Oberg (CfA): *SMA-SPEC: the SMA Survey of Protoplanetary disks to Explore their Chemistry [SAO Large Scale]*
2023A-A009 Chia-Ying Chung (ASIAA): *A statistical study to constrain grain growth efficiency in protoplanetary disks*
2023A-S003 Sean Andrews (CfA): *Mitigating "Survivor" Bias in Constraints on Disk Evolution*
2023A-S017 David Wilner (CfA): *A 1.3mm Survey of a New Sample of Herbig Be stars*
2023A-S019 Charles Law (CfA): *HNC as a Novel Tracer of Protoplanetary Disk Properties*

SUBMM/HI-Z GALAXIES

2023A-H001 Lenox Cowie (UH): *JWST and SCUBA-2: A Powerful Combination for Studying Submm Galaxies*

STANDARD, DDT, AND LARGE SCALE PROJECTS OBSERVED DURING 2022B

SMA Semester 2022B encompassed the period December 8, 2022 through May 23, 2023, with some overlapping projects. Listed below are all projects that were at least partially completed during the SMA Semester 2022B.

EVOLVED STARS, AGB, PPN

2022B-S005 Manali Jeste (MPIfR): *Imaging HCN emission from the carbon-rich AGB stars CQ Pyx, CIT 6, and V Hya*
2022B-S009 Tianyu Tu (Nanjing U): *Shock and cosmic ray chemistry in molecular clouds interacting with supernova remnant W28*

GALACTIC CENTER

2022B-S025 Garrett Keating (CfA): *Polarimetric VLBI for the 2023 Event Horizon Telescope Campaign*

GRB, SN, HIGH ENERGY

2022B-S013 Anna Ho (Cornell): *The Landscape of Relativistic Stellar Explosions*

HIGH MASS (OB) STAR FORMATION, CORES

2022B-A003 Natsuko Izumi (ASIAA): *Core Mass Function in Metal-Poor Environment*
2022B-A004 Greta Hiu Lam Siu (NTHU): *Turbulence and magnetic fields in high mass star forming clumps*
2022B-S007 Qizhou Zhang (CfA): *What drives the starburst in W49A?*

LOCAL GALAXIES, STARBURSTS, AGN

2022B-H002 Roman Burridge (UH): *A survey of submm flux densities in water megamaser black hole galaxies*
2022B-S003 Gerrit Schellenberger (CfA): *Probing the high frequency variability of NGC5044: the key to AGN feedback*
2022B-S022 Dhanya Nair (U Concepcion): *Towards a sample of SMBH shadows, rings, accretion flows and jet bases: SMA fluxes of SMBHs with large photon rings*
2022B-S023 Ioannis Myserlis (IRAM): *SMAPOL: SMA Monitoring of AGNs with POLarization*
2022B-S026 Ivana Beslic (U Bonn): *Unraveling the Cigar: dense molecular gas across M82*
2022B-S032 Steven Willner (CfA): *Disentangling radiating particle properties and jet physics from M87 multi-wavelength variability*
2022B-S034 Jakob den Brok (CfA): *A wide-band high-resolution molecular survey in the starburst M82*
2022B-S040 Fabio Pacucci (CfA) DDT: *Unveiling the Spectral Energy Distribution of the SMBH at the Center of Leo I*
2022B-S050 Jakob den Brok (CfA) DDT: *Towards extensive northern nearby galaxy mapping in CO(2-1)*

OTHER

2022B-A007 Hau-Yu Liu (ASIAA): *2022-Nov Radio Interferometry Lecture (on-sky project)*

2022B-S044 Jakob de Brok (CfA) DDT: *Molecular gas in extreme galaxy merger environments (AY 191 Student Project)*

2022B-S051 Garrett Keating (CfA) DDT: *SMA School Attendee Projects*

PROTOPLANETARY, TRANSITION, DEBRIS DISKS

2022B-H001 Jonathan Williams (UH): *The chemical composition of gas in the disk-clearing phase of planet formation*

2022B-A005 Yuka Terada (NTU): *Testing planet formation theory around very low mass stars*

2022B-S002 David Wilner (CfA): *An Imaging Survey of Forgotten Nearby Herbig Ae/Be Stars (redux, part 2)*

2022B-S015 Sean Andrews (CfA): *Detailed (Sub)Millimeter Continuum Spectra of Protoplanetary Dust Disks*

2022B-S049 Joshua Lovell (CfA): *DDT: What The Flare? Measuring the first-ever T-Tauri Star millimeter flare frequency distribution*

2022B-S054 Kristina Monsch (CfA) *DDT: A burger is not always a sandwich - Characterizing the edge-on planet-forming disk candidate Dracula's Chivito*

SOLAR SYSTEM

2022B-S012 Nathan Roth (NASA GSFC): *Coordinated SMA/JWST Studies of Comet C/2022 E3: Inner Coma Thermal Physics and a Window into Sulfur Chemistry*

SUBMM/HI-Z GALAXIES

2022B-S028 Garrett Keating (CfA): *Untangling the Molecular Mystery of An Unusual High-Redshift Galaxy*

2022B-S039 Luwenjia Zhou (Nanjing U): *A systematic survey on the dust/gas emission of cluster galaxies in the early Universe*

RECENT PUBLICATIONS

TITLE: Hidden giants in JWST's PEARLS: An ultra-massive z=4.26 sub-millimeter galaxy that is invisible to HST
AUTHOR: Smail, I., Dudzeviciute, U., Gurwell, M., Fazio, G. G., Willner, S. P., Swinbank, A. M., Arumugam, V., Summers, J., Cohen, S. H., Jansen, R. A., Windhorst, R. A., Meena, A., Zitrin, A., Keel, W. C., Coe, D., Conselice, C. J., D'Silva, J. C. J., Driver, S. P., Frye, B., Grogin, N. A., Koekemoer, A. M., Marshall, M. A., Nonino, M., Pirzkal, N., Robotham, A., Rutkowski, M. J., Ryan, R. E., Tompkins, S., Willmer, C. N. A., Yan, H., Broadhurst, T. J., Cheng, C., Diego, J. M., Kamieneski, P., Yun, M.
PUBLICATION: *arXiv e-prints, arXiv:2306.16039*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230616039S
DOI: 10.48550/arXiv.2306.16039

TITLE: Millimeter Observations of the Type II SN2023ixf: Constraints on the Proximate Circumstellar Medium
AUTHOR: Berger, E., Keating, G. K., Margutti, R., Maeda, K., Alexander, K. D., Cendes, Y., Eftekhari, T., Gurwell, M., Hiramatsu, D., Ho, A. Y. Q., Laskar, T., Rao, R., Williams, P. K. G.
PUBLICATION: *arXiv e-prints, arXiv:2306.09311*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230609311B
DOI: 10.48550/arXiv.2306.09311

TITLE: Double SSA Spectrum and Magnetic Field Strength of the FSRQ 3C 454.3
AUTHOR: Jeong, H.-W., Lee, S.-S., Cheong, W. Y., Kim, J.-Y., Lee, J. W., Kang, S., Kim, S.-H., Rani, B., Park, J., Gurwell, M. A.
PUBLICATION: *Monthly Notices of the Royal Astronomical Society,*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023MNRAS.tmp.1778J
DOI: 10.1093/mnras/stad1736

TITLE: Absence of the predicted 2022 October outburst of OJ 287 and implications for binary SMBH scenarios
AUTHOR: Komossa, S., Grupe, D., Kraus, A., Gurwell, M. A., Haiman, Z., Liu, F. K., Tchekhovskoy, A., Gallo, L. C., Berton, M., Blandford, R., Gómez, J. L., Gonzalez, A. G.
PUBLICATION: *Monthly Notices of the Royal Astronomical Society, 522, L84-L88*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023MNRAS.522L..84K
DOI: 10.1093/mnrasl/slad016

TITLE: Multimessenger Characterization of Markarian 501 during Historically Low X-Ray and γ-Ray Activity
AUTHOR: Abe, H., Abe, S., Acciari, V. A., Agudo, I., Aniello, T., Ansoldi, S., Antonelli, L. A., Arbet-Engels, A., Arcaro, C., Artero, M., Asano, K., Baack, D., Babić, A., Baquero, A., Barres de Almeida, U., Barrio, J. A., Batković, I., Baxter, J., Becerra González, J., Bednarek, W., Bernardini, E., Bernardos, M., Berti, A., Besenrieder, J., Bhattacharyya, W., Bigongiari, C., Biland, A., Blanch, O., Bonnoli, G., Bošnjak, Ž., Burelli, I., Busetto, G., Carosi, R., Carretero-Castrillo, M., Castro-Tirado, A. J., Ceribella, G., Chai, Y., Chilingarian, A., Cikota, S., Colombo, E., Contreras, J. L., Cortina, J., Covino, S., D'Amico, G., D'Elia, V., da Vela, P., Dazzi, F., de Angelis, A., de Lotto, B., Del Popolo, A., Delfino, M., Delgado, J., Delgado Mendez,

C., Depaoli, D., di Pierro, F., di Venere, L., Do Souto Espiñeira, E., Dominis Prester, D., Donini, A., Dorner, D., Doro, M., Elsaesser, D., Emery, G., Escudero, J., Fallah Ramazani, V., Fariña, L., Fattorini, A., Foffano, L., Font, L., Fruck, C., Fukami, S., Fukazawa, Y., García López, R. J., Garczarczyk, M., Gasparyan, S., Gaug, M., Giesbrecht Paiva, J. G., Giglietto, N., Giordano, F., Gliwny, P., Godinović, N., Grau, R., Green, D., Green, J. G., Hadasch, D., Hahn, A., Hassan, T., Heckmann, L., Herrera, J., Hrupec, D., Hütten, M., Imazawa, R., Inada, T., Iotov, R., Ishio, K., Jiménez Martínez, I., Jormanainen, J., Kerszberg, D., Kobayashi, Y., Kubo, H., Kushida, J., Lamastra, A., Lelas, D., Leone, F., Lindfors, E., Linhoff, L., Lombardi, S., Longo, F., López-Coto, R., López-Moya, M., López-Oramas, A., Loporchio, S., Lorini, A., Lyard, E., Machado de Oliveira Fraga, B., Majumdar, P., Makariev, M., Maneva, G., Mang, N., Manganaro, M., Mangano, S., Mannheim, K., Mariotti, M., Martínez, M., Mas-Aguilar, A., Mazin, D., Menchiari, S., Mender, S., Mićanović, S., Miceli, D., Miener, T., Miranda, J. M., Mirzoyan, R., Molina, E., Mondal, H. A., Moralejo, A., Morcuende, D., Moreno, V., Nakamori, T., Nanci, C., Nava, L., Neustroev, V., Nievas Rosillo, M., Nigro, C., Nilsson, K., Nishijima, K., Njoh Ekoume, T., Noda, K., Nozaki, S., Ohtani, Y., Oka, T., Okumura, A., Otero-Santos, J., Paiano, S., Palatiello, M., Paneque, D., Paoletti, R., Paredes, J. M., Pavletić, L., Persic, M., Pihet, M., Pirola, G., Podobnik, F., Prada Moroni, P. G., Prandini, E., Principe, G., Priyadarshi, C., Rhode, W., Ribó, M., Rico, J., Righi, C., Rugliancich, A., Sahakyan, N., Saito, T., Sakurai, S., Satalecka, K., Saturni, F. G., Schleicher, B., Schmidt, K., Schmuckermaier, F., Schubert, J. L., Schweizer, T., Sitarek, J., Sliusar, V., Sobczynska, D., Spolon, A., Stamerra, A., Strišković, J., Strom, D., Strzys, M., Suda, Y., Surić, T., Tajima, H., Takahashi, M., Takeishi, R., Tavecchio, F., Temnikov, P., Terauchi, K., Terzić, T., Teshima, M., Tosti, L., Truzzi, S., Tutone, A., Ubach, S., van Scherpenberg, J., Vazquez Acosta, M., Ventura, S., Verguilov, V., Viale, I., Vigorito, C. F., Vitale, V., Vovk, I., Walter, R., Will, M., Wunderlich, C., Yamamoto, T., Zarić, D., MAGIC Collaboration, Cerruti, M., Acosta-Pulido, J. A., Apolonio, G., Bachev, R., Baloković, M., Benítez, E., Björklund, I., Bozhilov, V., Brown, L. F., Bugg, A., Carbonell, W., Carnerero, M. I., Carosati, D., Casadio, C., Chamani, W., Chen, W. P., Chigladze, R. A., Damljanovic, G., Epps, K., Erkenov, A., Feige, M., Finke, J., Fuentes, A., Gazeas, K., Giroletti, M., Grishina, T. S., Gupta, A. C., Gurwell, ., Heidemann, E., Hiriart, D., Hou, W. J., Hovatta, T., Ibryamov, S., Joner, M. D., Jorstad, S. G., Kania, J., Kiehlmann, S., Kimeridze, G. N., Kopatskaya, E. N., Kopp, M., Korte, M., Kotas, B., Koyama, S., Kramer, J. A., Kunkel, L., Kurtanidze, S. O., Kurtanidze, O. M., Lähteenmäki, A., López, J. M., Larionov, V. M., Larionova, E. G., Larionova, L. V., Leto, C., Lorey, C., Mújica, R., Madejski, G. M., Marchili, N., Marscher, A. P., Minev, M., Modaressi, A., Morozova, D. A., Mufakharov, T., Myserlis, I., Nikiforova, A. A., Nikolashvili, M. G., Ovcharov, E., Perri, M., Raiteri, C. M., Readhead, A. C. S., Reimer, A., Reinhart, D., Righini, S., Rosenlehner, K., Sadun, A. C., Savchenko, S. S., Scherbantin, A., Schneider, L., Schoch, K., Seifert, D., Semkov, E., Sigua, L. A., Singh, C., Sola, P., Sotnikova, Y., Spencer, M., Steineke, R., Stojanovic, M., Strigachev, A., Tornikoski, M., Traianou, E., Tramacere, A., Troitskaya, Y. V., Troitskiy, I. S., Trump, J. B., Tsai, A., Valcheva, A., Vasilyev, A. A., Verrecchia, F., Villata, M., Vince, O., Vrontaki, K., Weaver, Z. R., Zaharieva, E., Zottmann, N.

PUBLICATION: *The Astrophysical Journal Supplement Series, 266, 37*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJS..266...37A
DOI: 10.3847/1538-4365/acc181

TITLE: Surveying Flux Density in Galaxies with Apparent Large Black Holes at Millimeter/Submillimeter Wavelengths
AUTHOR: Lo, W.-P., Asada, K., Matsushita, S., Pu, H.-Y., Nakamura, M., Bower, G. C., Park, J., Inoue, M.
PUBLICATION: *The Astrophysical Journal, 950, 10*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...950...10L
DOI: 10.3847/1538-4357/acc855

TITLE: A Search for Extragalactic Fast Blue Optical Transients in ZTF and the Rate of AT2018cow-like Transients
AUTHOR: Ho, A. Y. Q., Perley, D. A., Gal-Yam, A., Lunnan, R., Sollerman, J., Schulze, S., Das, K. K., Dobie, D., Yao, Y., Fremling, C., Adams, S., Anand, S., Andreoni, I., Bellm, E. C., Bruch, R. J., Burdge, K. B., Castro-Tirado, A. J., Dahiwale, A., De, K., Dekany, R., Drake, A. J., Duev, D. A., Graham, M. J., Helou, G., Kaplan, D. L., Karambelkar, V., Kasliwal, M. M., Kool, E. C., Kulkarni, S. R., Mahabal, A. A., Medford, M. S., Miller, A. A., Nordin, J., Ofek, E., Petitpas, G., Riddle, R., Sharma, Y., Smith, R., Stewart, A. J., Taggart, K., Tartaglia, L., Tzanidakis, A., Winters, J. M.
PUBLICATION: *The Astrophysical Journal, 949, 120*
PUBLICATION DATE: 06/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...949..120H
DOI: 10.3847/1538-4357/acc533

TITLE: Discovery of X-ray polarization angle rotation in active galaxy Mrk 421
AUTHOR: Di Gesu, L., Marshall, H. L., Ehlert, S. R., Kim, D. E., Donnarumma, I., Tavecchio, F., Liodakis, I., Kiehlmann, S., Agudo, I., Jorstad, S. G., Muleri, F., Marscher, A. P., Puccetti, S., Middei, R., Perri, M., Pacciani, L., Negro, M., Romani, R. W., Di Marco, A., Blinov, D., Bourbah, I. G., Kontopodis, E., Mandarakas, N., Romanopoulos, S., Skalidis, R., Vervelaki, A., Casadio, C., Escudero, J., Myserlis, I., Gurwell, M., Rao, R., Keating, G., Kouch, P. M., Lindfors, E., Josè Aceituno, F., Bernardos, M. I., Bonnoli, G., Casanova, V., Garcìa-Comas, M., Agìs-Gonzàlez, B., Husillos, C., Marchini, A., Sota, A., Imazawa, R., Sasada, M., Fukazawa, Y., Kawabata, K. S., Uemura, M., Mizuno, T., Nakaoka, T., Akitaya, H., Savchenko, S. S., Vasilyev, A. A., Gòmez, J. L., Antonelli, L. A., Barnouin, T., Bonino, R., Cavazzuti, E., Costamante, L., Chen, C.-T., Cibrario, N., De Rosa, A., Di Pierro, F., Errando, M., Kaaret, P., Karas, V., Krawczynski, H., Lisalda, L., Madejski, G., Malacaria, C., Marin, F., Marinucci, A., Massaro, F., Matt, G., Mitsuishi, I., O'Dell, S. L., Paggi, A., Peirson, A. L., Petrucci, P.-O., Ramsey, B. D., Tennant, A. F., Wu, K., Bachetti, M., Baldini, L., Baumgartner, W. H., Bellazzini, R., Bianchi, S., Bongiorno, S. D., Brez, A., Bucciantini, N., Capitanio, F., Castellano, S., Ciprini, S., Costa, E., Del Monte, E., Di Lalla, N., Doroshenko, V., Dovčiak, M., Enoto, T., Evangelista, Y., Fabiani, S., Ferrazzoli, R., Garcia, J. A., Gunji, S., Hayashida, K., Heyl, J., Iwakiri, W., Kislat, F., Kitaguchi, T., Kolodziejczak, J. J., La Monaca, F., Latronico, L., Maldera, S., Manfreda, A., Ng, C.-Y., Omodei, N., Oppedisano, C., Papitto, A., Pavlov, G. G., Pesce-Rollins, M., Pilia, M., Possenti, A., Poutanen, J., Rankin, J., Ratheesh, A., Roberts, O. J., Sgrò, C., Slane, P., Soffitta, P., Spandre, G., Swartz, D. A., Tamagawa, T., Taverna, R., Tawara, Y., Thomas, N. E., Tombesi, F., Trois, A., Tsygankov, S. S., Turolla, R., Vink, J., Weisskopf, M. C., Xie, F., Zane, S.
PUBLICATION: *arXiv e-prints, arXiv:2305.13497*
PUBLICATION DATE: 05/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230513497D
DOI: 10.48550/arXiv.2305.13497

TITLE: Testing the linear relationship between black hole mass and variability timescale in low-luminosity AGN at submillimeter wavelengths
AUTHOR: Chen, B.-Y., Bower, G. C., Dexter, J., Markoff, S., Ridenour, A., Gurwell, M. A., Rao, R., Wallström, S. H. J.
PUBLICATION: *arXiv e-prints, arXiv:2305.06529*
PUBLICATION DATE: 05/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230506529C
DOI: 10.48550/arXiv.2305.06529

TITLE: Atmospheric molecular blobs shape up circumstellar envelopes of AGB stars
AUTHOR: Velilla-Prieto, L., Fonfría, J. P., Agúndez, M., Castro-Carrizo, A., Guélin, M., Quintana-Lacaci, G., Cherchneff, I., Joblin, C., McCarthy, M. C., Martín-Gago, J. A., Cernicharo, J.
PUBLICATION: *Nature, 617, 696-700*
PUBLICATION DATE: 05/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023Natur.617..696V
DOI: 10.1038/s41586-023-05917-9

TITLE: An infrared transient from a star engulfing a planet
AUTHOR: De, K., MacLeod, M., Karambelkar, V., Jencson, J. E., Chakrabarty, D., Conroy, C., Dekany, R., Eilers, A.-C., Graham, M. J., Hillenbrand, L. A., Kara, E., Kasliwal, M. M., Kulkarni, S. R., Lau, R. M., Loeb, A., Masci, F., Medford, M. S., Meisner, A. M., Patel, N., Quiroga-Nuñez, L. H., Riddle, R. L., Rusholme, B., Simcoe, R., Sjouwerman, L. O., Teague, R., Vanderburg, A.
PUBLICATION: *Nature, 617, 55-60*
PUBLICATION DATE: 05/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023Natur.617...55D
DOI: 10.1038/s41586-023-05842-x

TITLE: Deviation from a Continuous and Universal Turbulence Cascade in NGC 6334 due to Massive Star Formation Activity
AUTHOR: Liu, J., Zhang, Q., Liu, H. B., Qiu, K., Li, S., Li, Z.-Y., Ho, P. T. P., Girart, J. M., Ching, T.-C., Chen, H.-R. V., Lai, S.-P., Rao, R., Tang, Y.-. wen .
PUBLICATION: *The Astrophysical Journal, 949, 30*
PUBLICATION DATE: 05/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...949...30L
DOI: 10.3847/1538-4357/acc4c0

TITLE: X-Ray Polarization of BL Lacertae in Outburst
AUTHOR: Peirson, A. L., Negro, M., Liodakis, I., Middei, R., Kim, D. E., Marscher, A. P., Marshall, H. L., Pacciani, L., Romani, R. W., Wu, K., Di Marco, A., Di Lalla, N., Omodei, N., Jorstad, S. G., Agudo, I., Kouch, P. M., Lindfors, E., Aceituno, F. J., Bernardos, M. I., Bonnoli, G., Casanova, V., García-Comas, M., Agís-González, B., Husillos, C., Marchini, A., Sota, A., Casadio, C., Escudero, J., Myserlis, I., Sievers, A., Gurwell, M., Rao, R., Imazawa, R., Sasada, M., Fukazawa, Y., Kawabata, K. S., Uemura, M., Mizuno, T., Nakaoka, T., Akitaya, H., Cheong, Y., Jeong, H.-W., Kang, S., Kim, S.-H., Lee, S.-S., Angelakis, E., Kraus, A., Cibrario, N., Donnarumma, I., Poutanen, J., Tavecchio, F., Antonelli, L. A., Bachetti, M., Baldini, L., Baumgartner, W. H., Bellazzini, R., Bianchi, S., Bongiorno, S. D., Bonino, R., Brez, A., Bucciantini, N., Capitanio, F., Castellano, S., Cavazzuti, E., Chen, C.-T., Ciprini, S., Costa, E., De Rosa, A., Del Monte, E., Di Gesu, L., Doroshenko, V., Dovčiak, M., Ehlert, S. R., Enoto, T., Evangelista, Y., Fabiani, S., Ferrazzoli, R., Garcia, J. A., Gunji, S., Hayashida, K., Heyl, J., Iwakiri, W., Kaaret, P., Karas, V., Kitaguchi, T., Kolodziejczak, J. J., Krawczynski, H., La Monaca, F., Latronico, L., Madejski, G., Maldera, S., Manfreda, A., Marin, F., Marinucci, A., Massaro, F., Matt, G., Mitsuishi, I., Muleri, F., Ng, C.-Y., O'Dell, S. L., Oppedisano, C., Papitto, A., Pavlov, G. G., Perri, M., Pesce-Rollins, M., Petrucci, P.-O., Pilia, M., Possenti, A., Puccetti, S., Ramsey, B. D., Rankin, J., Ratheesh, A., Roberts, O. J., Sgró, C., Slane, P., Soffitta, P., Spandre, G., Swartz, D. A., Tamagawa, T., Taverna, R., Tawara, Y., Tennant, A. F., Thomas, N. E., Tombesi, F., Trois, A., Tsygankov, S., Turolla, R., Vink, J., Weisskopf, M. C., Xie, F., Zane, S.
PUBLICATION: *The Astrophysical Journal, 948, L25*
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ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...948L..25P
DOI: 10.3847/2041-8213/acd242

TITLE: Feedback in the Extremely Violent Group Merger NGC 6338
AUTHOR: Schellenberger, G., O'Sullivan, E., Giacintucci, S., Vrtilek, J., David, L. P., Combes, F., Bîrzan, L., Pan, H.-A., Lin, L.
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TITLE: An SMA Survey of Chemistry in Disks Around Herbig AeBe Stars
AUTHOR: Pegues, J., Öberg, K. I., Qi, C., Andrews, S. M., Huang, J., Law, C. J., Le Gal, R., Matrà, L., Wilner, D. J.
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ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...948...57P
DOI: 10.3847/1538-4357/acbf31

TITLE: CMZoom III: Spectral line data release
AUTHOR: Callanan, D., Longmore, S. N., Battersby, C., Hatchfield, H. P., Walker, D. L., Henshaw, J., Keto, E., Barnes, A., Ginsburg, A., Kauffmann, J., Kruijssen, J. M. D., Lu, X., Mills, E. A. C., Pillai, T., Zhang, Q., Bally, J., Butterfield, N., Contreras, Y. A., Ho, L. C., Immer, K., Johnston, K. G., Ott, J., Patel, N., Tolls, V.
PUBLICATION: *Monthly Notices of the Royal Astronomical Society, 520, 4760-4778*
PUBLICATION DATE: 04/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023MNRAS.520.4760C
DOI: 10.1093/mnras/stad388

TITLE: Modeling Two First Hydrostatic Core Candidates Barnard 1b-N and 1b-S
AUTHOR: Duan, H.-Y., Lai, S.-P., Hirano, N., Thieme, T. J.
PUBLICATION: *The Astrophysical Journal, 947, 48*
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ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...947...48D
DOI: 10.3847/1538-4357/acb531

TITLE: Precise Measurements of Self-absorbed Rising Reverse Shock Emission from Gamma-ray Burst 221009A
AUTHOR: Bright, J. S., Rhodes, L., Farah, W., Fender, R., van der Horst, A. J., Leung, J. K., Williams, D. R. A., Anderson, G. E., Atri, P., DeBoer, D. R., Giarratana, S., Green, D. A., Heywood, I., Lenc, E., Murphy, T., Pollak, A. W., Premnath, P. H., Scott, P. F., Sheikh, S. Z., Siemion, A., Titterington, D. J.
PUBLICATION: *arXiv e-prints, arXiv:2303.13583*
PUBLICATION DATE: 03/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230313583B
DOI: 10.48550/arXiv.2303.13583

TITLE: Interstellar Complex Organic Molecules towards outflows from the G351.16+0.70 (NGC 6334 V) massive protostellar system
AUTHOR: Rojas-García, O. S., Gómez-Ruiz, A. I., Palau, A., Orozco-Aguilera, M. T., Kurtz, S. E., Chavez Dagostino, M.
PUBLICATION: *arXiv e-prints, arXiv:2303.02527*
PUBLICATION DATE: 03/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023arXiv230302527R
DOI: 10.48550/arXiv.2303.02527

TITLE: Astronomical puzzle Cyg X-3 is a hidden Galactic ultraluminous X-ray source
AUTHOR: Veledina, A., Muleri, F., Poutanen, J., Podgorný, J., Dovčiak, M., Capitanio, F., Churazov, E., De Rosa, A., Di Marco, A., Forsblom, S., Kaaret, P., Krawczynski, H., La Monaca, F., Loktev, V., Lutovinov, A. A., Molkov, S. V., Mushtukov, A. A., Ratheesh, A., Rodriguez Cavero, N., Steiner, J. F., Sunyaev, R. A., Tsygankov, S. S., Zdziarski, A. A., Bianchi, S., Bright, J. S., Bursov, N., Costa, E., Egron, E., Garcia, J. A., Green, D. A., Gurwell, M., Ingram, A., Kajava, J. J. E., Kale, R., Kraus, A., Malyshev, D., Marin, F., Matt, G., McCollough, M., Mereminskiy, I. A., Nizhelsky, N., Piano, G., Pilia, M., Pittori, C., Rao, R., Righini, S., Soffitta, P., Shevchenko, A., Svoboda, J., Tombesi, F., Trushkin, S., Tsybulev, P., Ursini, F., Weisskopf, M. C., Wu, K., Agudo, I., Antonelli, L. A., Bachetti, M., Baldini, L., Baumgartner, W. H., Bellazzini, R., Bongiorno, S. D., Bonino, R., Brez, A., Bucciantini, N., Castellano, S., Cavazzuti, E., Chen, C.-T., Ciprini, S., Del Monte, E., Di Gesu, L., Di Lalla, N., Donnarumma, I., Doroshenko, V., Ehlert, S. R., Enoto, T., Evangelista, Y., Fabiani, S., Ferrazzoli, R., Gunji, S., Hayashida, K., Heyl, J., Iwakiri, W., Jorstad, S. G., Karas, V., Kislat, F., Kitaguchi, T., Kolodziejczak, J. J., Latronico, L., Liodakis, I., Maldera, S., Manfreda, A., Marinucci, A., Marscher, A. P., Marshall, H. L., Massaro, F., Mitsuishi, I., Mizuno, T., Negro, M., Ng, C.-Y., O'Dell, S. L., Omodei, N., Oppedisano, C., Papitto, A., Pavlov, G. G., Peirson, A. L., Perri, M., Pesce-Rollins, M., Petrucci, P.-O., Possenti, A., Puccetti, S., Ramsey, B. D., Rankin, J., Roberts, O., Romani, R. W., Sgrò, C., Slane, P., Spandre, G., Swartz, D., Tamagawa, T., Tavecchio, F., Taverna, R., Tawara, Y., Tennant, A. F., Thomas, N. E., Trois, A., Turolla, R., Vink, J., Xie, F., Zane, S.
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DOI: 10.48550/arXiv.2303.01174

TITLE: The Radio to GeV Afterglow of GRB 221009A
AUTHOR: Laskar, T., Alexander, K. D., Margutti, R., Eftekhari, T., Chornock, R., Berger, E., Cendes, Y., Duerr, A., Perley, D. A., Ravasio, M. E., Yamazaki, R., Ayache, E. H., Barclay, T., Duran, R. B., Bhandari, S., Brethauer, D., Christy, C. T., Coppejans, D. L., Duffell, P., Fong, W.-. fai ., Gomboc, A., Guidorzi, C., Kennea, J. A., Kobayashi, S., Levan, A., Lobanov, A. P., Metzger, B. D., Ros, E., Schroeder, G., Williams, P. K. G.
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PUBLICATION DATE: 03/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...946L..23L
DOI: 10.3847/2041-8213/acbfad

TITLE: The nature of 500 micron risers - II. Multiplicities and environments of sub-mm faint dusty star-forming galaxies
AUTHOR: Cairns, J., Clements, D. L., Greenslade, J., Petitpas, G., Cheng, T., Ding, Y., Parmar, A., Pérez-Fournon, I., Riechers, D.
PUBLICATION: *Monthly Notices of the Royal Astronomical Society, 519, 709-728*
PUBLICATION DATE: 02/2023
ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023MNRAS.519..709C
DOI: 10.1093/mnras/stac3486

TITLE: MOMO. VI. Multifrequency Radio Variability of the Blazar OJ 287 from 2015 to 2022, Absence of Predicted 2021 Pecursor-flare Activity, and a New Binary Interpretation of the 2016/2017 Outburst
AUTHOR: Komossa, S., Kraus, A., Grupe, D., Gonzalez, A. G., Gurwell, M. A., Gallo, L. C., Liu, F. K., Myserlis, I., Krichbaum, T. P., Laine, S., Bach, U., Gómez, J. L., Parker, M. L., Yao, S., Berton, M.
PUBLICATION: *The Astrophysical Journal, 944, 177*
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ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...944..177K
DOI: 10.3847/1538-4357/acaf71

TITLE: A Disk Wind Driving the Rotating Molecular Outflow in CB 26
AUTHOR: López-Vázquez, J. A., Zapata, L. A., Lee, C.-F.
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ABSTRACT: https://ui.adsabs.harvard.edu/abs/2023ApJ...944...63L
DOI: 10.3847/1538-4357/acb439

TITLE: The Event Horizon Telescope Image of the Quasar NRAO 530
AUTHOR: Jorstad, S., Wielgus, M., Lico, R., Issaoun, S., Broderick, A. E., Pesce, D. W., Liu, J., Zhao, G.-Y., Krichbaum, T. P., Blackburn, L., Chan, C.-. kwan ., Janssen, M., Ramakrishnan, V., Akiyama, K., Alberdi, A., Algaba, J. C., Bouman, K. L., Cho, I., Fuentes, A., Gómez, J. L., Gurwell, M., Johnson, M. D., Kim, J.-Y., Lu, R.-S., Martí-Vidal, I., Moscibrodzka, M., Pötzl, F. M., Traianou, E., van Bemmel, I., Alef, W., Anantua, R., Asada, K., Azulay, R., Bach, U., Baczko, A.-K., Ball, D., Baloković, M., Barrett, J., Bauböck, M., Benson, B. A., Bintley, D., Blundell, R., Bower, G. C., Boyce, H., Bremer, M., Brinkerink, C. D., Brissenden, R., Britzen, S., Broguiere, D., Bronzwaer, T., Bustamante, S., Byun, D.-Y., Carlstrom, J. E., Ceccobello, C., Chael, A., Chatterjee, K., Chatterjee, S., Chen, M.-T., Chen, Y., Cheng, X., Christian, P., Conroy, N. S., Conway, J. E., Cordes, J. M., Crawford, T. M., Crew, G. B., Cruz-Osorio, A., Cui, Y., Davelaar, J., De Laurentis, M., Deane, R., Dempsey, J., Desvignes, G., Dexter, J., Dhruv, V., Doeleman, S. S., Dougal, S., Dzib, S. A., Eatough, R. P., Emami, R., Falcke, H., Farah, J., Fish, V. L., Fomalont, E., Ford, H. A., Fraga-Encinas, R., Freeman, W. T., Friberg, P., Fromm, C. M., Galison, P., Gammie, C. F., García, R., Gentaz, O., Georgiev, B., Goddi, C., Gold, R., Gómez-Ruiz, A. I., Gu, M., Hada, K., Haggard, D., Haworth, K., Hecht, M. H., Hesper, R., Heumann, D., Ho, L. C., Ho, P., Honma, M., Huang, C.-W. L., Huang, L., Hughes, D. H., Ikeda, S., Impellizzeri, C. M. V., Inoue, M., James, D. J., Jannuzi, B. T., Jeter, B., Jiang, W., Jiménez-Rosales, A., Joshi, A. V., Jung, T., Karami, M., Karuppusamy, R., Kawashima, T., Keating, G. K., Kettenis, M., Kim, D.-J., Kim, J., Kim, J., Kino, M., Koay, J. Y., Kocherlakota, P., Kofuji, Y., Koyama, S., Kramer, C., Kramer, M., Kuo, C.-Y., La Bella, N., Lauer, T. R., Lee, D., Lee, S.-S., Leung, P. K., Levis, A., Li, Z., Lindahl, G., Lindqvist, M., Lisakov, M., Liu, K., Liuzzo, E., Lo, W.-P., Lobanov, A. P., Loinard, L., Lonsdale, C. J., MacDonald, N. R., Mao, J., Marchili, N., Markoff, S., Marrone, D. P., Marscher, A. P., Matsushita, S., Matthews, L. D., Medeiros, L., Menten, K. M., Michalik, D., Mizuno, I., Mizuno, Y., Moran, J. M., Moriyama, K., Müller, C., Mus, A., Musoke, G., Myserlis, I., Nadolski, A., Nagai, H., Nagar, N. M., Nakamura, M., Narayan, R., Narayanan, G., Natarajan, I., Nathanail, A., Fuentes, S. N., Neilsen, J., Neri, R., Ni, C., Noutsos, A., Nowak, M. A., Oh, J., Okino, H., Olivares, H., Ortiz-León, G. N., Oyama, T., Özel, F., Palumbo, D. C. M., Paraschos, G. F., Park, J., Parsons, H., Patel, N., Pen, U.-L., Piétu, V., Plambeck, R., PopStefanija, A., Porth, O., Prather, B., Preciado-López, J. A., Psaltis, D., Pu, H.-Y., Rao, R., Rawlings, M. G., Raymond, A. W., Rezzolla, L., Ricarte, A., Ripperda, B., Roelofs, F.,

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TITLE: A multi-band study and exploration of the radio wave-γ-ray connection in 3C 84

AUTHOR: Paraschos, G. F., Mpisketzis, V., Kim, J.-Y., Witzel, G., Krichbaum, T. P., Zensus, J. A., Gurwell, M. A., Lähteenmäki, A., Tornikoski, M., Kiehlmann, S., Readhead, A. C. S.

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Photo by Brooks Rownd

The Submillimeter Array (SMA) is a pioneering radio-interferometer dedicated to a broad range of astronomical studies including finding protostellar disks and outflows; evolved stars; the Galactic Center and AGN; normal and luminous galaxies; and the solar system. Located on Maunakea, Hawaii, the SMA is a collaboration between the Smithsonian Astrophysical Observatory and the Academia Sinica Institute of Astronomy and Astrophysics.

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