GCNEWS

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Edited by Angela Cotera, Heino Falcke & Sera Markoff

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Gemini North Observes the Galactic Center

Figure 1: Two color Gemini image of the central parsecs. Ks is red, H is blue. The image was taken with the QUIRC camera using the Hokupa'a adaptive optics system. The field-of-view provides the largest high resolution image of the GC to date.

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Editorial:

Angela Cotera, Heino Falcke & Sera Markoff

GC02: Houston, we have liftoff

After talking to a few brave souls who were interested in sponsoring a conference (and after an initial proposal from India evolved into a more general conference), we are pleased to announce that the next Galactic Center conference (workshop?) has found a home and an approximate date. Dr. Matthew Mountain, director of Gemini North has generously agreed to be the primary sponsor of a conference on the big island of Hawaii. We currently anticipate the conference to take place in February of 2002. As soon as the exact location and date have been determined, we will pass this along to you.

The primary organizer for this conference will be François Rigaut, a project scientist with Gemini, and coordinator of the very successful GC Demonstration Science Team (for more information see the feature article in this issue of GCNEWS). Your GCNEWS editors have agreed to provide substantial organizational assistance as François is new to both GC research and conference organization.

At the recent AAS meeting in San Diego a few GC aficionados got together and discussed the GC98 workshop: what worked, what didn't and what we would like to see for this upcoming conference. One proposal that was unanimously supported was reaching out to you, the GC community, for your ideas on what are the most intriguing and important questions facing GC research today. We anticipate soliciting your input in coming months, so start thinking about what questions you would like to see addressed.

AAS 197 GC Presence

The 197th meeting of the AAS in San Diego had a strong GC showing, with many posters in **Session 4: The Milky Way Galaxy**, as well as other GC-related posters and talks sprinkled throughout the conference. Here we will just give a cursory run-through of the presentations. To see the full abstracts, go to the program at http://www.aas.org/meetings/aas197/program, and follow the links to the session numbers included below with the first author name.

Starting from the big scales and working inwards, the results from several new line mapping and survey programs were reported. The MSC N-to-MIR deep fields presented by Mizuno et al. (4.11) include the GC, as well as an NIR survery for emission-line stars in the Galactic plane (Hoemeier et al. 4.12), which has already turned up one Wolf-Rayet star in the GC. In addition, Christopher et al. (4.07) presented high spatial and spectral resolution images of the central 4 pc in HC0+ and HCN from the Owens Valley mm array, and a CO J=7-6 map of the GC by AST/RO was presented by Kim et al. (4.04) (and see also Ojho et al., this issue).

The nonthermal filaments were a hot topic, as usual, starting with a dissertation talk by C. Lang [28.01] on the Arched Filament complex and environs. She showed that the ionization of the Arched Filament can be entirely accounted for by the Arches Cluster, which she estimates may be as far as 20 pc away in order to explain the observed uniformity. During the questions afterwards, A. Cotera and Lang discussed their respective views on the nearby molecular cloud, and whether it was the source of the star cluster or had moved into the region at a later time. Upcoming velocity comparisons should cast more light on the subject.

LaRosa et al. (4.06) discussed a different group of nonthermal filaments near the GC, which show spectral index variations that are inconsistent with simple aging calculations. And Chandran (4.08, and see this issue) considered the confinement and stability of the vertical ordered magnetic field assumed from these filaments.

Moving in to the central stellar cluster, Gezari et al. (4.01) presented 5 spectral identifications of member stars, while Sand & Ghez (4.10) showed that two familiar players, IRS 16SW and S2-7, are variable. How the central cluster managed to form in the first place is considered Kim (4.09), who presented simulations of dynamical friction as a way to move pre-formed clusters inward.

Some exciting results from the recent *Chandra* ACIS GC observation were presented by Baganoff et al. (4.02) and Maeda et al. (80.03), who focused on Sgr A* and Sgr A East, respectively. They found a suprisingly soft X-ray source coincident to within 0.35" of Sgr A*, which seems to be slightly extended and shows a hint of variability. The Sgr A E radio shell is non-luminous in the *Chandra* range, and is filled with plasma whose line emission suggests a temperature of ~ 2 keV. The oberabundance of heavy elements supports a SNR origin for this source.

Rounding the inner parsec out, another poster on Sgr A E by Fatuzzo et al. (4.05, and see this issue) suggests it may at some point become a strong source of annihilation radiation. And last but not least, Doeleman et al. (4.03) presented their new 86 GHz observations of Sgr A*, which limit the structure in the N-S direction to

$\lesssim 0.27$ mas. They find a best fit to a circular Gaussian brightness distribution.

We look forward to seeing many of these finalized results in our upcoming Volume 13!

Gemini North GC Demonstration Science

Angela Cotera (Steward Observatory) & François Rigaut (Gemini Observatory)

As part of the commissioning phase of Gemini North, two demonstration science programs were undertaken: one of the programs focused on the Galactic Center (GC). To establish the scientific goals for this program, a science group was assembled with members from all of the Gemini partner countries. [1] The science team discussed many observing options, and reached a consensus that the goals for the demonstration observations would be 1) to investigate the stellar population with the deepest images available over the largest practical area, 2) to study possible variability by monitoring a few fields over the two month observation period, 3) to use H and K′ images to map the extinction structure, and 4) to create a database that will be useful for future Gemini observations.

The observations were taken over several nights in July and August 2000. The observations were taken with the Hokupa'a adaptive optics (AO) system and the QUIRC infrared camera, both on loan from the University of Hawaii. Hokupa'a is based on a 36 element wavefront curvature correction, representing approximately a third of the elements which will eventually be available on the Gemini North telescope. QUIRC uses a 1024×1024 HAWAII HgCdTe array, which, when used with Hokupa'a, has a platescale $\sim$ 20 mas, for a field of view of $20'' \times 20''$. The observations were taken over many nights, under varying sky conditions. The FWHM of the point-spread-function (PSF) under the best conditions is $\sim$80 mas, with an typical FWHM of $\sim$140 mas. Since at Mauna Kea, the GC transits at 42^o, all of the observations were taken at airmass between 1.5 and 2, which is an additional challenge for the AO system.

Data was taken at 11 positions, numbered 1 to 13 (with 7 and 8 missing for historical reasons): 10 of these positions are shown with their relative offsets in Figure 2. Positions 1-6, 12 and 13, are within the central $\sim$ 3 pc of the galaxy. Positions 9 and 10 were taken as control fields to allow for establishing the reference properties of the bulge background stellar population. These positions (J2000 coordinates RA $17^h45^m33.25^s$ Dec $-29^o\,2'\,38.1''$ and RA $17^h45^m40.82^s$ $-28^o57'18.9''$ respectively) were centered on an available AO guide star in the general area, to provide for the best possible wavefront corrections and the least amount of distortion across the array. Position 12 was centered on the central parsec guide star, overlapping fields 1,2,5 and 6, and was taken both for use in establishing astrometric registration and for photometric consistency within the four central fields. Finally, field 11 is the Arches Cluster.

H and K′ images are available for all fields; for some of the fields, H and/or K′ or images were taken on several nights. CO and CO continuum have been taken for a few fields, which are labeled with the red dots in Figure 2. The original intent was to take CO for all fields, but this was not accomplished due to time constraints which resulted from a combination of bad weather, and both telescope and instrument engineering problems. All of the data have been reduced and released to the community. Information on how to obtain a copy of the data can be found at http://www.gemini.edu/sciops/data/dataSV.html. Additional details on the observations and in-

[1] The members of Galactic Center Demonstration Science Team were: V.Alonso (U.Cordoba, Argentina), R.Blum (CTIO, US), M.Burton (UNSW, Australia), S.Casassus (U.Chile, Chile), A.Cotera (Steward Obs., US), T.Davidge (HIA, Canada), T.Geballe (Gemini), A.Ghez (UCLA, US), F.Melia (Steward Obs., US), D.Minniti (U.Catolica, Chile) M.Morris (UCLA, US), A.Quirrenbach (UCSD, US) F.Rigaut (Gemini) and D.Simons (Gemini). A "program support" group was also put in place, which mission was to support the observations and data reduction members of this group were T.Davidge, R.Blum, A.Cotera and M.Chun (Gemini). W.Brandner (U. of Hawaii-IfA), M.Chun, J.Jensen (Gemini), D.Potter Malcolm Northcott and Buzz Graves (all at U. of Hawaii-IfA) provided instrument guidance and support throughout the runs. F.Rigaut at Gemini acted as a global coordinator for this program.

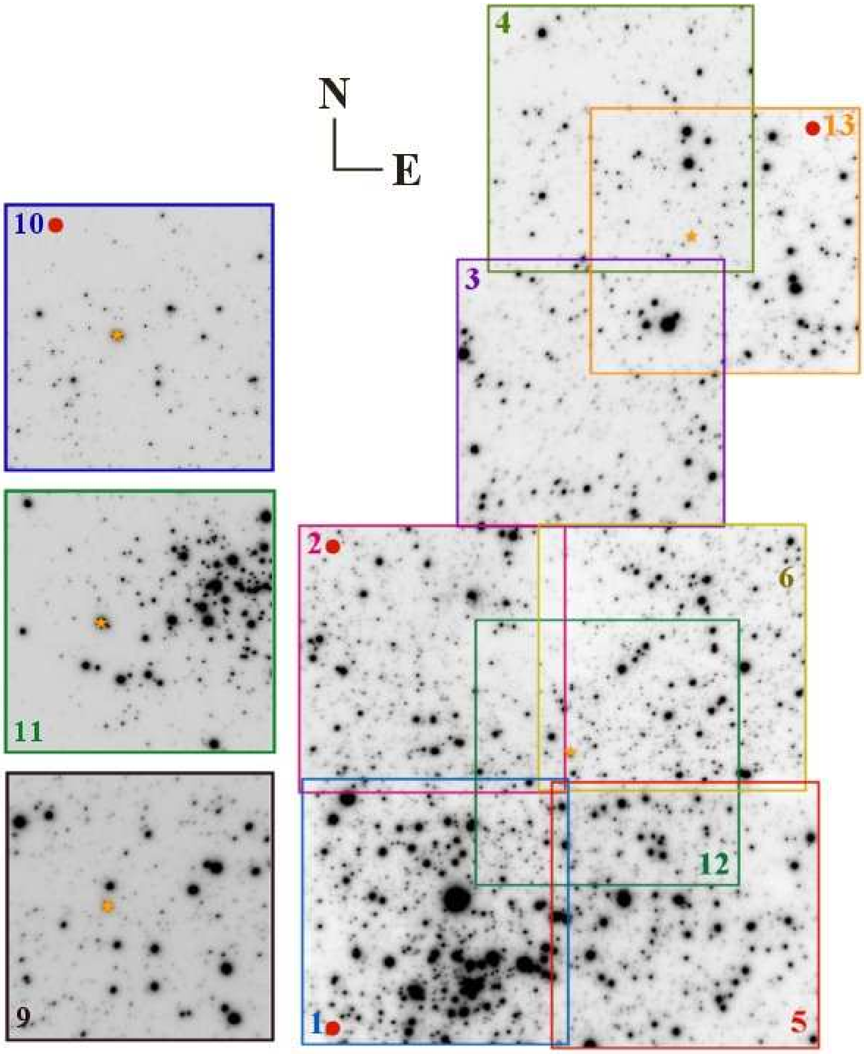

Figure 2: K′ band grayscale image of the fields obtained during the Gemini demonstration science program. For the regions with dots next to their number, in addition to H and K′ band images, CO and CO continuum observations were obtained.

formation on the methodology employed for the data reduction are also available with the released data.

Already, the extent and clarity of the Gemini images has revealed new information on IRS 8 (see Figure 3). IRS 8 appears to be plowing through the dust and gas near the galactic center, creating an obvious bow-shock wave. In addition, the deepest image yet of the Arches Cluster has been obtained. In order minimize distortion across the array, introduced by the AO system, the AO star was placed in the center of the array. To insure good observational depth, the same position was repeated numerous times. Therefore, only a portion of the cluster was observed. The reduced image is shown in Figure 4. By using the AO system, and coadding many integrations, the Gemini data provide unprecedented resolution of the inner portions of the cluster and provide us with the ability to measure numerous faint stars whose magnitudes have not been available to date. The data will undoubtably greatly improve our understanding of this cluster.

In addition to the sheer volume of released data, covering a much larger area than previously available, the primary advantage for those who utilize the Gemini data in their research will be

Figure 3: A close up of the bow shock preceding IRS 8 as it plows through the ISM.

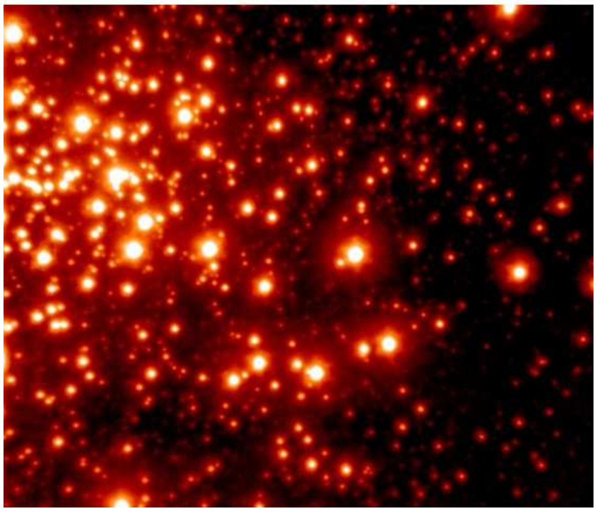

Figure 4: K′ band image of the lower left portion of the Arches Cluster. The image illustrates the excellent resolution of the Gemini images, and shows the wealth of stars in this amazing cluster.

the greatly improved point-spread-function (as compared with other publicly available data such as the HST NICMOS archival data). The resultant higher spatial resolution will permit investigations further down the main sequence, improving our understanding of the IMF in all the fields obtained. In conjunction with the reference fields, we will be able to investigate the variations in the stellar populations, greatly improving our understanding of the star formation history in this enigmatic region. Finally, this data set will provide an excellent baseline for future kinematic and variability investigations.

Abstracts

The Galactic Center He I Stars: Remains of a Dissolved Young Cluster?

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A massive young star cluster embedded in its parent molecular cloud will spiral into the Galactic Center from $\sim$ 30 pc during the life-time of its most massive stars, if the combined total mass is $\sim 10^6 M_\odot$. On its way inwards the system loses most of its mass to the strong tidal field, until the dense cluster core of high-mass stars is finally disrupted by the central black hole. A simple model is presented to argue that this scenario may under plausible conditions explain the observed location and rotation of the Galactic Center HeI stars. Accretion of star clusters into the Galactic Center could be recurrent, and play an important role in regulating the activity of Sgr A*.

Ref.: ApJ Letters, submitted
Email: Ortwin.Gerhard@unibas.ch
Eprint: astro-ph/0005096

X-ray Line Diagnostics of Hot Accretion Flows around Black Holes

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We compute X-ray emission lines from thermal plasma in hot accretion flows. We show that line profiles are strong probes of the gas dynamics, and we present line-ratio diagnostics which are sensitive to the distribution of mass with temperature in the flow. We show how these can be used to constrain the run of density with radius, and the size of the hot region. We also present diagnostics which are primarily sensitive to the importance of recombination versus collisional ionization, and which could help discriminate ADAFs from photoionization-dominated accretion disk coronae. We apply our results to the Galactic center source Sagittarius A* and to the nucleus of M87. We find that the brightest predicted lines are within the detection capability of current X-ray instruments.

Ref.: ApJ, in press
Email: rperna@cfa.harvard.edu
Eprint: astro-ph/0005387

Is the Galactic center populated with young star clusters?

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We study the evolution and observability of young and compact star clusters near the Galactic center, such as the Arches cluster and the Quintuplet. The star clusters are modeled with a combination of techniques; using direct nbody, integration to calculate the motions of all stars and detailed stellar and binary evolution to follow the evolution of the stars. The modeled star clusters dissolve within 10 to 60 million years in the tidal field of the Galaxy. The projected stellar density in the modeled clusters drops within 5% to 70% of the lifetime to a level comparable to the projected background density towards the Galactic center. And it will be very hard to distinguished these clusters at later age among the background stars. This effect is more severe for clusters at larger distance from the Galactic center but in projection at the same distance. Based on these arguments we conclude that the Galactic center easily hides 10 to 40 clusters with characteristics similar to the Arches and the Quintuplet cluster.

Ref.: to appear in Dynamics of Star Clusters and the Milky Way, eds. R.Spurzem et al. (ASP Conference Series)
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Eprint: astro-ph/0006428

New star clusters projected close to the Galactic Centre

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We carried out a systematic search for new star clusters in a field of $5^\circ \times 5^\circ$ centred close to the Galactic Nucleus using the infrared JHK$_s$ 2MASS Survey archive. In addition we searched for embedded clusters in the directions of HII regions and dark clouds

for $|\ell| \leq 4°$. As a result we present a list of 58 IR star clusters or candidates. We provide positions, sizes and reddening estimated from 100 μm dust emission. Their angular distribution together with previously catalogued objects in the region and possible relation with star forming complexes are also discussed.

Ref.: A&A, in press
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Eprint: astro-ph/0006409

To Probe a Black Hole

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We show how an idealized high-frequency VLBI can probe the metric of nearby supermassive black holes. No quantitative assumptions about plasma dynamics are used in the suggested diagnostic, which is based on strong-field lensing.

Ref.: ApJL, to be submitted
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Eprint: astro-ph/0007080

An X-ray Binary Model for the Galactic Center Source IRS 13E

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We present several models for IRS 13E, an infrared, mm and X-ray source in the Galactic Center. Our favored interpretation is that of an early-type binary with strong colliding winds emission. This naturally explains the observed X-ray count rate and the strong IR emission lines, and has a distinct advantage over competing hypotheses based upon a single star or BH system.

Ref.: A&A, in press
Email: rfc@physics.arizona.edu
Eprint: astro-ph/0008091

The Nuclear Star Cluster of the Milky Way: Star Formation, Dynamics and Central Black Hole

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High spatial resolution, near-infrared imaging and spectroscopy of the nuclear star cluster have given key new insights about the dynamics, evolution and mass distribution in the Milky Way Center. The central parsec is powered by a cluster of hot, massive stars which must have formed a few million years ago. Either star formation was triggered in the central parsec by the infall of a very dense cloud, or a dense, young star cluster formed outside of the central parsec sank rapidly into the nuclear region through dynamical friction. The presence of luminous asymptotic giant branch (AGB) stars suggests that there were earlier such star formation episodes. Measurements of radial and proper motions for more than 200 stars delineate the stellar dynamics to a scale of a few light days from the dynamic center which is coincident with the compact radio source (Sgr A*) within $\sim$0.1$''$ (800 AU). The stellar velocities increase toward Sgr A* with a Kepler law (to $>$1000 km/s for the innermost stars), implying the presence of a three million solar mass central (dark) mass. The observations make a compelling case that this mass concentration is a black hole which is currently accreting at a low rate or radiating at low efficiency. With the exception of the young, massive stars the velocity field of the central stellar cluster is close to isotropic. The young stars are characterized by a turbulent rotation pattern that still carries the imprint of the angular momentum distribution in the original cloud or star cluster.

Ref.: To appear in the Proceedings of the Star2000 Meeting (Heidelberg, March 2000), editor R. Spurzem
Email: genzel@mpe.mpg.de
Eprint: astro-ph/0008119

Discovery of a Slow X-Ray Pulsator, AX J1740.1−2847, in the Galactic Center Region

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We report the discovery of an X-ray pulsar AX J1740.1−2847 from the Galactic center region. This source was found as a faint hard X-ray object on 7–8 September 1998 with the *ASCA*

Galactic center survey observation. Then, coherent pulsations of $P = 729 \pm 14$ sec period were detected. The X-ray spectrum is described by a flat power-law of $\simeq 0.7$ photon index. The large absorption column of $\log N_{\rm H} \simeq 22.4$ (cm^{-2}) indicates that AX J1740.1−2847 is a distant source, larger than 2.4 kpc, and possibly near at the Galactic center region. The luminosity in the 2–10 keV band is larger than 2.5×10^{33} erg s^{-1}, or likely to be 3.2×10^{34} erg s^{-1} at the Galactic center distance. Although the slow pulse period does not discriminate whether AX J1740.1−2847 is a white dwarf or neutron star binary, the flat power-law and moderate luminosity strongly favor a neutron star binary.

Ref.: PASJ (2000), Vol.52 No.6 (Dec. 25), in press
Email: sakano.masaaki@nasda.go.jp
Eprint: astro-ph/0008331
http://www-maxi.tksc.nasda.go.jp/~sakano/work/paper/index-e.html

A Monte Carlo Study of the 6.4 keV Emission at the Galactic Center

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Strong fluorescent Fe line emission at 6.4 keV has been observed from the Sgr B2 giant molecular cloud located in the Galactic Center region. The large equivalent width of this line and the lack of an apparent illuminating nearby object indicate that a time-dependent source, currently in a low-activity state, is causing the fluorescent emission. It has been suggested that this illuminator is the massive black hole candidate, Sgr A*, whose X-ray luminosity has declined by an unprecedented six orders of magnitude over the past 300 years. We here report the results of our Monte Carlo simulations for producing this line under a variety of source configurations and characteristics. These indicate that the source may in fact be embedded within Sgr B2, although external sources give a slightly better fit to the data. The weakened distinction between the internal and external illuminators is due in part to the instrument response function, which accounts for an enhanced equivalent width of the line by folding some of the continuum radiation in with the intrinsic line intensity. We also point out that although the spectrum may be largely produced by Kα emission in cold gas, there is some evidence in the data to suggest the presence of warm ($\sim 10^5$ K) emitting material near the cold cloud.

Ref.: submitted
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Eprint: astro-ph/0008393

A Magnetic Dynamo Origin For The Sub-mm Excess In Sgr A*

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The sub-mm bump observed in the spectrum of Sgr A* appears to indicate the existence of a compact emitting component within several Schwarzschild radii, r_S, of the nucleus at the Galactic Center. This is interesting in view of the predicted circularized flow within $\sim 5 - 10\,r_S$, based on detailed multi-dimensional hydrodynamic simulations of Bondi-Hoyle accretion onto this unusual object. In this paper, we examine the physics of magnetic field generation by a Keplerian dynamo subject to the conditions pertaining to Sgr A*, and show that the sub-mm bump can be produced by thermal synchrotron emission in this inner region. This spectral feature may therefore be taken as indirect evidence for the existence of this circularization. However, the required accretion rate in the Keplerian flow is orders of magnitude smaller than that predicted by the Bondi-Hoyle simulations. We speculate that rapid evaporation, in the form of a wind, may ensue from the heating associated with turbulent mixing of gas elements with large eccentricity as they settle down into a more or less circular (i.e., low eccentricity) trajectory. The spectrum of Sgr A* longward of $\sim 1-2$ mm may be generated in the transition region outside of the Keplerian flow.

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Eprint: astro-ph/0008416
http://www.physics.arizona.edu/~liusm/publication/paper5.ps

Polarized mm And sub-mm Emission From Sgr A* At The Galactic Center

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The recent detection of significant linear polarization at mm and sub-mm wavelengths in the spectrum of Sgr A* (if confirmed) will be a useful probe of the conditions within several Schwarzschild radii (r_S) of the event horizon at the Galactic Center. Hydrodynamic simulations of gas flowing in the vicinity of this object suggest that the infalling gas circularizes when it approaches within $5-25\ r_S$ of the black hole. We suggest that the sub-mm "excess" of emission seen in the spectrum of Sgr A* may be associated with radiation produced within the inner Keplerian region and that the observed polarization characteristics provide direct evidence for this phenomenon.

Ref.: APJ Letter Submitted
Email: liusm@physics.arizona.edu
Eprint: astro-ph/0008261
http://www.physics.arizona.edu/~liusm/publication/paper4.ps

Electron-positron Annihilation Radiation from Sgr A East at the Galactic Center

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Maps of the Galactic electron-positron annihilation radiation show evidence for three distinct and significant features: (1) a central bulge source, (2) emission in the Galactic plane, and (3) an enhancement of emission at positive latitudes above the Galactic Center. In this paper, we explore the possibility that Sgr A East, a very prominent radio structure surrounding the Galactic nucleus, may be a significant contributer to the central bulge feature. The motivation for doing so stems from a recently proposed link between this radio object and the EGRET γ-ray source 2EG J1746-2852. If this association is correct, then Sgr A East is also expected to be a source of copious positron production. The results presented here show that indeed Sgr A East must have produced a numerically significant population of positrons, but also that most of them have not yet had sufficient time to thermalize and annihilate. As such, Sgr A East by itself does not appear to be the dominant *current* source of annihilation radiation, but it will be when the positrons have cooled sufficiently and they have become thermalized. This raises the interesting possibility that the bulge component may be due to the relics of earlier explosive events like the one that produced Sgr A East.

Ref.: ApJ, submitted
Email: melia@physics.arizona.edu

N-Body Simulations of Compact Young Clusters Near the Galactic Center

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We investigate the dynamical evolution of compact young star clusters (CYCs) near the Galactic center (GC) using Aarseth's Nbody6 codes. The relatively small number of stars in the cluster (5,000–20,000) makes real-number N-body simulations for these clusters feasible on current workstations. Using Fokker-Planck (F-P) models, Kim, Morris, & Lee (1999) have made a survey of cluster lifetimes for various initial conditions, and have found that clusters with a mass $\lesssim 2\times10^4 M_\odot$ evaporate in ~ 10 Myr. These results were, however, to be confirmed by N-body simulations because some extreme cluster conditions, such as strong tidal forces and a large stellar mass range participating in the dynamical evolution, might violate assumptions made in F-P models. Here we find that, in most cases, the CYC lifetimes of previous F-P calculations are 5–30 % shorter than those from the present N-body simulations. The comparison of projected number density profiles and stellar mass functions between N-body simulations and *HST*/NICMOS observations by Figer et al. (1999) suggests that the current tidal radius of the Arches cluster is ~ 1.0 pc, and the following parameters for the initial conditions of that cluster: total mass of $2 \times 10^4 M_\odot$ and mass function slope for intermediate-to-massive stars of 1.75 (the Salpeter function has 2.35). We also find that the lower stellar mass limit, the presence of primordial binaries, the amount of initial mass segregation, and the choice of initial density profile (King or Plummer models) do not significantly affect the dynamical evolution of CYCs.

Ref.: ApJ, Dec 20, 2000, in press
Email: sskim@astro.ucla.edu
http://www.astro.ucla.edu/~sskim/nbody.ps

AST/RO Observations of Atomic Carbon near the Galactic Center

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We present a coarsely-sampled map of the region $|l| \leq 2°$, $|b| \leq 0.1°$ in the 492 GHz ($^3P_1 \rightarrow ^3 P_0$) fine structure transition of neutral carbon, observed with the Antarctic Submillimeter Telescope and Remote Observatory (AST/RO). The distribution of [C I] emission is similar on the large scale to that of CO $J = 1 \rightarrow 0$. On average, the ratio of the integrated intensities, $I_{[CI]}/I_{^{12}CO}$, is higher in the Galactic disk than in the Galactic Center region. This result is accounted for by the absorption of ^{12}CO within the clouds located in the outer Galactic disk. $I_{[CI]}/I_{^{12}CO}$ is surprisingly uniform over the variety of environments near the Galactic Center. On average, [C I] is optically thin (or as optically thin as ^{13}CO ($J = 1 \rightarrow 0$)) even in the dense molecular clouds of the Galactic Center region.

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Email: rojha@cfa.harvard.edu
Eprint: astro-ph/0008439

Southern Hemisphere Observations of a 10^{18}eV Cosmic Ray Source Near the Direction of the Galactic Centre

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We report on an analysis of data from the southern hemisphere SUGAR cosmic ray detector. We confirm the existence of an excess of 10^{18}eV cosmic rays from a direction close to the Galactic Centre, first reported by the AGASA group. We find that the signal is consistent with that from a point source, and we find no evidence for an excess of cosmic rays coming from the direction of the Galactic Centre itself.

Ref.: Astroparticle Physics, in press
Email: jbellido@physics.adelaide.edu.au
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A ridge of recent massive star formation between Sgr B2M and Sgr B2N

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We present single dish and interferometric maps of several rotational transitions of HC_3N vibrationally excited levels towards Sgr B2. HC_3N is a very suitable molecule to probe hot and dense regions (hot cores) affected by high extinction since its vibrational levels are mainly excited by mid-IR radiation. The single dish maps show, for the first time, that the HC_3N vibrationally excited emission (HC_3N^*) is not restricted to Sgr B2M and N but extended over an area $40'' \times 20''$ in extent. We distinguish four bright clumps (Sgr B2R1 to B2R4) in the ridge connecting the main cores Sgr B2M and Sgr B2N, and a low brightness extended region to the west of the ridge (Sgr B2W). The physical properties and the kinematics of all hot cores have been derived from the HC_3N^* lines. Our high angular resolution images show that the Sgr B2N hot core breaks in two different hot cores, Sgr B2N1 and N2, with different radial velocities and separated by ~ 2" in declination. We find that the excitation of the HC_3N^* emission in all hot cores can be represented by a single temperature and that the linewidth of the HC_3N^* rotational lines arising from different vibrational levels systematically decreases as the energy of the vibrational level increases. The systematic trend in the linewidth is likely related to the increase of the velocity as the distance to the exciting source increases. We have developed a simple model to study the excitation of the HC_3N vibrational levels by IR radiation. We find that the single excitation temperature can be explained by high luminosities of embedded stars ($\sim 10^7$ $L_\odot$) and small source sizes ($\sim 2-3''$). The estimated clump masses are 500 $M_\odot$ for Sgr B2M, 800 $M_\odot$ for Sgr B2N and 10-30 $M_\odot$ for Sgr B2R1 to B2R4. Luminosities are $1-2\,10^6$ $L_\odot$ for Sgr B2R1-B2R4 and Sgr B2M and 10^7 $L_\odot$ for Sgr B2N. We estimate HC_3N abundances of $5\,10^{-9}$ for Sgr B2M and Sgr B2N2 and 10^{-7} for the rest of the hot cores. The different HC_3N abundances in the hot cores reflect different stages of evolution due to time dependent chemistry and/or photo-dissociation by UV radiation from nearby HII regions. According to the mass and the luminosity of the different hot

cores, we propose that Sgr B2M and B2N contain a cluster of 20-30 hot cores, each like that in Orion A, a number similar to the UC HII regions already detected in the region. The Sgr B2R1-B2R4 hot cores represent isolated formation of massive stars.

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Large Amplitude variables near the Galactic Centre

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We report here the results of a four-year K-band ($2.2\,\mu$m) survey for large-amplitude variable stars in a 24 × 24 arcmin^2 area centered on the Galactic Centre. A total of 409 likely long-period variables (LPVs) were detected, for which positions, amplitudes, average magnitudes and periods were obtained whenever possible. The surface density of LPVs is more than ten times greater than in the Sgr I Baade's window at $l = 1.37°$, $b = -2.63°$. The limits of completeness arising from interstellar and circumstellar absorption are discussed. Most of the area suffers interstellar extinction of $20 < A_V < 40$ mag. The shorter-period LPVs are less luminous than the longer-period ones and may be slightly under-represented in the data. Extremely heavy extinction ($A_V > 40$ mag), which affects the probability of detecting variables, occurs in less than 25% of the area. Almost all of the LPVs are Miras or OH/IR stars, with periods ranging from 150 days to about 800 days. K-band counterparts have been found for 59% of the 109 known OH sources in the field. The average period of the variables found is 427 days, while that of the OH/IR stars is 524 days. For comparison, the average period in the Sgr I window, which contains no known OH/IR stars, is 333 days and only two stars are detected with $P > 600$ days. The survey field also contains a number of long-period, large-amplitude variables which are not OH emitters.

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ftp://ftp.saao.ac.za/pub/isg/survey.ps.gz

Equilibrium and stability of strong vertical magnetic fields at the Galactic center

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Observations of narrow radio-emitting filaments near the Galactic center have been interpreted in previous studies as evidence of a pervasive vertical (i.e. $\perp$ to the Galactic plane) milliGauss magnetic field in the central ~ 150 pc of the Galaxy. Such a magnetic field would have important implications for the central environments of spiral galaxies and would, for somewhat complex reasons, be a key piece of evidence in support of a pre-Galactic origin of the Galactic magnetic field. This paper addresses the question of whether such an intense vertical magnetic field, whose pressure significantly exceeds the thermal pressure of the surrounding medium, could be confined. A simple cylindrically symmetric model for the equilibrium in this central region is proposed in which horizontal (i.e. $\parallel$ to the Galactic plane) magnetic fields embedded in an annular band of molecular material of radius ~ 150 pc are wrapped around vertical magnetic fields threading hot plasma. Since orthogonal magnetic fields can not easily interpenetrate, the horizontal magnetic field in this equilibrium can transfer the weight of the molecular material to the hot plasma and vertical magnetic field, potentially providing confinement. The stability of this equilibrium is studied indirectly by treating the equilibrium as an infinite isothermal slab, with high-density plasma representing the partially ionized molecular clouds suspended above low-density plasma, and with the orthogonal magnetic fields in the high- and low-density plasmas perpendicular to the effective gravitational acceleration $\mathbf{g}$ (true gravitational acceleration minus the centripetal acceleration of Galactic rotation). Perturbations of the interface are found to be unstable on wavelengths shorter than a critical wavelength that depends upon g and the sound and Alfvén speeds in the high-density plasma. The results of the slab-equilibrium calculation are extrapolated on a qualitative basis to argue that the proposed cylindrically symmetric equilibrium is unstable if the magnetic pressure of the vertical magnetic field $B_{\rm vert}$ greatly exceeds the thermal pressure in the molecular material, or if $B_{\rm vert} \gg 50\mu$G for Galactic-center parameters. If this qualitative argument is correct, then milliGauss vertical fields can not be stably confined using the weight of the molecular material in the kind

of equilibrium that has been proposed. If an equilibrium can not be found that can stably confine pervasive vertical milliGauss magnetic fields at the Galactic center, then a powerful argument will be added in favor of other interpretations of the Galactic-center radio filaments.

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The Accelerations of Stars Orbiting the Milky Way's Central Black Hole

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Recent measurements, of the velocities of stars near the center of the Milky Way have provided the strongest evidence for the presence of a supermassive black hole in a galaxy, but the observational uncertainties poorly constrain many of the properties of the black hole. Determining the accelerations of stars in their orbits around the center provides much more precise information about the position and mass of the black hole. Here we report measurements of the accelerations for three stars located ~0.005 pc from the central radio source Sgr A*; these accelerations are comparable to those experienced by the Earth as it orbits the Sun. These data increase the inferred minimum mass density in the central region of the Galaxy by an order of magnitude relative to previous results and localized the dark mass to within 0.05 ± 0.04 arcsec of the nominal position of Sgr A*. In addition, the orbital period of one of the observed stars could be as short as 15 years, allowing us the opportunity in the near future to observe an entire period.

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http://www.astro.ucla.edu/~ghez/gc_nat.html

Enhanced Microlensing by Stars Around the Black Hole in the Galactic Center

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The effect of stars on the lensing properties of the supermassive black hole in the Galactic Center is similar to the effect of planets on microlensing by a star. We show that the dense stellar cluster around SgrA* enhances by up to an order of magnitude the probability of high-magnification lensing events of a distant background source by the black hole. Conversely, the gravitational shear of the black hole changes and enhances the microlensing properties of the individual stars. The effect is largest when the source image lies near the Einstein radius of the black hole ($1.75'' \pm 0.20''$ for a source at infinity). We estimate that the probability of observing at least one distant background star which is magnified by a factor > 5 in any infrared snapshot of the inner ~3" of the Galactic Center is ~ 20% with present-day photometric sensitivity. Deeper future photometry will significantly increase the number of detected images. The largest source of uncertainty in this estimate is the luminosity function of the background stars. The gravitational shear of the black hole lengthens the duration of high-magnification events near the Einstein radius up to a few months, and introduces a large variety of lightcurve shapes that are different from those of isolated microlenses. Identification of such events by image subtraction can be used to probe the mass function, density and velocity distributions of faint stars near the black hole, which are not detectable otherwise.

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UHECR Production and Curvature TeV Emission in Nearby, Dormant AGNs

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The possibility that rapidly rotating supermassive black holes associated with quasar remnants may provide sites for the acceleration of ultra-high energy cosmic rays (UHECRs) is considered. It is shown that prodigious TeV emission through curvature losses is an important consequence of this mechanism. Given the measured UHECR flux, it is expected that nearby dormant AGNs will be detectable by current Tev experiments. The implications for the Sgr A* source are also briefly considered.

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Unusual Properties of X-Ray Emission near the Galactic Center

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The X-ray spectrum in a $1^\circ \times 1^\circ$ region of the Galactic center observed with the ASCA satellite is examined in detail, following the first report by Koyama et al. (1996, AAA 65.155.208). The observed spectrum contains prominent emission lines from helium-like and hydrogen-like ions of various elements, and is essentially the same all over the region. If the observed spectrum is thermal emission from hot plasmas, it requires multi-temperature plasma components, each at a different degree of ionization and with a different amount of absorption. The absence of adiabatic cooling and of systematic changes in the degree of ionization over the region is against the Galactic center origin of hot plasmas. A significant broadening of the helium-like and hydrogen-like iron K-lines is confirmed. The line width corresponds to a rms velocity of ~ 3300 km s^{-1}, which far exceeds the sound velocity in a plasma of $kT \sim 14$ keV measured with the Ginga satellite. These facts cast doubt on a thermal origin of the observed X-ray emission.

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Warm H_2 in the Galactic center region

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We present ISO observations of several H2 pure-rotational lines (from S(0) to S(5)) towards a sample of 16 molecular clouds distributed along the central 500 pc of the Galaxy. We also present C18O and 13CO J=1-¿0 and J=2-¿1 observations of these sources made with the IRAM-30m telescope. With the CO data we derive H2 densities of 10e(3.5-4.0) cm-3 and H2 column densities of a few 10e22 cm-2. We have corrected the H2 data for 30 magnitudes of visual extinction using a self-consistent method. In every source, we find that the H2 emission exhibits a large temperature gradient. The S(0) and S(1) lines trace temperatures (T) of 150 K while the S(4) and S(5) lines indicate temperatures of 600K. The warm H2 column density is typically 1-2 x 10e22 cm-2, and is predominantly gas with T=150 K. This is the first direct estimate of the total column density of the warm molecular gas in the Galactic center region. These warm H2 column densities represent a fraction of 30 CO. Comparing our H2 and CO data with available ammonia NH3 observations from literature one obtains relatively high NH3 abundances of a few 10e(-7) in both the warm and the cold gas. A single shock or Photo-Dissociation Region (PDR) cannot explain all the observed H2 lines. Alternatives for the heating mechanisms are discussed.

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A deep submillimetre survey of the Galactic Centre

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We present first results from a submillimetre continuum survey of the Galactic Centre 'Central Molecular Zone' (CMZ), made with SCUBA on the James Clerk Maxwell Telescope. SCUBA's scan-map mode has allowed us to make extremely wide-field maps of thermal dust emission with unprecedented speed and sensitivity. We also discuss some issues related to the elimination of artefacts in scan-map data. Our simultaneous $850/450\,\mu$m maps have a total size of approximately $2.8 \times 0.5°$ $(400 \times 75$ pc$)$ elongated along the galactic plane. It covers the Sgr A region—including Sgr A*, the circumnuclear disc, and the +20 km/s and +50 km/s clouds; the area around the Pistol; Sgr B2—the brightest feature on the map; and at its Galactic Western and Eastern edges the Sgr C and Sgr D regions. There are many striking features such as filaments and shell-like structures, as well as point sources such as Sgr A* itself. The total mass in the Central Molecular Zone is greater than that revealed in previous optically-thin molecular line maps by a factor of ~ 3, and new details are revealed on scales down to 0.33 pc across this 400 pc -wide region.

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Mid-infrared imaging and spectroscopy of the enigmatic cocoon stars in the Quintuplet Cluster

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In an attempt to determine the nature of the enigmatic cocoon stars in the Quintuplet Cluster, we have obtained mid-infrared imaging and spectrophotometry of the cluster, using the CAM and SWS instruments on ISO, using SpectroCam-10 on the Palomar 5m telescope, and NICMOS on HST. The spectra show smooth continua with various dust and ice absorption features. These features are all consistent with an interstellar origin, and there is no clear evidence for any circumstellar contribution to these features. We find no spectral line or feature that could elucidate the nature of these sources. Detailed modeling of the silicate absorption features shows that they are best reproduced by the μ Cep profile, which is typical of the interstellar medium, with tau(sil) $\simeq 2.9$. The high spatial resolution mid-IR images show that three of the five cocoon stars have spatially extended and asymmetric envelopes, with diameters of $\sim 20,000$ AUs. A reddening law similar to that of Lutz (1999) but with silicate features based on the μ Cep profile and normalized to our value of tau(sil) is used to deredden the observed spectrophotometry. The dereddened energy distributions are characterised by temperatures of 750–925 K, somewhat cooler than determined from near IR data alone. Models of optically thin and geometrically thick dust shells, as used by Williams et al. (1987) for very dusty, late-type WC stars, reproduce the observed SEDs from 4 to 17μm, and imply shell luminosities of $\log(L/L_\odot) \simeq 4.5$–$4.9$ for the brightest four components. An analysis of the various suggestions proposed to explain the nature of the cocoon stars reveals serious problems with all the hypotheses, and the nature of these sources remains an enigma.

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Radio Variability of Sagittarius A* - A 106 Day Cycle

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We report the presence of a 106-day cycle in the radio variability of Sgr A* based on an analysis of data observed with the Very Large Array (VLA) over the past 20 years. The pulsed signal is most clearly seen at 1.3 cm with a ratio of cycle frequency to frequency width $f/\Delta f = 2.2 \pm 0.3$. The periodic signal is also clearly observed at 2 cm. At 3.6 cm the detection of a periodic signal is marginal. No significant periodicity is detected at both 6 and 20 cm. Since the sampling function is irregular we performed a number of tests to insure that the observed periodicity is not the result of noise. Similar results were found for a maximum entropy method and periodogram with CLEAN method. The probability

of false detection for several different noise distributions is less than 5% based on Monte Carlo tests. The radio properties of the pulsed component at 1.3 cm are spectral index $\alpha \sim 1.0 \pm 0.1$ (for $S \propto \nu^\alpha$), amplitude $\Delta S = 0.42 \pm 0.04$ Jy and characteristic time scale $\Delta t_{FWHM} \approx 25 \pm 5$ days. The lack of VLBI detection of a secondary component suggests that the variability occurs within Sgr A* on a scale of ~ 5 AU, suggesting an instability of the accretion disk.

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New Results on the Helium Stars in the Galactic Center Using BEAR Spectro-Imagery

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Integral field spectroscopy of the central parsec of the Galactic Center was obtained at 2.06 μm using BEAR, an imaging Fourier Transform Spectrometer, at a spectral resolution of 74 km s^{-1}. Sixteen stars were confirmed as "helium stars" by detecting the HeI 2.058 μm line in emission, providing a homogeneous set of fully resolved line profiles. These observations allow us to discard some of the earlier detections of such stars in the central cluster and to add three new stars. The sources detected in the BEAR data were compared with adaptive optics images in the K band to determine whether the emission was due to single stars. Two sub-classes of almost equal number are clearly identified from the width of their line profiles, and from the brightness of their continuum. The first class is characterized by very broad line profiles (FWHM $\simeq$ 1000 km s^{-1}) and by their relative faintness. The other, brighter in K by an average factor of ~ 9, has a much narrower emission component of width $\simeq$ 200 km s^{-1}. Most of the emission lines show a P Cygni profile. From these results, we propose that the latter group is formed of stars in or near the LBV phase, and the other one of stars at the WR stage. The division into two groups is also shown by their spatial distribution, with the narrow-line stars in a compact central cluster IRS 16 and the other group distributed at the periphery of the central cluster of hot stars. In the same data cube, streamers of interstellar helium gas are also detected. The helium emission traces the densest parts of the SgrA West Mini-Spiral. Several helium stars have a radial velocity comparable to the velocity of the interstellar gas in which they are embedded. In the final discussion, all these findings are examined to present a possible scenario for the formation of very massive stars in the exceptional conditions of the vicinity of the central Black Hole.

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Molecular Tracers of the Central 12 pc of the Galactic Center

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We have used the BIMA array to image the Galactic Center with a 19-pointing mosaic in HCN(1-0), HCO^+(1-0), and H 42α emission with 5 km s^{-1} velocity resolution and $13'' \times 4''$ angular resolution. The $5'$ field includes the circumnuclear ring (CND) and parts of the 20 and 50 km s^{-1} clouds. HCN(1-0) and HCO^+ trace the CND and nearby giant molecular clouds while the H 42α emission traces the ionized gas in Sgr A West. We find that the CND has a definite outer edge in HCN and HCO^+ emission at $\sim 45''$ radius and appears to be composed of two or three distinct streams of molecular gas rotating around the nucleus. Outside the CND, HCN and HCO^+ trace dense clumps of high-velocity gas in addition to optically thick emission from the 20 and 50 km s^{-1} clouds. A molecular ridge of compressed gas and dust, traced in NH_3 emission and self-absorbed HCN and HCO^+, wraps around the eastern edge of Sgr A East. Just inside this ridge are several arcs of gas which have been accelerated by the impact of Sgr A East with the 50 km s^{-1} cloud. HCN and HCO^+ emission trace the extension of the northern arm of Sgr A West which appears to be an independent stream of neutral and ionized gas and dust originating outside the CND. Broad line widths and OH maser emission mark the intersection of the northern arm and the CND. Comparison to previous NH_3 and 1.2mm dust observations shows that HCN and HCO^+ preferentially trace the CND and are weaker tracers of the GMCs than NH_3 and dust. We discuss possible scenarios for the emission mechanisms and environment at the Galactic center which could explain the differences in these images.

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The Snake - a Reconnecting Coil in a Twisted Magnetic Flux Tube

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We propose that the curious Galactic Center filament known as "The Snake" is a twisted giant magnetic flux tube, anchored in rotating molecular clouds. The MHD kink instability generates coils in the tube and subsequent magnetic reconnection injects relativistic electrons. Electrons diffuse away from a coil at an energy-dependent rate producing a flat spectral index at large distances from it. Our fit to the data of Gray et al. 1995 shows that the magnetic field ~ 0.4 mG is large compared to the ambient $\sim 7\mu$ G field, indicating that the flux tube is force-free. If the *relative* level of turbulence in the Snake and the general interstellar medium are similar, then electrons have been diffusing in the Snake for about 3×10^5 yr, comparable to the timescale at which magnetic energy is annihilated in the major kink. Estimates of the magnetic field in the G359.19-0.05 molecular complex are similar to our estimate of the magnetic field in the Snake suggesting a strong connection between the physics of the anchoring molecular regions and the Snake. We suggest that the physical processes considered here may be relevant to many of the radio filaments near the Galactic Center. We also suggest further observations of the Snake and other filaments that would be useful for obtaining further insights into the physics of these objects.

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Stellar Collisions and Mergers in the Galactic Center

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Stars are most likely to merge or collide in regions of the highest stellar densities, and our own Galactic Center contains many stars packed into a relatively small volume – even the ambient stellar number density in the central 50 pc is quite high, $\sim 10^3$ $stars\ pc^{-3}$. More striking, the three compact young clusters in this region have central densities as high as 10^6 $stars\ pc^{-3}$. We discuss these extreme environments and the possibility that stellar mergers and collisions have recently occured there. In particular, we predict that at least one massive star in the Arches cluster has already experienced a stellar merger in its short lifetime. Further, the Pistol Star, in the nearby Quintuplet cluster, might owe its apparent relative youth to a rejuvinating stellar merger. Finally, the apparently young stars in the central arcsecond could be products of either collisions, inducing atmospheric stripping, or mergers.

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The Initial Mass Function in the Galactic Center

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The Galactic Center contains the most massive young clusters in the Galaxy and serves as the closest example of a massive starburst region. Our recent results suggest that the Galactic Center environment produces massive clusters with relatively flat initial mass functions, as might be expected on theoretical grounds. I will discuss these recent results, along with evidence for star formation in the immediate vicinity of the super massive black hole at the Galactic Center. The results of this work might be useful in extrapolating to other galactic centers with similar conditions, as well as other starburst regions.

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Large scale grain mantle disruption in the Galactic Center

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We present observations of C2H5OH toward molecular clouds in Sgr A, Sgr B2 and associated with thermal and non-thermal features in the Galactic center. C2H5OH emission in Sgr A and Sgr B2 is widespread, but not uniform. C2H5OH emission is much weaker or it is not detected in some molecular clouds in both complexes, in particular those with radial velocities between 70 and 120 km/s. While most of the clouds associated with the thermal features do not show C2H5OH emission, that associated with the Non-Thermal Radio Arc shows emission. and The fractional abundance of C2H5OH in most of the clouds with radial velocities between 0 and 70 km/s in Sgr A and Sgr B2 is relatively high, of few 10^{-8}. The C2H5OH abundance decreases by more than one order of magnitude ($\lesssim 10^{-9}$) in the clouds associated with the thermal features. The large abundance of C2H5OH in the gas-phase indicates that C2H5OH has formed in grains and released to gas-phase by shocks in the last $\approx 10^5$ years. in The implications of this finding in the origin of the shocks in the GC is briefly discussed.

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Cold H_2O and CO ice and gas toward the Galactic Center

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We present observations of CO, ^{13}CO and of H_2O in the middle and far-infrared taken with the ISO-SWS and ISO-LWS spectrometers toward two positions in the Galactic Center region (Sgr A* and GCS-3). Both ice and gas phase molecules are detected. The ISO data have been complemented with observations of the J=3-2 and J=7-6 lines of CO carried out at the Caltech Submillimeter Observatory. The ISO and CSO data indicate that the absorbing gas is extremely cold, $T_K \simeq 10$ K, suggesting that it is located in the dark clouds of the different spiral arms that intersect the line of sight towards the Galactic Center. From the analysis of the CO absorption we derive ^{13}CO gas phase column densities of 1.1 and $0.7 \cdot 10^{17}$ cm^{-2} towards Sgr A* and GCS-3 respectively. The H_2O gas column density in the direction of Sgr A* is $\simeq 2 \cdot 10^{16}$ cm^{-2}. The derived CO/H_2O and gas/solid abundance ratios corresponding to these cold clouds are remarkably similar along the two lines of sight. We find that nearly all the CO is in the gas phase, while the H_2O is almost entirely frozen onto the surfaces of cold dust grains. Finally, the $N_{gas+ice}$(CO)/$N_{gas+ice}$(H_2O) abundance ratio is $\simeq 5$ implying that H_2O formation processes are highly efficient.

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UHECR Production by a Compact Black-Hole Dynamo: Application to Sgr A*

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The possibility that the excess cosmic ray (CR) flux near 10^{18} eV, reported recently by the AGASA group, is due to a compact black hole dynmo associated with the Sgr A* source is considered. Under the assumption that the Galactic center black hole rotates with nearly maximal spin, and that the magnetic field threading the horizon is in rough equipartition with matter accreted by the hole, the spectra and total fluxes of accelerated CRs and their associated curvature emission depend only on accretion rate. For the accretion rate estimated on the basis of observations of stellar winds near Sgr A* ($\sim 10^{-3}$ Eddington), the maximum proton energy achievable by this mechanism is of the order of 10^{18} eV, and the corresponding CR power is $\sim 10^{41}\alpha_{CR}$ erg s^{-1}, where $\alpha_{CR} << 1$ is the CR production efficiency. The corresponding spectrum of curvature photons peaks at several hundreds GeV, with a total luminosity comparable to the CR power released. For much lower accretion rates both the CR and gamma-ray fluxes predicted are completely insignificant. Upcoming gamma-ray experiments, such as HESS and GLAST, can be used to probe the parameters of this system.

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Email: levinson@wise1.tau.ac.il
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Starburst Clusters in Galactic Nuclei

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Galactic nuclei often harbor a disproportionately large amount of star formation activity with respect to their surrounding disks. Not coincidentally, the density of molecular material in galactic nuclei is often also much greater than that in disks (Table 1 in Kennicutt 1998). The interplay between rich populations of young stars and dense molecular environments is evident in our own Galactic center, which hosts over 10% of Galactic star formation activity within only <0.1% of the volume of the Galactic disk. Data obtained with the VLA and HST reveal a variety of star forming sites in the Galactic Center, including a substantial population of stars that are formed in very dense and massive clusters, while other stars are formed in somewhat sparsely populated associations of massive stars. Indeed, three of the stellar clusters are the most massive and densest in the Galaxy. In this paper, we discuss the Galactic center environment and its compact young star clusters, and compare them to their counterparts in star forming galactic nuclei, concluding that dense molecular environments and large velocity dispersions combine to alter star formation activity in both cases, particularly as regards massive young clusters.

Ref.: conference proceedings, Modes of Star
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http://nemesis.stsci.edu/~figer/web/papers.html

Database of Geneva stellar evolution tracks and isochrones for $(\mathrm{UBV})_J(\mathrm{RI})_C$ JHKLL′M, HST-WFPC2, Geneva and Washington photometric systems

Thibault Lejeune[1,2], Daniel Schaerer[3]

We have used an updated version of the empirically and semi-empirically calibrated *BaSeL* library of synthetic stellar spectra of Lejeune et al. (1997, 1998) and Westera et al. (1999) to calculate synthetic photometry in the $(\mathrm{UBV})_J(\mathrm{RI})_C$ JHKLL′M, HST-WFPC2, Geneva, and Washington systems for the entire set of non-rotating Geneva stellar evolution models covering masses from 0.4–0.8 to 120–150 $M_\odot$ and metallicities Z=0.0004 (1/50 $Z_\odot$) to 0.1 (5 $Z_\odot$). The results are provided in a database which includes all individual stellar tracks and the corresponding isochrones covering ages from 10^3 yr to 16–20 Gyr in time steps of $\Delta \log t = 0.05$ dex. The database also includes a new grid of stellar tracks of very metal-poor stars (Z=0.0004) from 0.8 – 150 $M_\odot$ calculated with the Geneva stellar evolution code. The full database will be available in electronic form at the CDS (http://cdsweb.u-strasbg.fr) and at http://webast.ast.obs-mip.fr/stellar/.

Ref.: A&A, in press
Email: schaerer@ast.obs-mip.fr
Eprint: astro-ph/00114497
http://webast.ast.obs-mip.fr/stellar/

Announcements

Changes at the VLA After 14 years at the helm of the VLA, Dr. Miller Goss will be retiring as Director at the end of the coming year. Fortunately for the GC community, he will not be retiring from research, and is instead looking forward to the opportunity to indulge in research fulltime. Both as the Director of the VLA and an active GC scientist, his contributions to our understanding of the complex phenomena with the Galactic Center are innumerable. His leadership will be greatly missed, but we are eager to see where uninterrupted research will lead him, and subsequently all of us. The editors of GCNEWS would also like to take this opportunity to thank Miller for his early and continuing support of a little venture we call GCNEWS.

GC/BH Summer School The summer school on "The Galactic Black Hole" (General Relativity and Astrophysics)is taking shape, hosted by the German Physical Society (DPG) and organized by H.

Falcke & F.W. Hehl. An excellent list of lecturers has been confirmed (GC: M. Morris, S. Hüttemeister, T. Alexander, A. Eckart, F. Melia, A. Zensus; GR: V. Frolov, G. Neugebauer, B. Mashhoon, C. Kiefer). The dates are 26-31 August 2001 and international applications are welcome. More informations can be obatined at: http://www.thp.Uni-Koeln.DE/BH2001.

GC02: Galactic Center Workshop After almost four years, the next GC conference is about to materialize: February or March 2002 on the Big Island. For more information please read the editorial.

GCNEWS popular? The search engine links2go claims to evaluate traffic to popular websites and has GCNEWS among the 50 most popular Astronomy publications on the net (well, it is #47 to be fair). This is well after "Astronomy" magazine but still in front of the ESO star formation newsletter and the Irish Astronomical Journal (http://www.links2go.com/topic/Astronomical_Publications).

And finally ... Junk mails are running amok. Here is a random recent selection and our reaction:

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From: bm21@prodigy.com
Subject: IS YOUR WEB SITE MAKING MONEY?

Is Your Web Site Making Money?
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Good point, we actually never thought about that. As #47 in the world of astronomy publications we should perhaps ask for page charges for the next issue. Watch out for the next Fortune 500 list.

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From: znc@persia-mail.com
Date: Sun, 21 Jan 2001 19:43:31 +0100 (MET)

Dear manager

please let me know the field of your activity.

If you have any catalog, please send me one.

Yours sincerely,
F. Shahbazi
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This is obviously a person who knows how to start a business. We sent him a star catalog.

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