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SMA Newsletter

Submillimeter Array Newsletter | Number 15 | February 2013

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FROM THE DIRECTOR

Dear SMA Newsletter readers,

With the impending completion of the Atacama Large Millimeter Array (ALMA), scientific interest in millimeter and submillimeter wavelength astronomy, worldwide, is at an all-time high. User interest in the SMA remains strong, especially where it offers unique facilities such as submillimeter polarimetry, and we continue to expand its capabilities.

For example, last week witnessed the first on-sky tests of an interim signal processing upgrade that will significantly increase the instantaneous throughput of the SMA, as well as greatly increase the total bandwidth which can be imaged with high spectral resolution. The article **'First Light For The New SMA Digital Back End'** ***(pg. 10)*** illustrates a single baseline spectrum taken towards MWC349 using the new SMA FX Packetized Digital Back End, based on CASPER technology, in parallel with the existing SMA correlator.

We expect to complete the installation and tests of the upgraded back end during the next few months with plans to offer it for astronomical observations in the fall.

Please join me in thanking SMA Hawaii, Cambridge, and Taipei based staff for making this upgrade possible.

Ray Blundell

HIERARCHICAL FRAGMENTATION OF THE ORION MOLECULAR FILAMENTS

Satoko Takahashi, Paula Stella Teixeira, Paul Ho

Recent infrared studies of star forming regions located less than 2 kpc distant suggest that the majority of stars (80%-90%) form in embedded clusters (defined as having more than 35 young stars) within a giant molecular cloud (GMC), rather than in isolated star formation environments (e.g., Lada & Lada 2003; Porras et al. 2003). These GMCs, as well as less massive molecular clouds often show filamentary structures (e.g., Myers, 2009). Revealing the physical relation between pc-scale filamentary structures and individual star formation sites is crucial to the understanding of the initial conditions and evolutionary processes of the early stage of star formation – How do cores form within filamentary molecular clouds? How do filament fragmentation processes influence mass and spatial distribution of cores, and their consequential evolution?

We carried out an SMA study (Takahashi et al., 2013) that revealed a great detail of the star formation activity and fragmentation properties within a filamentary molecular cloud, Orion Molecular Cloud-3 (OMC 3), located in the northern part of the nearest GMC, Orion A molecular cloud.

Our 85-pointing mosaic observations cover an area of 6'.5x2'.0 (or 0.88x0.27 pc) of the OMC-3 region; we found 12 continuum sources in the 850 μm continuum emission with a mass detection limit of 0.15 $M_\odot$ (Figure 1). Their H_2 masses and projected sizes range between 0.3-5.7 $M_\odot$ and 1400-8200 AU, respectively. Ten sources are previously known and two are newly detected , and all are spatially resolved. The detected sources have a variety of structures such as concentrated, fluffy, and faint (Figure 1 zoomed images). All the detected sources are found in the main filamentary ridge ($n_{H2} \geq 10^6$ cm^{-3}). Analysis based on the Jeans criterion suggests that the detected continuum sources are most likely gravitationally unstable (Figure 2). Comparison of multi-wavelength data sets indicates that among the continuum sources, 6/12 (50 %) are associated with molecular outflows, 8/12 (67 %) with infrared sources, and 3/12 (25 %) with ionized jets. Their evolutionary status ranges from prestellar to protostar, confirming that OMC-3 is an active region with ongoing embedded star-formation.

Our data suggests that the SMA continuum sources have quasi-periodic separations of ~17" or 0.035 pc. This spatial distribution is part of a large hierarchical structure, that also includes fragmentation scales of the GMC (~35 pc), large-scale clumps (~1.3 pc), and small-scale clumps (~0.3 pc), implying a multi-size scale fragmentation process (Figure 3). The fragmentation spacings (0.1-1pc) are roughly consistent with thermal fragmentation at each size scale

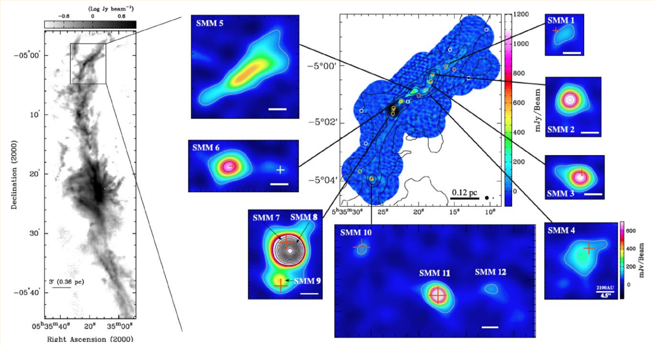

Figure 1:

Left panel: Filamentary structure observed in the Orion Molecular Cloud obtained in the 850 μm continuum emission (traces thermal dust emission) taken with the JCMT/SCUBA (Johnstone & Bally 1999). The observed area by SMA (OMC 3 region) is denoted by the open box.

Right panel: SMA 850 μm continuum images (color), obtained with 85-pointing mosaic observations, overlaid with the 850 μm continuum image taken with JCMT/SCBA (black contours). Positions of 8 μm Spitzer sources identified by Peterson & Megeath (2008) are denoted by orange (protostars) and white (T Tauri stars) circles/crosses. Zoomed-in images of each source are presented in the individual panels. Black filled circles in the bottom right corner show the JCMT and SMA beam size of 14" and 4.5", respectively.

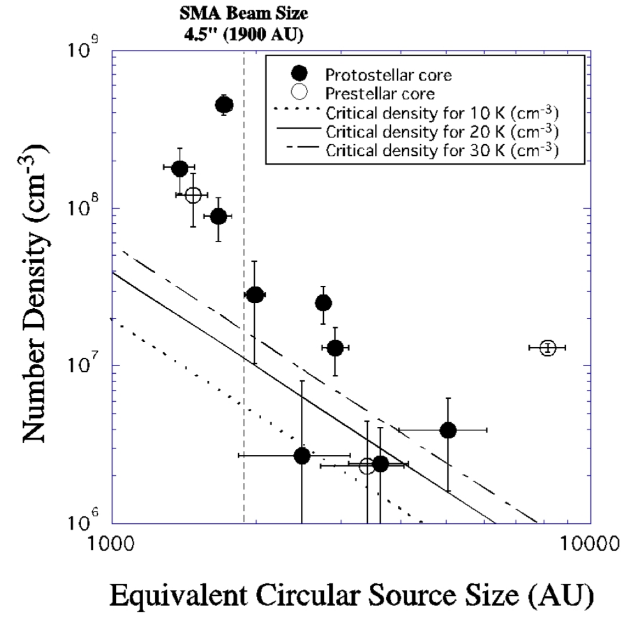

Figure 2: Filled and open circles show the source size as a function of number density for SMA identified protostellar and prestellar source. Dotted, solid, and dashed lines show the critical Jeans length as a function of number density with the gas temperature of T_{gas}=10 K, 20 K, and 30 K, respectively. The Jeans length corresponds to the critical scale when the gas cloud becomes gravitationally unstable. The plotted results show that most of the SMA sources are located very close to the critical line (T_{gas}=20 K) and several sources have a lager size than the Jeans length at their measured density. This result suggests that most of the sources are gravitationally unstable.

at a typical gas temperature in Orion, T_{gas}=20 K (e.g., Cesaroni & Wilson 1994). However, shorter spacings than those expected from thermal fragmentation have been detected on the scale of the individual star forming cores (0.035 pc). This shorter spacing could be explained by either a helical magnetic field, parental cloud rotation (e.g., Hanawa et al. 1993), or large-scale filament collapse (e.g., Burket & Hartmann 2004; Pon et al. 2011; 2012); however, follow-up observations focusing on magnetic field measurements and kinematic studies are necessary in order to quantitatively interpret the observed core separation.

In addition, possible evidence for sequential fragmentation as local conditions evolve is suggested in the observed filament. A chain of continuum sources seen in SMM 2 to SMM 8 (Figure 1) show the elongated structure at the middle of the filament (SMM 5). One possible explanation is that fragmentation propagates along the filament from each end inward. The fragmentation propagation timescale is estimated to be τ_{frag}~3.0×10^5 yr. This timescale is roughly consistent with (or slightly longer than) the lifetime of the detected protostellar sources, which is 10^4-10^5 yr. These results suggest that the protostars formed within the fragmented cores, and that star formation began at almost the same time as the core fragmentation.

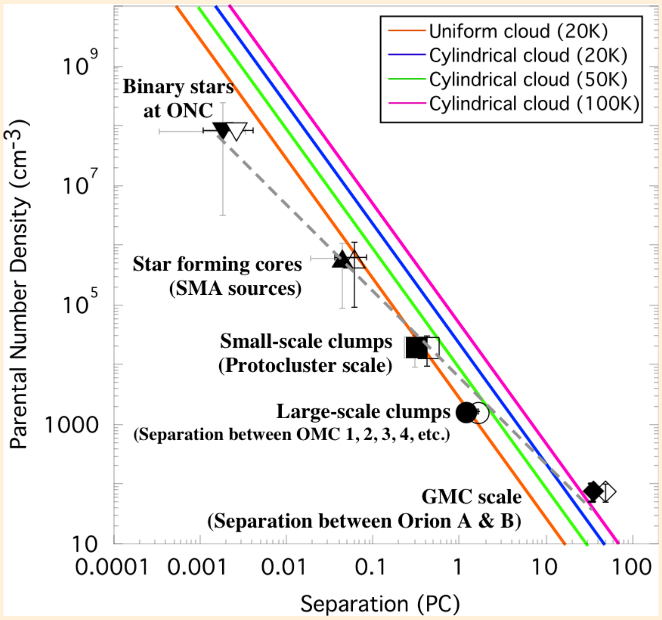

Figure 3: Observed separations of clouds/large-scale clumps/small-scale clumps/cores in parsec as a function of the mean hydrogen number density of the parental structure in cm^{-3}. (e.g., a core's parent is a small-scale clump, a small-scale clump's parental structure is a large-scale clump, etc). The filled symbols show the separations with an assumption of *i*=90°(filament in the plane of the sky), and the open symbols show the separation with an assumption of *i*=45°. Data from GMC (Sakamoto et al. 1994; Wilson et al. 2005), large-scale clumps (Dutrey et al. 1991; 1993; Hanawa et al. 1993; Johnstone & Bally 1999), small-scale clumps (Cesaroni & Wilson 1994; Johnstone & Bally 1999), dense cores (this work), and binaries (Reipurth et al. 2007) are denoted by diamonds, circles, squares, upright triangles, and inverted triangles, respectively. The dashed line shows a reference power law index of (n_{H2} λ-1.4). The color lines show the expected maximum instability size as a function of number density derived from equations (4) and (5) of Takahashi et al. (2013): uniform background density with a gas temperature of 20 K (orange), cylindrical cloud with a gas temperature of 20 K (blue line), 50 K (green), and 100 K (pink).

The SMA, equipped with 345 GHz receivers, is one of the most powerful facilities, even in the ALMA era, to search for prestellar and protostellar cores and circumstellar disks, especially in the northern hemisphere. The SMA spatially resolves their structures through the thermal dust continuum emission and molecular lines observations. In addition, relatively small SMA antennas (6m) provide a wider field of view, and have an advantage for studies of extended emission associated with cores and filaments. In the future, the combination of wide-field imaging coupled with ultra wide band receivers now under development will enable us to study cloud structures in great detail and carry out a census of deeply embedded sources especially at the earliest evolutionary stage.

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RESOLVING THE JET-LAUNCH REGION NEAR THE SUPERMASSIVE BLACK HOLE IN M87

Shep Doeleman on behalf of The Event Horizon Telescope Project

Relativistic jets launched by the central engines of Active Galactic Nuclei are some of the most energetic phenomena in the Universe. Very Long Baseline Interferometry (VLBI) observations confirm that jets in radio-loud AGN originate from extremely compact regions, while lower resolution instruments including connected-element interferometers, optical and x-ray telescopes trace these highly collimated outflows for hundreds of thousands of light years. Energetically, jets are best explained through conversion of gravitational potential energy via accretion onto a supermassive black hole. Most models of the jet-launch mechanism invoke magnetic fields, concentrated and swept along in the orbiting accretion flow, that accelerate charged particles to relativistic speeds, producing synchrotron emission. On the cosmic stage, jets redistribute energy and matter on galactic scales, playing an important role in the symbiotic evolution of galaxies and the black holes at their cores (Richstone et al 1998).

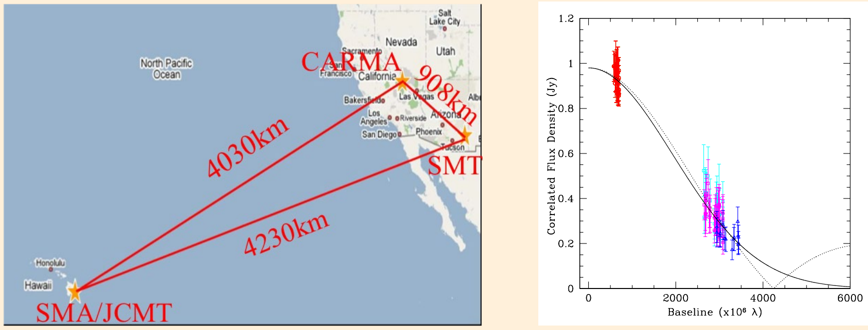

Figure 1: (left) Map of the Event Horizon Telescope 1.3mm VLBI array, showing baseline lengths between sites in Mauna Kea, California, and Arizona. **(right)** Measuring the size of the M87 core with 1.3mm VLBI. Correlated flux density data from three consecutive days of observing are plotted as a function of baseline length. The CARMA-SMT baselines are shown in red; the two baselines from CARMA dishes to the SMA/JCMT are shown in magenta and teal; the SMT-SMA/JCMT baseline is shown in blue. The weighted least squares best-fit circular Gaussian model is shown as a solid line, and has a total flux density of 0.98 Jy and a FWHM size of 40.0 micro arcseconds. A hybrid model (dotted line) combines a circular Gaussian of the same size with a thin ring of diameter 40.0 micro arcseconds, which represents the expected shadow feature due to illumination of the central supermassive black hole from behind by a counter-jet in M87.

The precise physics of AGN jet launching remains an outstanding mystery in astrophysics, in large part because no astronomical technique has yet been able to spatially resolve the immediate surrounding of the central black hole. VLBI at cm wavelengths is limited by optical depth effects and can only probe jets to distances from the black hole at which the synchrotron emission becomes self-absorbing. To resolve structure on scales of the black hole and accretion disk requires two things: 1. short wavelength VLBI where optical depth effects are diminished and angular resolutions measured in 10's of micro arcseconds can be achieved; and 2. nearby AGN, for which the apparent size of the black hole event horizon is large. At a distance of 16.7 Mpc, the Schwarzschild radius of the M87 black hole ($R_{SCH} = 2GM/c^2 = 5.9 \times 10^{-4}$ parsec $= 1.9 \times 10^{15}$ cm) subtends an angle of 7.3 micro arcseconds, and strong gravity effects will magnify the apparent size of emission near the event horizon by a factor of ~5. M87 produces one of the most well studied AGN jets in the sky, and thus presents us with the best opportunity for studying jet formation on the smallest scales.

Using a 1.3mm wavelength VLBI array consisting of the SMT (Mt. Graham, AZ), CARMA (Bishop, CA), and the JCMT and SMA on Mauna Kea, our international collaboration (the Event Horizon

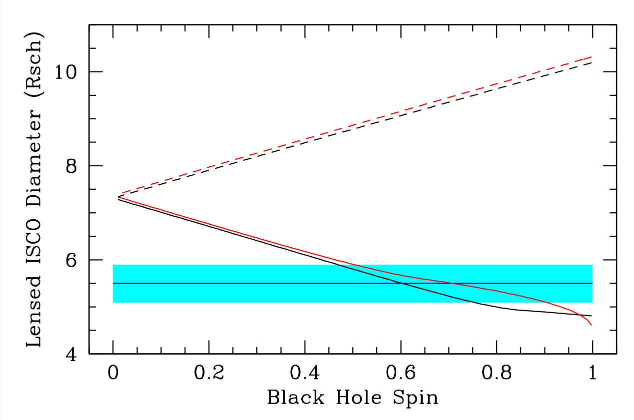

Figure 2: Diameter of the Innermost Stable Circular Orbit (ISCO) for a black hole of arbitrary spin. The apparent diameter of the ISCO due to the strong gravitational lensing near the black hole was computed using ray-tracing algorithms through Kerr spacetime (red and black curves). Solid lines show prograde ($a > 0$; a is black hole spin) orbits and dashed lines show retrograde ($a < 0$) orbits. The 1.3mm VLBI size derived using SMA observations is shown as a horizontal blue line with a cyan band marking the +/- 1σ uncertainty. The 3σ upper limit on the 1.3mm VLBI size corresponds to a lower limit on the black hole spin of ($a > 0.2$).

Telescope) observed M87 over 3 separate nights in April 2009. By achieving a fringe spacing (λ/D: λ , observing wavelength and D, projected distance between VLBI sites) of 55 micro arcseconds, these observations resolved the base of the jet and led to a robust size measurement of the jet launch point where General Relativity in a strong gravity regime dominates the jet structure. This result has allowed us to estimate not only the black hole spin, but also the orbital direction of the accretion flow.

Figure 1 shows geo-locations of the array sites and the plot of correlated flux density as a function of VLBI baseline length. Given the sparse array, we fit the VLBI amplitudes with a circular Gaussian model, which yields a Full Width Half Maximum size of 40±1.8 micro arcseconds, or 5.5±0.4 R_{SCH}. This marks detection of the smallest physical structures discerned to date in an AGN jet source (Doeleman et al 2012).

This size has several implications for jet study. First, because the measured size is commensurate with physical scales of energy extraction from a black hole (Blandford & Payne 1982; Blandford & Znajek 1977), it provides strong evidence that the base of the M87 jet is co-located (to within a few R_{SCH}) with the central supermassive black hole. Previous astrometric VLBI at longer wavelengths (Hada et al 2011) has shown that the absolute location of the jet base shifts with frequency. Such behavior is expected as one approaches the black hole due to gradients of particle and magnetic field density in the jet nozzle, but the angular resolution of these earlier observations was insufficient to confirm the black hole location. This new 1.3mm VLBI finding stands in contrast to the situation in much brighter blazar sources, where it is thought the observed jet base may form thousands of R_{SCH} away from the black hole (Marscher et al 2008).

The second result is an estimate of the black hole spin and direction of the orbiting accretion flow. This is possible if we assume the base of the jet is anchored at the inner edge of the accretion disk, defined as the Innermost Stable Circular Orbit (ISCO) of the black hole. The intrinsic ISCO diameter (D_{ISCO}) is sensitively dependent on black hole spin, with a value of $D_{ISCO} = 6\ R_{SCH}$ for a non-spinning (Schwarzschild) black hole, and ranging from $D_{ISCO} = 9\ R_{SCH}$ to $D_{ISCO} = 1\ R_{SCH}$ for retrograde and prograde orbits, respectively, around a maximally spinning (Kerr) black hole. Strong lensing effects due to the Kerr spacetime metric near the rotating black hole magnify the apparent size of the ISCO, with the relationship between observed ISCO size and black hole spin shown in Figure 2 (Broderick, Loeb & Narayan 2009; Doeleman et al 2012). The measured 1.3mm VLBI size corresponds to a prograde ISCO around a black hole with spin $a > 0.2$ (at the 3σ level). This result explicitly excludes the possibility of a retrograde ISCO orbit in the accretion flow because all such orbits would be larger than the core size derived here. The smallest possible retrograde ISCO orbit would present an apparent diameter of 7.35 R_{SCH}, more than 4σ larger than the observed size.

The last result is one of future impact. These initial M87 findings with the Event Horizon Telescope now signal that full imaging of the jet launch region is possible if enough new dishes are added to

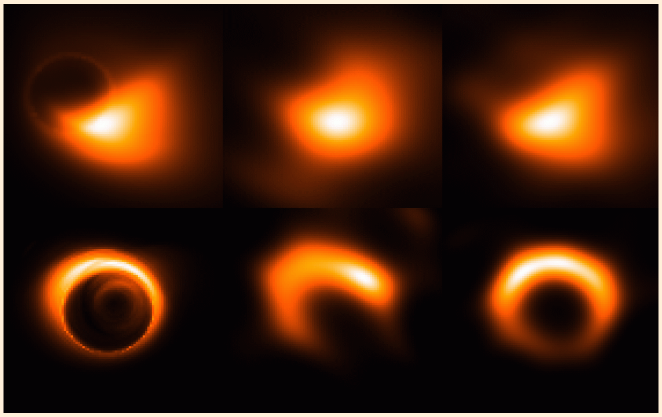

Figure 3: Imaging simulations of M87 with the EHT. Panels show model images (left), reconstructions using the US stations (CARMA, SMA, SMT) and phased ALMA (middle), and reconstructions also including the IRAM 30m, phased Plateau de Bure, and the LMT (right). The top row shows a standard jet model (based on Broderick & Loeb 2009), while the bottom row shows a model in which the emission comes from the lensed counterjet (Dexter et al 2012). Both models are presently consistent with millimeter VLBI data and the multiwavelength spectrum of M87. Early images, made possible by the proposed activities as early as 2015, can differentiate between the models..

the existing array. Within 2-3 years, ALMA (~50 dishes phased), the LMT, the IRAM 30m and the Plateau de Bure interferometer will join the array. Simulations of synthetic 1.3mm VLBI data indicate that with these additional dishes, the EHT can produce images that will differentiate between detailed models of the M87 jet at the R_{SCH} level (Figure 3). The SMA continues to play a key role in these observations, providing essential infrastructure and collecting area on the long VLBI baselines to Mauna Kea. Over the next several years, continued EHT observations with the SMA hold the promise of opening new windows on AGN jet genesis, and linking emission near the black hole event horizon with the impact of jets on galactic scales.

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A RESOLVED DISK AROUND THE CLASS 0 PROTOSTAR L1527 IR

John J. Tobin[1] & David J. Wilner[2]

Disks play a pivotal role in the star and planet formation process, as material must be accreted through the disk to grow the protostar, and disks are the sites of planet formation. The very young Class 0 protostars (Andre et al. 1993) are characterized by a massive and dense envelope of gas and dust, and disks are thought to form during this early phase via conservation of angular momentum from the collapsing envelope. Numerous studies have attempted to identify disks in the Class 0 phase (e.g. Harvey et al. 2003, Jorgensen et al. 2009) but have lacked sufficient angular resolution to characterize the disks. A recent study by Maury et al. (2010) attempted to directly resolve disks around a sample of 5 Class 0 protostars with resolution as high as 50 AU but did not find strong evidence for disks in these systems. Furthermore, theoretical investigations suggest that disk sizes may be less than 10 AU in the Class 0 phase when magnetic fields are included (Dapp & Basu 2010), though larger disks are possible if magnetic fields are ignored, very weak, or are misaligned with the rotation axis (e.g. Vorobyov 2010; Joos et al. 2012).

The Class 0 protostellar system L1527 IRS in Taurus (d= 140 pc) was found by Tobin et al. (2010) to have the distinct signature of an edge-on disk in 3.8 μm scattered light imaging. While suggestive, the scattered light tells us very little about the properties of the disk itself, since it illuminates only the uppermost layers of the disk. To confirm the presence of a disk and learn more about its internal structure, we observed L1527 with the Submillimeter Array (SMA) in very extended configuration at 870 μm (Tobin et al. 2012). The resultant image is shown in the left panel of Figure 1. The SMA observations detected a resolved structure in the same orientation as the dark lane in the scattered light image, shown in the right panel of Figure 1. These two pieces of evidence lend strong support to L1527 harboring a disk at least 75 AU in radius and possibly as large as ~200 AU. The integrated flux density of L1527 from the 870 μm emission is 214±8 mJy.

We can calculate the mass of the disk by following Andrews et al. (2005). Assuming a temperature T = 30 K, mass opacity κ850μm = 3.5 cm^2 g^{-1} , and the usual dust-to-gas mass ratio of 100, we derive a disk mass of 0.007 M$_\odot$, with roughly 10% uncertainty. Despite

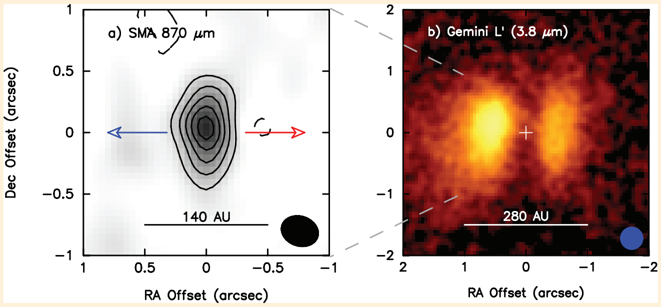

Figure 1: Images of the edge-on disk around the protostar L1527. High-resolution images of L1527 are shown at wavelengths of 870 μm from the SMA (a) and 3.8 μm from Gemini (b), showing the disk in dust continuum emission and scattered light. The Gemini image is shown on a larger scale to fully capture the scattered light features, the dashed gray lines mark the outer edge of the region shown in the submillimeter image. The submillimeter image is elongated in the direction of the dark lane shown in panel (b), consistent with an edge-on disk in this Class 0 protostellar system. The outflow direction is indicated by the red and blue arrows in panel (a), denoting the respective directions of the outflow. The white cross in panel (b) marks the central position of the disk from the SMA images. The contours in the 870 μm image starts at 3 times the noise level and increase at this interval; the noise level is 5.0 mJy beam^{-1} for the SMA data. The ellipses in the lower right corner of each image gives the resolution of the observations, approximately 0.3″ in both the SMA and Gemini images.

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being in the Class 0 phase, the mass of the disk around the L1527 protostar is typical of disks found around much more evolved pre-main sequence stars.

While the scattered light and submillimeter dust emission images have the obvious appearances of a disk-like structure, these observations do not provide evidence for the rotational support characteristic of disk. We therefore followed-up the SMA disk detection with observations from the Combined Array for Research in Millimeter-wave Astronomy (CARMA) in the ^{13}CO ($J = 2 \rightarrow 1$) line (and associated dust continuum) at ~1″ resolution. Though 1.3 mm dust emission is not resolved, the ^{13}CO emission shows the distinct pattern of rotation on the scale of the disk, with higher velocity emission at smaller scales consistent with Keplerian motions. This result lead us to conclude that the SMA observations were indeed detecting a disk in this system. These line data also provided an estimate of the mass of the L1527 protostar of $M_{ps} = 0.19 \pm 0.04\ M_\odot$ (assuming that the rotation curve is dominated by the central protostar and the disk does not contribute to the velocity field).

The SMA observations of L1527 have provided the most convincing evidence to date for a large disk around a Class 0 protostar. Moreover, subsequent follow-up observations resulted in the first use of disk rotation to measure the mass of a Class 0 protostar, a very low value consistent with youth, and likely to grow with accretion from the ~1 $M_\odot$ envelope.

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FIRST LIGHT FOR THE NEW SMA DIGITAL BACK END

Jonathan Weintroub and SMA DBE Team

A new wideband high spectral resolution digital back end (DBE) for the SMA is currently under development by SAO and ASIAA. The DBE combines the functions of a cross-correlator for interferometry and a phased array data formatter that enables the SMA to function as a single element for VLBI.

Operating as a correlator, the DBE provides uniform spectral resolution of 150 KHz over a 2 GHz dual polarization band. With 28 baselines per receiver, and full Stokes capability, 112 baselines must be processed simultaneously. The computational demands require state-of-the-art technology with highly parallel signal processing engines. The open-source Field Programmable Gate Array (FPGA) hardware, gateware, and software developed by the Collaboration for Astronomy Signal Processing and Electronics Research (CASPER) has been selected as the processing and development platform. The DBE uses an “FX” packetized correlator architecture, with an Arista 10Gb/s Ethernet switch as the corner turner.

CASPER technology has previously been applied to larger arrays than the 8-element SMA, but the extremely wide bandwidth of the new SMA DBE is novel within CASPER. The new SMA DBE design optimizes among different requirements. To minimize the complexity and cost of the IF system it is desirable to divide the full processed bandwidth into the smallest possible number of blocks. This is because, with 8 antennas having two receivers each, the hardware for each IF subband must be duplicated 16 times. However, wide bandwidth per block presents other challenges. First, the maximum bandwidth of each block is limited by the speed of available analog to digital converters (ADC's). Second, the signal processing operations for each block, dominated by the polyphase filter bank computations which process the ADC voltage samples

Requirements and benefits

Table 1 tabulates the target requirements of the new DBE.

Table 1: DBE Requirements

FEATURE	SPECIFICATION	REMARKS
number of antennas	8	two receivers or two polarizations each
bandwidth per receiver band	2 GHz	dual polarization, in each side band
number of sidebands	2	90-270 Walsh splits sidebands, receivers are DSB
simultaneous receivers	2	dual frequency or dual polarization 230 & 345 GHz
baselines	56	28 per receiver, full Stokes, 112 total
finest uniform resolution	140 kHz	16384 channels / 2.3 GHz Nyquist block
fastest dump rate	0.65 s	single full Walsh cycle
maximum baseline delay	2 km	assumes current SMA configuration
simultaneous auto-correlations	16	simultaneous auto-correlation of each receiver
VLBI bandwidth	4 GHz	2 GHz ×dual polarization, 16 Gb/s data rate

to channelized spectra, must fit within the resources available on a single FPGA chip. Based on our analysis of FPGA resource requirements, and on the the availability of 5 Gsps CASPER-compatible ADC's developed at ASIAA, we have elected to process the data in 2 GHz-wide blocks.

The new DBE has similar signal processing capacity to the present SMA correlator but substantial improvements in a number of areas. It can process either dual 2 GHz polarization bands, computing all Stokes parameters for polarimetry, or 4 GHz of bandwidth from a single receiver. The new DBE is an order of magnitude more compact than the existing SMA correlator, with the digital hardware taking up just part of a single equipment rack. When completed, this new DBE will run in parallel with the present SMA correlator, doubling the SMA's instantaneous bandwidth.

While the new DBE matches the legacy SMA correlator's bandwidth, it will have significantly improved capabilities:

- Higher uniform spectral resolution
- No sacrifice of bandwidth in zooming spectral modes
- Built in VLBI phased array processor and data storage, with 4× the present VLBI bandwidth
- 12 percent better SNR due to more processed bits
- Very much smaller size and lower power consumption
- Improved spectral channel isolation using Polyphase Filter Bank

First light

With the first system running at half speed and processing a 1 GHz block of bandwidth, first astronomical fringes have been obtained at the SMA. The spectral plots show a single 1.144 GHz block of bandwidth (Nyquist), the eventual requirements are for each block to be double that bandwidth, or 2 GHz usable. The system is designed to process two such blocks (dual pol 2 GHz , or 4 GHz BW single pol). For this test, only 1/8th of the eventual ROACH2 hardware was deployed. The distribution of computation in the FX algorithm is such that with this test setup only 1/8th of correlations were computed. Thus the spectra show every eighth point, or 2048 points (70kHz bin width), with 7/8th of the spectrum between the points empty.

This first result is a validation of the FX algorithm, of resource estimates for ROACH2, and of the use of a quad core ADC. Doubling the block bandwidth will required doubling the clock rate of the FPGA from 143 MHz to 286MHz. We view compiling the bitcode to meet timing at full speed as the greatest remaining technical hurdle.

Shown in figures 1, 2, 3 are plots of the first cross-correlation detections of 3C279 and the H30 Alpha maser line in MWC349, with the new and partially deployed CASPER-based SMA FX Packetized Digital Back End. 3C279 was used as a bandpass calibrator for the maser spectrum. The integrated timeline shows excellent phase stability on both sources. Figure 4 *(pg 12)* shows a partially built version of the new correlator in the Hawaii laboratory.

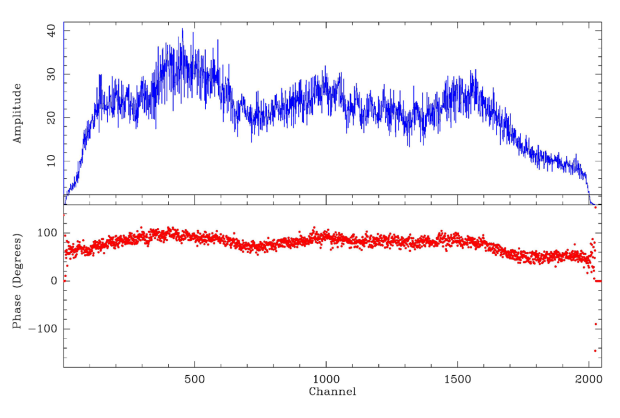

Figure 1: Continuum detection on 3C279. Upper panel is correlation amplitude, lower panel is phase.

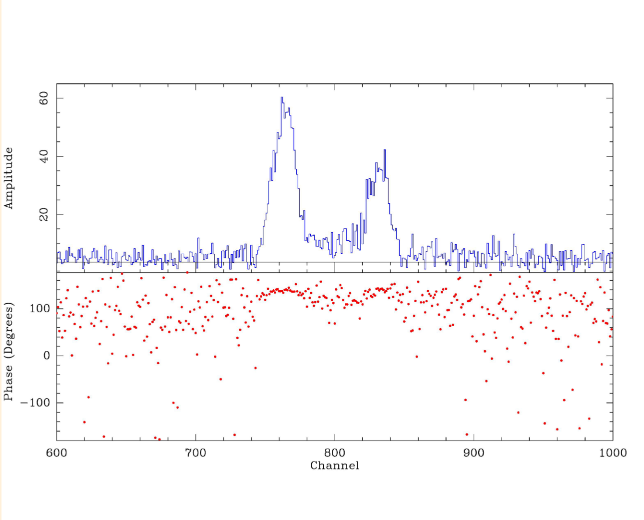

Figure 2: H30 Alpha hydrogen recombination line maser in MWC349, zoomed in on the line (full bandwidth not shown) and passband calibrated with the 3C279 detection.

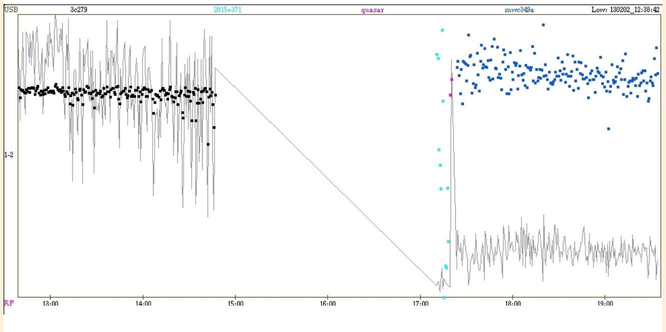

Figure 3: Magnitude (line) and phase (points) timeline for both sources, integrated across frequency.

Figure 4: A photo of the DBE currently under development in the SMA summit correlator room. Photo courtesy of Derek Kubo.

PROPOSAL STATISTICS 2012B (16 NOV 2012 – 15 MAY 2013)

The SMA received a total of 104 proposals (SAO & ASIAA: 98 and UH: 6) requesting observing time in the 2012B semester. The proposals received by the joint SAO and ASIAA Time Allocation Committee are divided among science categories as follows:

Category	Proposals
low/intermediate mass star formation, cores	24
local galaxies, starbursts, AGN	19
high mass (OB) star formation, cores	15
protoplanetary, transition, debris disks	15
submm/hi-z galaxies	11
evolved stars, AGB, PPN	6
GRB, SN, high energy	3
galactic center	2
other	2
solar system	1
UH	6

TRACK ALLOCATIONS BY WEATHER REQUIREMENT (ALL PARTNERS):

PWV[1]	SAO+ASIAA	UH[2]
< 4.0mm	16A + 36B	8
< 2.5mm	37A + 30B	8
< 1.0mm	12A + 1B	3
Total	**65A + 67B**	**19**

(1) Precipitable water vapor required for the observations.
(2) UH does not list As and Bs.

TOP-RANKED SAO AND ASIAA PROPOSALS - 2012B SEMESTER

The following is the listing of all SAO and ASIAA proposals with at least partial A ranking with the names and affiliations of the principal investigators.

EVOLVED STARS, AGB, PPN

Hyosun Kim, ASIAA
Binary characteristics imprinted in the observed circumstellar pattern of an AGB star, CIT 6

GALACTIC CENTER

Dan Marrone, University of Arizona
Capitalizing on the G2 Cloud Impact: Understanding Sgr A Accretion with SMA+CARMA*

GRB, SN, HIGH ENERGY

Sayan Chakraborti, ITC, Harvard University
The SMA Rapid Transient (SMART) Legacy Program

Yuji Urata, NCU/ASIAA
Constrain Reverse and Forward shock Emissions of GRB Afterglows

HIGH MASS (OB) STAR FORMATION, CORES

Justin Neill, University of Michigan
The distribution of deuterated organics within Orion KL

Qizhou Zhang, CfA
Role of Magnetic Fields in the Early Phase of Massive Star Formation

Vivien Huei-Ru Chen, National Tsing Hua University
Resolving the Magnetic Field Structures in the W3(H2O) Hot Core

LOCAL GALAXIES, STARBURSTS, AGN

Ho Seong Hwang, Center for Astrophysics
A Submillimeter Array Survey for 870 micron Dust Continuum Emission in local Dust-Obscured Galaxies

Rosie Chen, Max Planck Institute for Radio Astronomy
The Birth Environment of Super-Star Clusters at Low-Metallicity

Sheperd Doeleman, MIT Haystack Observatory
Polarization Emission on Event Horizon Scales

LOW/INTERMEDIATE MASS STAR FORMATION, CORES

Chin-Fei Lee, ASIAA
Mapping the B-fields in Protostellar Jets

Jaime Pineda, ESO ALMA Fellow/University of Manchester
Fragmentation in the isothermal filament embedded in the Barnard 5 dense core

Lars Kristensen, Harvard-Smithsonian Center for Astrophysics
Small-scale irradiated shocks in a low-mass protostar: are they there?

Ramprasad Rao, ASIAA SMA
Are Magnetic Fields important for Low Mass Star Formation?

Shigehisa Takakuwa, ASIAA
Investigation of the Keplerian Disk Formation in the Infalling Envelope around L1551 IRS 5

OTHER

Hua-bai Li, MPIA
Can galactic magnetic fields resist cloud rotation during the formation processes?

PROTOPLANETARY, TRANSITION, DEBRIS DISKS

Jun Hashimoto, NAOJ
Probing Gap Formation Mechanism of Pre-transitional Disk around PDS 70

Meredith Hughes, UC Berkeley
Understanding Variations in Turbulent Linewidth Between Sources

Sean Andrews, CfA
A Snapshot SMA Survey to Complete the Disk Mass Census in Taurus

Stefan Kraus, CfA
Studying the gap-clearing mechanism in a pre-transitional disk using infrared + SMA sub-millimeter interferometry

SOLAR SYSTEM

Charlie Qi, CfA
The Primary Volatile Composition of a Dynamically New Comet - C/2011 L4 (PanSTARRS)

SUBMM/HI-Z GALAXIES

David Clements, Imperial College London
HerMES Selected High z Dusty Galaxies

Manuel Aravena, European Southern Observatory
The last piece in the puzzle: [CII] in a bright gravitationally lensed submillimeter galaxy at z~4

Shane Bussmann, CfA
An SMA Pilot Project for a Thousand-Lens Cosmological Survey

Shane Bussmann, CfA
Spatially resolved [CII] observations in a z~6 SMG found in H-ATLAS

Scott Chapman, Dalhousie University,
SMA 890um continuum map in the most overdense galaxy cluster known at z > 2

David Clements, Imperial College, London
A z=5.29 lensed or highly luminous submm galaxy

Wei-Hao Wang, ASIAA
SMA Identification of SCUBA-2 Sources in the GOODS-N

Steven Willner, CfA
Confirmation of a Strongly-Lensed Submillimeter Galaxy

ALL SAO PROPOSALS - 2012A SEMESTER

The following is the listing of all proposals observed in the 2012A semester (16 May 2012 – 15 November 2012)

Sean Andrews, CfA
Dynamical Measurements of Young Star Masses from Gas Disk Rotation Curves

Sean Andrews, CfA
A Disk-Based Dynamical Mass Estimate for the Young Binary Star AK Sco

Sean Andrews, CfA
Dark Matter and the Missing Lensed Images of CX2201-3201

Amber Bauermeister, UC Berkeley
Gas Excitation in Intermediate Redshift Galaxies

Adwin Boogert, Caltech/IPAC
Characterization of a Spitzer-discovered Massive YSO Candidate in the Galactic Center: An SMA Pilot Project

Joanna Brown, CfA
CO J=2-1 Imaging of M Supergiant Winds - Antares and Rasalgethi

Shane Bussmann, CfA
SMA Observations of Candidate z >4 SMGs Discovered By Herschel

Sayan Chakraborti, CfA
The SMA Rapid Transient (SMART) Legacy Program

Laura Chomiuk, CfA/NRAO
Exploring the Millimeter Behavior of Novae

Claudia Cyganowski, CfA
Building an Evolutionary Sequence for Massive Star Formation

Yu (Sophia) Dai, CfA
Mapping the dust in extremely luminous AGNs — approaching the z >1 universe with the SMA

Helmut Dannerbauer, Universitat Wien, Institut fur Astrophysik
An Overdensity of Ultraluminous Starbursts inside an evolved Cluster at z=2.07

Giovanni G. Fazio, CfA
SMA Observations of an Exceptionally Bright Gravitationally-Lensed Submillimeter Galaxy at z = 2.4

Gary Fuller, Jodrell Bank Centre for Astrophysics
Fragmentation of a quiescent massive core in a Spitzer IRDC

Roberto Galvan-Madrid, ESO (Germany)
Disentangling the Accretion Flow around the Massive Protostar W33A

Mark Gurwell, CfA
Initial map of Cygnus X-3 region (preparation for approved project 2012A-S058)

Mark Gurwell, CfA
SUN: Structure of Uranus and Neptune

Naomi Hirano, ASIAA
Probing the earliest stage of low-mass star formation

Paul Ho, SAO/ASIAA
Kinematic Processes of the Extremely Turbulent ISM around the Supermassive Blackholes

Joseph Hora, CfA
Investigating Massive Star Formation in Cygnus-X

Meredith Hughes, UC Berkeley
The Structure of Debris Disks around Solar-Type Stars

Xuejian Jiang, CfA
Evolution of C2H Abundance in Massive Star-forming Regions

Izaskun Jimenez-Serra, CfA
Deuteration toward AFGL2591: Impact of Warm Gas-phase Reactions and UV Photochemistry on Deuterium Fractionation in Hot Cores

Izaskun Jimenez-Serra, CfA
Unveiling the hot-core cluster population toward the massive star formation ridge in SgrB2

Katharine Johnston, Max Planck Institute for Astronomy
The Cradle of an Arches-like cluster?

Jens Kauffmann, Jet Propulsion Lab
High Mass Cold GMCs in the Galactic Center

Patrick Koch, ASIAA
Magnetic Field Strength Profiles

Lars Kristensen, CfA
Probing small-scale UV heating in Ser SMM1 with HCN/CN emission

Hau-Yu Baobab Lu, CfA
Structures and Kinematics of the Hub-Filament System: The High Mass Case

Hau-Yu Baobab Lu, CfA
Zoom In From the Confluence of Molecular Filaments to Massive Disks

Dan Marrone, University of Arizona
CII Observations of Lensed SMGs with ALMA Redshifts

Dan Marrone, University of Arizona
Flaring in Sagittarius A: Coordinated Monitoring from 1mm to <1nm*

Sergio Martin Ruiz, European Southern Observatory
Observing the peak emission of gamma-ray bursts afterglows in submillimeter frequencies

Sergio Martin Ruiz, European Southern Observatory
Studying the effects of fueling and star formation feedback on the ISM through high-resolution/fidelity chemical imaging

Arielle Moullet, NRAO
How fast does Neptune's stratosphere spin?

Nimesh Patel, CfA
Imaging Cold Dust around Wolf-Rayet Stars

Dave Principe, Rochester Institute of Technology
Submillimeter Imaging of X-ray Sources in L1630: Investigating Magnetic Activity in Class 0/I Young Stellar Objects

Charlie Qi, CfA
Resolving the Distribution N2H+ in the Disk of HD 163296

Ramprasad Rao, ASIAA
Magnetic Fields through Polarization Observations of the Serpens Main Core

Kazushi Sakamoto, ASIAA
Toward Precise Merging of SMA and Single-dish Data for Wide-field Imaging

Carmen Sanchez Contreras, Astrobiology Center (CAB)-CSIC/INTA
High-angular resolution CO mapping of the fast, massive outflow of the pre-planetary nebula IRAS 19374

Anika Schmiedeke, University of Cologne
Star Formation from Filament to Cluster Scales: NGC6334

Gregory Sivakoff, University of Alberta
Constraining the Jet Properties of Transient X-ray Binaries

Howard Smith, CfA
From cold cores to hot cores (2b): The early evolution of massive star formation, an SMA followup of Herschel FIR maps

John Tobin, National Radio Astronomy Observatory
The Inner Envelope Kinematics of a Class 0 Protostar: Observationally Constraining Disk Formation

An-Li Tsai, NCU
Constrain the SED of the Unidentified Fermi Object 2FGL J1823.8+4312

Junko Ueda, CfA
The Reformed Molecular Gas Disk in the Merger Remnant NGC 828

Ewine van Dishoeck, Leiden Observatory, Leiden University
Separated at birth? Comparing the physical and chemical evolution of disks in the VV CrA binary system

Wouter Vlemmings, Chalmers University of Technology
CO polarization probing the large scale magnetic field in circumstellar envelopes

Wei-Hao Wang, ASIAA
Identification of a high-redshift SMG candidate

Zhong Wang, CfA
A Survey of Molecular Gas in Star-forming Galaxies Beyond Virgo

Linda Watson, CfA
The Resolved Vertical Structure of Molecular Gas in a Low-mass, Edge-on Disk Galaxy

Ann Wehrle, Space Science Institute
BL Lac During A Major Flare

Lisa H. Wei, CfA
Circumnuclear Starbursts: Put a Ring On It

David Wilner, CfA
Structure of the HD 181327 Debris Disk

David Wilner, CfA
Subcompact Observations of the 49 Ceti Disk

Nicholas Wright, CfA
Photoevaporating Protostars in Cygnus OB2

Luis Zapata, CRyA-UNAM
What is powering the massive outflow in DR21?

Qizhou Zhang, CfA
AY191: H30 Alpha & H 26 Alpha in MWC349A

Qizhou Zhang, CfA
Filaments, Star Formation and Magnetic Fields

RECENT PUBLICATIONS

Title: A ~0.2-solar-mass protostar with a Keplerian disk in the very young L1527 IRS system
Authors: Tobin, John J.; Hartmann, Lee; Chiang, Hsin-Fang; Wilner, David J.; Looney, Leslie W.; Loinard, Laurent; Calvet, Nuria; D'Alessio, Paola
Publication: *Nature, Volume 492, Issue 7427, pp. 83-85 (2012)*
Publication Date: 12/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1212.0861T

Title: Jet-Launching Structure Resolved Near the Supermassive Black Hole in M87
Authors: Doeleman, Sheperd S.; Fish, Vincent L.; Schenck, David E.; Beaudoin, Christopher; Blundell, Ray; Bower, Geoffrey C.; Broderick, Avery E.; Chamberlin, Richard; Freund, Robert; Friberg, Per; Gurwell, Mark A.; Ho, Paul T. P.; Honma, Mareki; Inoue, Makoto; Krichbaum, Thomas P.; Lamb, James; Loeb, Abraham; Lonsdale, Colin; Marrone, Daniel P.; Moran, James M.; Oyama, Tomoaki; Plambeck, Richard; Primiani, Rurik A.; Rogers, Alan E. E.; Smythe, Daniel L.; SooHoo, Jason; Strittmatter, Peter; Tilanus, Remo P. J.; Titus, Michael; Weintroub, Jonathan; Wright, Melvyn; Young, Ken H.; Ziurys, Lucy M.
Publication: *Science, Volume 338, Issue 6105, pp. 355- (2012)*
Publication Date: 10/2012
Abstract: http://adsabs.harvard.edu/abs/2012Sci...338..355D

Title: Constraints on the Radial Variation of Grain Growth in the AS 209 Circumstellar Disk
Authors: Pérez, Laura M.; Carpenter, John M.; Chandler, Claire J.; Isella, Andrea; Andrews, Sean M.; Ricci, Luca; Calvet, Nuria; Corder, Stuartt A.; Deller, Adam T.; Dullemond, Cornelis P.; Greaves, Jane S.; Harris, Robert J.; Henning, Thomas; Kwon, Woojin; Lazio, Joseph; Linz, Hendrik; Mundy, Lee G.; Sargent, Anneila I.; Storm, Shaye; Testi, Leonardo; Wilner, David J.
Publication: *The Astrophysical Journal Letters, Volume 760, Issue 1, article id. L17, 7 pp. (2012)*
Publication Date: 11/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1210.5252P

Title: The Protocluster G18.67+0.03: A Test Case for Class I CH3OH Masers as Evolutionary Indicators for Massive Star Formation
Authors: Cyganowski, C. J.; Brogan, C. L.; Hunter, T. R.; Zhang, Q.; Friesen, R. K.; Indebetouw, R.; Chandler, C. J.
Publication: *The Astrophysical Journal Letters, Volume 760, Issue 2, article id. L20, 7 pp. (2012)*
Publication Date: 12/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1210.3366C

Title: Strong irradiation of protostellar cores in Corona Australis
Authors: Lindberg, J. E.; Jørgensen, J. K.
Publication: *Astronomy & Astrophysics, Volume 548, id.A24, 21 pp.*
Publication Date: 12/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.4817L

Title: Illuminating the Darkest Gamma-Ray Bursts with Radio Observations
Authors: Zauderer, B. A.; Berger, E.; Margutti, R.; Levan, A. J.; Olivares, F.; Perley, D. A.; Fong, W.; Horesh, A.; Updike, A. C.; Greiner, J.; Tanvir, N. R.; Laskar, T.; Chornock, R.; Soderberg, A. M.; Menten, K. M.; Nakar, E.; Carpenter, J.; Chandra, P.
Publication: *eprint arXiv:1209.4654*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.4654Z

Title: A Disk-based Dynamical Mass Estimate for the Young Binary V4046 Sgr
Authors: Rosenfeld, Katherine A.; Andrews, Sean M.; Wilner, David J.; Stempels, H. C.
Publication: *The Astrophysical Journal, Volume 759, Issue 2, article id. 119, 12 pp. (2012).*
Publication Date: 11/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.4407R

Title: Substellar-mass Condensations in Prestellar Cores
Authors: Nakamura, Fumitaka; Takakuwa, Shigehisa; Kawabe, Ryohei
Publication: *The Astrophysical Journal Letters, Volume 758, Issue 2, article id. L25, 5 pp. (2012)*
Publication Date: 10/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.3801N

Title: Matryoshka Holes: Nested Emission Rings in the Transitional Disk Oph IRS 48
Authors: Brown, J. M.; Rosenfeld, K. A.; Andrews, S. M.; Wilner, D. J.; van Dishoeck, E. F.
Publication: *The Astrophysical Journal Letters, Volume 758, Issue 2, article id. L30, 5 pp. (2012).*
Publication Date: 10/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.1641B

Title: Precise Identifications of Submillimeter Galaxies: Measuring the History of Massive Star-forming Galaxies to $z > 5$
Authors: Barger, A. J.; Wang, W.-H.; Cowie, L. L.; Owen, F. N.; Chen, C.-C.; Williams, J. P.
Publication: *The Astrophysical Journal, Volume 761, Issue 2, article id. 89, 23 pp. (2012).*
Publication Date: 12/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...761...89B

Title: The circumstellar disk of AB Aurigae: evidence for envelope accretion at late stages of star formation?
Authors: Tang, Y.-Wen; Guilloteau, S.; Piétu, V.; Dutrey, A.; Ohashi, N.; Ho, P. T. P.
Publication: *Astronomy & Astrophysics, Volume 547, id.A84, 17 pp.*
Publication Date: 11/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1209.1299T

Title: Mid-J CO emission from the Orion BN/KL explosive outflow
Authors: Peng, T.-C.; Zapata, L. A.; Wyrowski, F.; Güsten, R.; Menten, K. M.
Publication: *Astronomy & Astrophysics, Volume 544, id.L19, 4 pp.*
Publication Date: 08/2012
Abstract: http://adsabs.harvard.edu/abs/2012A%26A...544L..19P

Title: Molecular line survey of the high-mass star-forming region NGC 6334I with Herschel/HIFI and the Submillimeter Array
Authors: Zernickel, A.; Schilke, P.; Schmiedeke, A.; Lis, D. C.; Brogan, C. L.; Ceccarelli, C.; Comito, C.; Emprechtinger, M.; Hunter, T. R.; Möller, T.
Publication: *Astronomy & Astrophysics, Volume 546, id.A87, 31 pp.*
Publication Date: 10/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1208.5516Z

Title: Multiwavelength Variations of 3C 454.3 during the 2010 November to 2011 January Outburst
Authors: Wehrle, Ann E.; Marscher, Alan P.; Jorstad, Svetlana G.; Gurwell, Mark A.; Joshi, Manasvita; MacDonald, Nicholas R.; Williamson, Karen E.; Agudo, Iván; Grupe, Dirk
Publication: *The Astrophysical Journal, Volume 758, Issue 2, article id. 72, 21 pp. (2012).*
Publication Date: 10/2012
Abstract: http://adsabs.harvard.edu/abs/2012arXiv1208.4564W

Title: Resolving the Inner Jet Structure of 1924-292 with the Event Horizon Telescope
Authors: Lu, Ru-Sen; Fish, Vincent L.; Weintroub, Jonathan; Doeleman, Sheperd S.; Bower, Geoffrey C.; Freund, Robert; Friberg, Per; Ho, Paul T. P.; Honma, Mareki; Inoue, Makoto; Krichbaum, Thomas P.; Marrone, Daniel P.; Moran, James M.; Oyama, Tomoaki; Plambeck, Richard; Primiani, Rurik; Shen, Zhi-Qiang; Tilanus, Remo P. J.; Wright, Melvyn; Young, Ken H.; Ziurys, Lucy M.; Zensus, J. Anton
Publication: *The Astrophysical Journal Letters, Volume 757, Issue 1, article id. L14, 5 pp. (2012).*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...757L..14L

Title: Disentangling the Circumnuclear Environs of Centaurus A: Gaseous Spiral Arms in a Giant Elliptical Galaxy
Authors: Espada, D.; Matsushita, S.; Peck, A. B.; Henkel, C.; Israel, F.; Iono, D.
Publication: *The Astrophysical Journal Letters, Volume 756, Issue 1, article id. L10, 5 pp. (2012).*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...756L..10E

Title: Forming an O Star via Disk Accretion?
Authors: Qiu, Keping; Zhang, Qizhou; Beuther, Henrik; Fallscheer, Cassandra
Publication: *The Astrophysical Journal, Volume 756, Issue 2, article id. 170, 10 pp. (2012).*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...756..170Q

Title: A Detailed Gravitational Lens Model Based on Submillimeter Array and Keck Adaptive Optics Imaging of a Herschel-ATLAS Submillimeter Galaxy at $z = 4.243$
Authors: Bussmann, R. S.; Gurwell, M. A.; Fu, Hai; Smith, D. J. B.; Dye, S.; Auld, R.; Baes, M.; Baker, A. J.; Bonfield, D.; Cava, A.; Clements, D. L.; Cooray, A.; Coppin, K.; Dannerbauer, H.; Dariush, A.; De Zotti, G.; Dunne, L.; Eales, S.; Fritz, J.; Hopwood, R.; Ibar, E.; Ivison, R. J.; Jarvis, M. J.; Kim, S.; Leeuw, L. L.; Maddox, S.; Michałowski, M. J.; Negrello, M.; Pascale, E.; Pohlen, M.; Riechers, D. A.; Rigby, E.; Scott, Douglas; Temi, P.; Van der Werf, P. P.; Wardlow, J.; Wilner, D.; Verma, A.
Publication: *The Astrophysical Journal, Volume 756, Issue 2, article id. 134, 11 pp. (2012).*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...756..134B

Title: Variability of the blazar 4C 38.41 (B3 1633+382) from GHz frequencies to GeV energies
Authors: Raiteri, C. M.; Villata, M.; Smith, P. S.; Larionov, V. M.; Acosta-Pulido, J. A.; Aller, M. F.; D'Ammando, F.; Gurwell, M. A.; Jorstad, S. G.; Joshi, M.; Kurtanidze, O. M.; Lähteenmäki, A.; Mirzaqulov, D. O.; Agudo, I.; Aller, H. D.; Arévalo, M. J.; Arkharov, A. A.; Bach, U.; Benítez, E.; Berdyugin, A.; Blinov, D. A.; Blumenthal, K.; Buemi, C. S.; Bueno, A.; Carleton, T. M.; Carnerero, M. I.; Carosati, D.; Casadio, C.; Chen, W. P.; Di Paola, A.; Dolci, M.; Efimova, N. V.; Ehgamberdiev, Sh. A.; Gómez, J. L.; González, A. I.; Hagen-Thorn, V. A.; Heidt, J.; Hiriart, D.; Holikov, Sh.; Konstantinova, T. S.; Kopatskaya, E. N.; Koptelova, E.; Kurtanidze, S. O.; Larionova, E. G.; Larionova, L. V.; León-Tavares, J.; Leto, P.; Lin, H. C.; Lindfors, E.; Marscher, A. P.; McHardy, I. M.; Molina, S. N.; Morozova, D. A.; Mujica, R.; Nikolashvili, M. G.; Nilsson, K.; Ovcharov, E. P.; Panwar, N.; Pasanen, M.; Puerto-Gimenez, I.; Reinthal, R.; Richter, G. M.; Ros, J. A.; Sakamoto, T.; Schwartz, R. D.; Sillanpää, A.; Smith, N.; Takalo, L. O.; Tammi, J.; Taylor, B.; Thum, C.; Tornikoski, M.; Trigilio, C.;

Troitsky, I. S.; Umana, G.; Valcheva, A. T.; Wehrle, A. E.
Publication: *Astronomy & Astrophysics, Volume 545, id.A48, 18 pp.*
Publication Date: 09/2012
Abstract: http://adsabs.harvard.edu/abs/2012A%26A...545A..48R

Title: A Multi-wavelength High-resolution study of the S255 Star-forming Region: General Structure and Kinematics
Authors: Zinchenko, I.; Liu, S.-Y.; Su, Y.-N.; Kurtz, S.; Ojha, D. K.; Samal, M. R.; Ghosh, S. K.
Publication: *The Astrophysical Journal, Volume 755, Issue 2, article id. 177, 19 pp. (2012).*
Publication Date: 08/2012
Abstract: http://adsabs.harvard.edu/abs/2012ApJ...755..177Z

Title: H2CO and N2H+ in Protoplanetary Disks: Evidence for a CO-ice Regulated Chemistry
Authors: Qi, Chunhua; Oberg, Karin; Wilner, David
Publication: *eprint arXiv:1301.2465*
Publication Date: 01/2013
Abstract: http://adsabs.harvard.edu/abs/2013arXiv1301.2465Q

Title: Submillimeter Interferometry of the Luminous Infrared Galaxy NGC 4418:
A Hidden Hot Nucleus with an Inflow and an Outflow
Authors: Sakamoto, Kazushi; Aalto, Susanne; Costagliola, Francesco; Martin, Sergio; Ohyama, Youichi; Wiedner, Martina C.; Wilner, David J.
Publication: *eprint arXiv:1301.1878*
Publication Date: 01/2013
Abstract: http://adsabs.harvard.edu/abs/2013arXiv1301.1878S

Title: Resolved Depletion Zones and Spatial Differentiation of N2H+ and N2D+
Authors: Tobin, John J.; Bergin, Edwin A.; Hartmann, Lee; Lee, Jeong-Eun; Maret, Sebastien; Myers, Phillip C.; Looney, Leslie W.; Chiang, Hsin-Fang; Friesen, Rachel
Publication: *eprint arXiv:1301.1655*
Publication Date: 01/2013
Abstract: http://adsabs.harvard.edu/abs/2013arXiv1301.1655T

Title: The Galactic Center Cloud G0.253+0.016: A Massive Dense Cloud with low Star Formation Potential
Authors: Kauffmann, Jens; Pillai, Thushara; Zhang, Qizhou
Publication: *eprint arXiv:1301.1338*
Publication Date: 01/2013
Abstract: http://adsabs.harvard.edu/abs/2013arXiv1301.1338K

Title: A new radio recombination line maser object toward the MonR2 HII region
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Title: High angular resolution millimetre continuum observations and modelling of S140-IRS1
Authors: Maud, Luke T.; Hoare, Melvin G.; Gibb, Andy G.; Shepherd, Debra; Indebetouw, Rémy
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