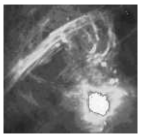
GCNEWS



The Newsletter of Galactic Center Research

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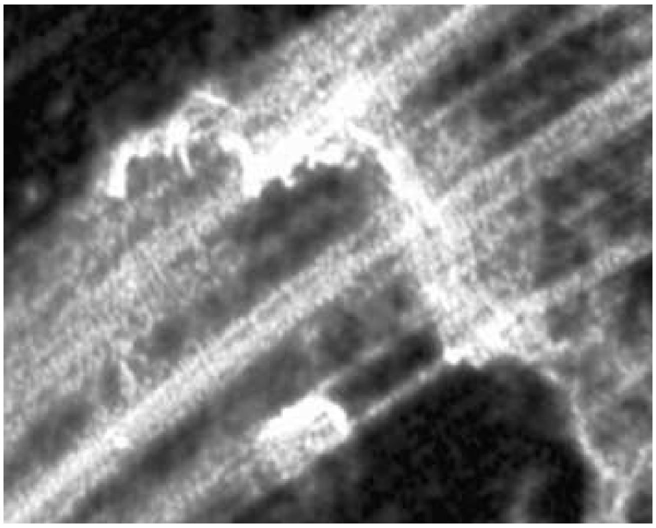
What's in a Name? — QPS: Quintuplet/Pistol/Sickle



A specialized mini-workshop is scheduled this September to discuss the QPS complex (see p. 12 for this workshop and the IAU Symp. 184). If the naming of radio regions like these confuses you, read the enlightning article by Palmer & Goss about the history of the Nomenclature in the GC. (Image from NCSA Astro. Digit. Lib.)

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Notes from the Editors: Publishing on the Internet

Angela Cotera & Heino Falcke

Soap Opera

GCNEWS is taking off nicely, we now have over 150 subscribers, including several libraries. We are continuing to work to expand the number of users to insure the widest possible audience for our subscribers. Publishing a newsletter on the Internet is not, however, without surprises. As we mentioned about a month ago in a Newsflash, we have received a communication from the *other* GCNEWS (Genoa City Newsletter) that we have to provide a disclaimer on our webpage in case the Newsletter for Galactic Center Research be confused with their copyrighted newsletter on the latest plot twists on the American daytime soap-opera "The Young and the Restless". Now, sometimes science in the U.S. may resemble a soap-opera, with Congress funding then not funding projects, NASA running then contracting out key projects — and, of course there is the drama of the job search — but we would like to think that the two newsletters would not be confused. Fortunately after closer inspection of this GCNEWS, the editors of GCNEWS agreed that no further steps are necessary. This may, however, be indicative of problems we in the science community will face in the future as business interests 'discover' the Internet. Already there has been a noticable change in the last few years in the speed with which one can ftp files or work remotely over the net.

Another amusing (at least to us) incident occured just last week. We got a message from someone we thought had subscribed to the service, asking to be taken off the list – which, considering the quality of the service, we found impossible to believe. Upon further investigation, it turned out that this person had been added to our list, and about 200 other lists, by an irate ex-boyfriend, resulting in a deludge of unwanted email. An example of a creative, if not entirely ethical, use of the Internet. Consequently, we offered to put the ex-boyfriend on our subscriber list — an offer which, even though declined, did produce some emotional relief for a while.

To check the proper usage of GCNEWS, we are constantly monitoring access of our Web-site, which seems to indicate that indeed the large majority of virtual visitors are interested in astronomy. Many are referred to our site by search engines like DIGITAL's AltaVista which automatically references keywords in all Web-pages. This means that the abstracts which appear in GCNEWS are available to a much wider audience than just the GC community. However, one sometimes wonders if the reason why Angela's article on "Hot Stars" is so popular among those coming from AltaVista has anything to do with astronomy at all.

Electronic Journals and Newsletters

Despite these amusing side effects, electronic publishing is taking off everywhere (see SCIENCE article at http://science-mag.aaas.org / science / scripts / display / full / 271 / 5250 / 764.html). The electronic version of the ApJ Letters is quite impressive and fast, even though it appears as if, despite strict format requirements, the editorial office spends a significant amount of time manually extracting papers and figures from their mailbox. A&A had lost much of its momentum towards electronic publication, gained from introducing the very useful Springer A&A LaTeX/TeX-Macros, by delaying electronic publication, and even email communication between editors, authors and referees. Now that A&A has announced bold plans to go compleletly(?) electronic, with a possible dramatic change in format, an intense discussion has started within Europe about electronic publication. Meanwhile, Elsevier Science tries to take part in this game by launching a new, fully electronic journal "New Astronomy" (http://www.elsevier.nl:80 / section / physics / newast / doc / menu.htm). The launching date seems to be later than expected, but one paper submitted to this journal can already be found in the current issue of GCNEWS – fully electronic of course.

Electronic newsletters for professional astronomers seem to be increasingly popular offsprings of recent developments in the Internet. Besides GCNEWS, there is "A Peculiar Newsletter" on Ap and related stars (http://obswww.unige.ch / ~north / APN), the Magellanic Clouds Newsletter (MCNEWS! — with a beautiful Web-page at http://www.astro.uiuc.edu / mc-news / MCNews.html) and the "Hot Star Newsletter" (http://www.inaoep.mx / ~eenens / hot) — with 340 subscribers certainly one of the largest (but with this name they must have a lot of hits from lonely and disappointed AltaVista users).

These newsletters cannot and will not replace traditional journals – however, they can help to avoid new ones. With the exponentially increasing flood of astronomy related publications, the next step would likely be the creation of new, more specialized Journals, e.g. one for each decade in photon energy or each square-degree on the sky. Instead, specialized Newsletters can provide the necessary concentration of papers by topic and provide relief from the herculean task of persuing every journal for relevant papers. This will be even more true once all articles are available electronically and a simple mouse click can establish the link between newsletter or preprint server and the archived journal paper. Given the potential of wider circulation and accessibility, it is surprising that neither publishers nor Astronomical Societies seem to be a driving force in this development.

This Issue

In this issue, in addition to a very interesting, and sometimes amusing, article by Patrick Palmer and Miller Goss on the origin of the nomenclature of the Sagittarius radio sources, and the abstracts of some recent, very exciting papers, we have two announcements on upcoming conferences. The first to occur, will be a short conference on the Pistol and Sickle complex in Los Angeles in mid-September. The other conference will be next summer in Kyoto, Japan — don't forget to include this trip in your 1996-97 travel budgets!

Our policy is that we are happy to distribute all information related to the Galactic Center to our subscribers. If you are interested in reaching our subscribers all you need to do is email us at gcnews@astro.umd.edu and we will send out your announcement with the next Newsflash and include it in the next Newsletter. In addition our Web-page contains a listing of current subscribers (unless they object) with email and departmental addresses to facilitate personal communication — similar to the AAS directory. Those email addresses are, however, only available one-by-one and not as a bulk list. By maintaining control over access to our subscriber list we hope to ensure the quality and relevance of the information you receive.

Nomenclature of The Galactic Center Radio Sources

Patrick Palmer *(University of Chicago)* and W. Miller Goss *(National Radio Astronomy Observatory)*[1]

The discovery of the dominant source in the Galactic center, Sagittarius A, in the era 1951 – 1960 has been described by Goss and McGee at the recent ESO/CTIO conference[2]. Due to the high density of sources in the Galactic center and the wide range of spectral indices, the recognition of the many components of Sgr A was dependent on both resolution and observing frequency.

In some sense Karl Jansky and Grote Reber did discover the Galactic center radio source in the 1930's – 1940's. However, with their poor resolutions (beams of many degrees) the radio emission that was detected was the Galactic background peak near the Galactic center. The recognition that discrete radio sources existed (other than the Sun) emerged in the era 1946 – 1948[3]; until that era radio emission was regarded as coming from a general background[4].

The realization that Sgr A is a discrete radio source at the Galactic center was first made by Jack Piddington and Harry Minnett[5] . These authors had the handicap that they published in a rather obscure journal – Australia was even more isolated from Europe and the US in the 1950's than at present. Often the credit for the association of Sgr A with the Galactic nucleus is given to McGee and Bolton based on their 1954 paper in *Nature*[6]. Of course, the fact that *Nature* was more widely read than the Australian publication did help. However, many famous astronomers of the 20th century played a role in the preparation, refereeing, and publication of the 1954 paper: Baade, Oort, van de Hulst, Pawsey, Mills, Kerr, Bracewell and Shain. Goss and McGee have corrected the previously published record on the details of the publication of the 1954 *Nature* paper. Bernie Mills has been especially helpful in reconstructing the atmosphere at the CSIRO Division of Radiophysics in Sydney, NSW, Australia in the early 1950's and the understanding of the nature of radio sources at that time. In the late 1950's the association of Sgr A with the center of the Milky Way was generally accepted[7].

Dick McGee pointed out to us that in those early years the name Sgr A was *not* used in Australia . This is rather puzzling since John Bolton and his collaborators (Bruce Slee, Gordon Stanley and Kevin Westfold) had given the names Taurus A, Centarus A, and Virgo A to other early radio sources discovered at Dover Heights in Sydney. Goss has tried to find the earliest reference to Sgr A (can anyone find an earlier reference ?). The earliest found is in *Sky and Telescope* in 1954[8] in a summary of a paper given at the June 1954 American Astronomical Society Meeting in Ann Arbor, Michigan by John Kraus and H. C. Ko. John Kraus has recently written: "... whether or not I actually 'invented' the name Sagittarius A , I was certainly one of the first to use it consistently. Then more recently I took the naming a step further by calling it J1 for Jansky One. See page 313 of my book *Big Ear Two* ...." [9] As we know J1 did not catch on!

The names of the discrete sources around Sgr A have a complex and confusing history. One might ask why bother with it: the names based on galactic coordinates are perfectly sufficient and unambiguous. First, if one wishes to read the older literature, one must be aware of certain pitfalls; but, perhaps the more important result of this study is that it reveals the importance of private communications and unpublished manuscripts in the development of this field.

The first map of the Galactic center region with adequate resolution to resolve several distinct sources around Sgr A was made by Frank Drake in 1959 with the 85 foot telescope at Green Bank at 3.75 cm[10]. Drake himself never named the components[11]. However, he distributed the map widely, including sending a copy to James Lequeux for use in his thesis. Lequeux recalls[12] adding the designations A for Sgr A, and B1, B2, and B3[13] for the other three prominent discrete sources (ordered by their distance from Sgr A) to Drake's figure for use in his 1962 paper in *Annales d'Astrophysique*[14] . In modern terms, sources B1, B2, and B3 correspond to G0.2-0.0, the blend of G0.5-0.0 and G0.7-0.0, and G359.4-0.1. (Kraus and Ko had already defined a Sgr B in 1954[8]; however, this source at $\ell \sim 4°$ does not appear elsewhere in the literature.)

Soviet astronomers, especially Yuri Parijskij, also were studying the Galactic center at this time[15], and they also proposed names for the components. However, because their source names were not picked up by others, no attempt will be made here to trace them. Drake notes facetiously that it is a pity that these names were not used because the sources on opposite sides of Sgr A (B2 and B3) were interpreted as part of a ring which was named the "Drake Ring"[11].

Relatively little use was made of Lequeux's names. For example, in Cooper and Price's 10 cm map made at Parkes in 1962, no names were attached to the sources[16]. Rougoor, however, used Lequeux's names in his 1964 paper on the nuclear region of the Galaxy[17].

A surprisingly influential unpublished paper helped disseminate the Lequeux names in Jaunary 1965. Dennis Downes, then an undergraduate at Harvard, wrote a term paper on Galactic center radio emission for a course given by Alan Maxwell[18]. In this paper he used Lequeux's naming system and added B4 for a source near $\ell = 1.1°$ that was on Cooper and Price's map but beyond the edge of Drake's map. This paper was distributed to other radio astronomers at Harvard; and, because it was found to be very useful by them, 50 - 100 copies were made and distributed to other radio astronomers around the world[19]. However, when this paper was published in 1966 in collaboration with Alan Maxwell[20], the Sgr Bn form of names was discarded and names based on Galactic coordinates were used.

The shift to names based on Galactic coordinates had been discussed for some time, but it was most clearly proposed by Mezger and Henderson in 1967[21]. In fact, the Galactic center region was one of their prime examples that something else should be done: "... the example of the Sagittarius region, where designations A, B, C, etc., are used concurrently with designations A, B1, B2, etc., shows clearly that this type of nomenclature will lead to serious confusion as more results of high resolution studies ... become available."

The last appearance of B1 in the literature for more than 20 years (and the only appearance of B4) is found in a paper on OH by Palmer and Zuckerman in 1967[22]. The name B2 persisted (although it silently migrated from $\ell = 0.6°$ – the centroid of the low resolution blend – to $\ell = 0.7°$), probably because of the almost continuous interest in this source due to the various molecular discoveries. Otherwise the system of naming components by their Galactic coordinates triumphed among the radio astronomers.

A new attempt to name Galactic center sources was made by Hoffmann, Fredrick, and Emery in 1971[23] for their 100 micron survey of this region. They named sources A, B2, C, D, and E. Sgr A and B2 corresponded to the radio astronomer's sources with the same names, but they introduced C (corresponding to Lequeux's B3 at $\ell = 359.4°$), D (corresponding to Downes' B4 at $\ell = 1.1°$), and E (only later studied by radio astronomers at $\ell = 358.4°$). Sgr B1 was lost.

Sgr B1 reappeared in 1986 in a proposal for recombination line studies at the VLA by Palmer, Yusef-Zadeh, Goss, Lasenby, & Lasenby[24]. The name Sgr B1 was apparently suggested by Yusef-Zadeh. He knew that a source name Sgr B1 had been used in the past, but had been unable to find any definite information about it, and made the apparently straightforward identification of G0.5-0.0 with Sgr B1[25]. The observations were carried out, as were other observations of the region, and the name Sgr B1 came back into use[26].

However, Sgr B1 was not the source so named by Lequeux! In modern terms, Lequeux's Sgr B1 is the source now called G0.2-0.0. The source called Sgr B2 in the early papers was a blend of G0.5-0.0 and G0.7-0.0, the sources now called Sgr B1 and Sgr B2. (Palmer should have known better, but did not think about the contradiction between the OH spectra for Sgr B1 and Sgr B2 in the paper referenced in note 22 if Sgr B1 had been at the current position until discussion leading to preparation of this report.)

What of the future for names of Galactic sources? It is clear that there is no simple solution. The G – type names are indeed unambiguous; but at the time they were proposed, the extent to which Galactic sources would continue to resolve was not foreseen. For example, Sgr B2 is now known to contain almost 60 components[27]. In order to manage this complexity, one needs some larger organizing principles which the letter – type names provide. It seems that for practical reasons both types of names will continue to coexist.

We are indebted to very helpful correspondence from a number of individuals, some of whom were "bugged" many times for details. We especially wish to thank Dennis Downes, Frank Drake, James Lequeux, Harvey Liszt, John Kraus, Dick McGee, David Mehringer, Peter Mezger, Mark Morris, and Farhad Yusef-Zadeh.

Notes

1 The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.
2 Goss, W. M. & McGee, R. X. 1996, in *Proceedings of the 4th ESO/CTIO Workshop: The Galactic Center* ed Gredel and Schommer, in press.
3 Beginning with Hey, Parsons & Phillips, (Nature, 158, 234 (1946)) who write "It appears probable that such variations could only originate from a small number of discrete sources."; followed by Bolton and Stanley (Australian J. Sci. Res., Ser A, 1, 58 (1948)) and Ryle and Smith (Nature, 162, 462 (1948)) who provided the earliest source diameter measurements.
4 For example, Pawsey, Payne-Scott & McCready (Nature, 157, 158 (1946)) argued that the observed radio emission was the sum of emission from large numbers of stars emitting radio waves by the same (unknown) mechanism as sunspots; while Greenstein, Henyey, & Kennan (Nature, 157, 805 (1946)) defended their view that it was free-free emission from the interstellar medium.
5 Piddington, J. H. & Minnett, H. C. 1951, Australian J. Sci. Res, Ser A, 4, 495.
6 McGee, R. X. & Bolton, J. G. 1954, Nature, 173, 985.
7 Representative examples of this acceptance are: the title of an article "The Radio Position of the Galactic Nucleus" (Kraus, J. D. & Ko, H. C 1955, Ap. J., 122, 139); a note on the source W24 "believed to be the Galactic nucleus" (Westerhout, G. 1958, B. A. N., 14, 215), and finally the five papers published in MNRAS giving reasons for the redefinition of the Galactic coordinate system and the actual form which the new definition takes. These papers begin with Blaauw, Gum, Pawsey, and Westerhout (MNRAS, 121, 123 (1960)) which states: "We shall, on the basis of evidence presented in Paper V, assume that Sagittarius A is located at the Galactic centre."
8 (uncredited news story) 1954, Sky & Telescope, 14, 22; subsequently published in: Kraus, J. D. & Ko, H. C. 1955, Ap. J., 175, 159.
9 J. Kraus, letter to W. M. Goss, May 7, 1996.
10 This map was never published in the refereed literature, but did appear in the NRAO Annual Report for 1959.
11 F. Drake, telephone conversation, July 10, 1996.
12 J. Lequeux, letter to W. M. Goss, June 13, 1996.
13 Lequeux used the numbers as subscripts. However, almost from the beginning, there was no consistency about whether or not the numbers were subscripts; consequently, there is little point trying to decide on a "correct" way to write them.
14 Lequeux, J. 1962, Annales d'Astrophysique, 25, 221.
15 See for example, Parijskij, Y. 1959, Soviet Physics – Doklady, 4, 1172.
16 This map was first shown by Kerr (Sky & Telescope, 24, 254 (1962)). It was later published by Cooper, B. F. C. & Price, R. M. 1964 in *The Galaxy and the Magellanic Clouds*, ed F. J. Kerr & A. W. Rodgers (Aust. Acad. Sci.), p. 1964.
17 Rougoor, G. W. 1964, B. A. N., 17, 381.
18 D. Downes, unpublished manuscript, January, 1965; revised August, 1965.
19 D. Downes, letter to W. M. Goss, July 10, 1996. A copy was sent to J. G. Bolton who acknowledged receipt of the paper in a letter to Downes on October 15, 1965.
20 Downes, D. & Maxwell, A. 1966, Ap. J., 146, 653.
21 Mezger, P. G. & Henderson, A. P. 1967, Ap. J., 147, 471.
22 Palmer, P. & Zuckerman, B. 1967, Ap. J., 148, 727.
23 Hoffmann, W. F., Fredrick, C. L. & Emery, R. J. 1971, Ap. J., 164, L23.
24 Proposal AP139, received Dec, 19, 1986; VLA proposal archive.

25 F. Yusef-Zadeh, telephone conversation, July 10, 1996.
26 See, for example, Liszt, H. L. 1988, in *Galactic and Extragalactic Radio Astronomy* ed G. L. Verschuur & K. I. Kellermann (Springer: New York), p. 359; Morris, M. 1989, in *The Center of The Galaxy* ed M. Morris (Kluwer: Dordrecht), p. 171; and Mehringer, D. M., Yusef-Zadeh, F., Palmer, P. & Goss, W. M. 1992, Ap. J., 401, 168.
27 Gaume, R. A., Claussen, M. J., De Pree, C. G., Goss, W. M., & Mehringer, D. M. 1995, Ap. J., 449, 663.
28 The interest of W. M. Goss in this topic began during visits with John & Letty Bolton in Buderim, Queensland, Australia in September, 1988 and November, 1992. The last visit was a short time before John Bolton's death on July 6, 1993.

Abstracts

G357.1−00.2: a peculiar nonthermal radio source near the Galactic Centre

Andrew D. Gray

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The Galactic Centre is home to a number of unusual non-thermal radio emitting objects, such the filaments and threads near Sgr A, the Snake, and G357.7−0.1. This paper presents recent high resolution radio observations of an object first catalogued at low resolution nearly 20 years ago, which reveal it to have unsuspected properties. The possible classifications of this object are discussed.

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http://www.drao.nrc.ca/~agray/chile.ps.Z

Old Isolated Accreting Neutron Stars: The Diffuse X–ray Emission From The Galactic Center

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The contribution of weakly–magnetized ($B \sim 10^9$ G) neutron stars accreting the interstellar medium to the diffuse X–ray emission observed in the Galactic Center is investigated. It is shown that, under rather conservative assumptions about the neutron stars and gas distributions, the accretion luminosity can account for a sizable fraction, possibly most, of the detected X–ray flux in the 2.5–7 keV band. In particular, model results are compared with *Granat* data and show a general agreement in both the flux energy and radial distributions.

to be published in ApJ
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http://xxx.lanl.gov/abs/astro-ph/9605071

TGRS Observation of the Galactic Center Annihilation Line

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The TGRS (Transient Gamma-Ray Spectrometer) experiment is a high-resolution germanium detector launched on the WIND satellite on Nov. 1, 1994. Although primarily intended to study gamma-ray bursts and solar flares, TGRS also has the capability of studying slower transients (e.g. x-ray novae) and certain steady sources. We present here results on the narrow 511 keV annihilation line from the general direction of the Galactic Center accumulated over the period Jan. 1995 through Oct. 1995. These results were obtained from the TGRS occultation mode, in which a lead absorber occults the Galactic Center region for 1/4 of each spacecraft rotation, thus chopping the 511 keV signal. The occulted region is a band in the sky of width 16′

that passes through the Galactic Center. We detect the narrow annihilation line from the galactic center with flux = $(1.64 \pm 0.09) \times 10^{-3} ph cm^{-2} s^{-1}$. The data are consistent with a single point source at the galactic center, but a distributed source of extent up to $\sim 30'$ cannot be ruled out. No evidence for temporal variability on time scales longer than 1 month was found.

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http://www.aas.org/ApJ/v463n2/5127/5127.html

2.2 μm Keck Images of the Galaxy's Central Stellar Cluster at 0.″05 Resolution

B. L. Klein, A. M. Ghez, M. Morris, and E. E. Becklin

UCLA Department of Physics and Astronomy

We present preliminary results from a high angular resolution study of the inner $5'' \times 5''$ of the central Galactic stellar cluster. This program was carried out at the W. M. Keck telescope using the facility near-infrared camera with a $K[2.2\mu\text{m}]$-band filter. A few thousand short exposure frames, combined using a shift-and-add algorithm, contribute to the final image which has the diffraction-limited resolution of 0.″05. Even prior to deconvolution, sources as faint as $\sim 15^{th}$ Kmag are detected at the 5σ level and new isolated point sources are identified.

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The galactic center arc as source of high energy γ-rays

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In this paper we discuss the radio *arc* at the galactic center to be the counterpart of the high-energy γ-ray source 2EG J1746-2852. Though 2EG J1746-2852 must be regarded as true source in excess of the diffuse background, its position can not be determined to better than 0.3°. The observed flux is constant within the statistical limits and the spectrum is very hard. The lack of variability makes it highly unlikely that any of the compact sources in the vicinity of the Galactic Center is the counterpart of 2EG J1746-2852. This includes the peculiar source Sgr A* at the very center of the Galaxy, which is often discussed to harbour a black hole of $10^6 M_\odot$. Existing radio data on the *arc* support the view that its synchrotron emission originates from cooling, initially monoenergetic electrons which diffuse and convect from their sources to the outer extensions of the *arc*. If the source of high-energy electrons coincides with the sickle region (G0.18-0.04), as indicated by the radio data, then the ambient far-infrared (FIR) photons can be up-scattered to γ-rays by inverse-Compton interaction with the young high-energy electrons. We solve the continuity equation for the electrons including terms for diffusion, convection, monoenergetic injection, and the full energy loss. With that we show that the predicted γ-ray emission depends mainly on the magnetic field strength in the *arc* and that both the flux and the spectrum of 2EG J1746-2852 can be well explained. Our model shall be tested on radio data at frequencies beyond 10 GHz in future work.

A&A in press
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http://xxx.lanl.gov/abs/astro-ph/9605145

Detection of OH(1720 MHz) Masers at the Galactic Center: Evidence for Shock Excited Gas and Milli-Gauss Fields

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Radio observations of the Sgr A region have been carried out at the 1720 MHz transition of the OH molecule using the Very Large Array (VLA) and the Australia Telescope Compact Array (ATCA). OH(1720 MHz) maser emission is detected at seven different positions within a few arcminutes of the Galactic center. Most of the masers are located to the southeast of Sgr A*, at the boundary of the Sgr A East nonthermal source with the M−0.02−0.07 molecular cloud. One maser is located within the circumnuclear disk (CND) and another may arise as the result of an expansion of Sgr A East into molecular gas to the northwest of Sgr A*. It is likely that these maser features are excited by the interaction of shocks in the Galactic center with adjacent molecular gas. Significant circular polarization is observed toward ten distinct spectral components in the seven maser spots; if the V signal is due to Zeeman splitting, preliminary measurements of strong fields (local line-of-sight components of $\mathbf{B}$ [B_{los}] are estimated to be between 2-4 milligauss) are inferred toward all sources. The direction of these magnetic fields is positive for all masers except for the CND maser, which is negative. The potential for these maser features as a diagnostic of shocked gas in the Galactic center is discussed.

ApJ Letters, in press
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The 1720 MHz OH Emission from G359.1–0.5 and the CND

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VLA observations of the CND, which surrounds Sgr A West, and G359.1–0.5 have been carried out at the 1720 MHz transition of the OH molecule. 1720 MHz OH maser emission has been detected from the CND and G359.1-0.5 at velocities near V_{LSR} = +132 and −5 km s−1, respectively. The OH maser features toward G359.1–0.5 have been detected along the interface between a large-scale non-thermal continuum shell G359.1–0.5 and its surrounding ring of high velocity molecular CO gas. The V spectra of a number of bright maser sources associated with the CND and G359.1–0.5 suggest strong magnetic fields between 0.4 and 4 mG. We argue that these masers are produced at the boundaries of G359.1–0.5 and the CND and that the maser features signify regions of shocked gas resulting from the supernova expansion and from cloud-cloud collisions at the Galactic center.

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Modelling the Galatic Bar using Red Clump Giants

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The color-magnitude diagrams of $\sim 7 \times 10^5$ stars obtained for 12 fields across the Galactic bulge with the OGLE project reveal a well-defined population of bulge red clump giants. We find that the distributions of the apparent magnitudes of the red clump stars are systematically fainter when moving towards lower galactic l fields. The most plausible explanation of this distinct trend is that the Galactic bulge is a bar, whose nearest end lies at positive galactic longitude. We model this Galactic bar by fitting for all fields the observed luminosity functions in the red clump region of the color-magnitude diagram. We find that almost regardless of the analytical function used to describe the 3-D stars distribution of the Galactic bar, the resulting models have the major axis inclined to the line of sight by $20-30°$, with axis ratios corresponding to $x_0 : y_0 : z_0 = 3.5 : 1.5 : 1$. This puts a strong constraint on the possible range of the Galactic bar models. Gravitational microlensing can provide us with additional constrains on the structure of the Galactic bar.

submitted to New Astronomy
email: stanek@astro.princeton.edu
http:ftp://www.astro.princeton.edu/stanek/Barmodel/
http://xxx.lanl.gov/abs/astro-ph/9605145

Our Galactic Center

W. Kundt

IfA of Bonn University

My 1990 twin-exhaust model is updated [Ap & SS **172**, 109]. The ribbon of falling high-velocity clouds in the upper Galactic hemisphere can be traced back to Sgr A, via the approaching 21 cm 'jet' of Burton & Liszt (1978) and a nested set of four parallel 'chimneys', and further to Sgr A* via Sgr A East and Sgr A West. Lower spectral turnovers of Sgr A East, A West, and A* are interpreted as Razin cutoffs. Five stars near Sgr A* show blown-off windzones, including IRS 7.

in: Jets from Stars and Galactic Nuclei, Lecture Notes in Physics 471, ed. W. Kundt, Springer 1996, pp. 284-287
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OH/IR Stars - Dynamical Studies

Anders Winnberg

Onsala Space Observatory, Sweden

Since 20 years surveys have been undertaken to find OH/IR stars in the central parts of our Galaxy using various radio telescopes around the world. The present paper gives a review of such surveys and of dynamical studies using their data. Presently, two major survey projects are going on: a deep search in the very Centre of the Galaxy using both VLA monitoring data and new AT data and a large–scale survey of the area $|l| \leq 45°$, $|b| \leq 3°$ also using both VLA and AT data. The fact that only three parameters per OH/IR star are known – the two sky coordinates and the line–of–sight velocity – implies that severely limiting and simplifying assumptions have to be made regarding the distribution function of the stars and the gravitational potential. Usually spherical symmetry and isotropic velocity dispersion have been assumed. Recently, a project has been initiated to determine the proper motions of the OH/IR stars close to the Galactic Centre using the VLA and the VLBA on the associated H_2O and SiO masers. It is pointed out that the analysis of $l - v$ diagrams so far has overlooked the fact that they are superpositions of many $l - v$ diagrams from concentric ring areas within the total area. The slopes of the regression lines of these 'inner' $l - v$ diagrams get increasingly larger for smaller areas. The '$l - v$ slope' as a function of galactocentric distance is that expected for differential rotation in an r^{-2} mass density distribution, a fact which also is suggested by the surface density distribution of the stars.

to appear in the proceedings of the 4th ESO/CTIO workskop: "The Galactic Center", R. Gredel
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Detection of Stellar Variability in the Central Parsec of the Galaxy

M. Tamura, M.W.Werner, E.E.Becklin and E.S.Phinney

We have searched for time variability of the stars in the central parsec of the Galaxy through K-band (2.2um) imaging and photometry. The observations were made with an array-based camera at the NASA Infrared Telescope Facility in 1991, 1992, and 1993. In 1991, on timescales ranging from 20 seconds to a week, no time variability greater than 0.1 mag was found for about five dozen sources in this region, and the brighter sources were stable to ~0.05 mag. On timescales of one to two years, we found a new source near IRS10E that varied in brightness by at least one magnitude and detected variability of 0.15 to 0.5 mag in several other sources, most notably the red giants IRS9 and IRS12N. None of the luminous blue stars identified in the Galactic center region show evidence for variability.
to appear in ApJ, August 20, 1996
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44 GHz Methanol Masers and Quasi-Thermal Emission in Sagittarius B2

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The Very Large Array has been used to obtain ~3″ resolution observations on the 44 GHz $7_0 - -6_1 A^+$ transition of CH_3OH (methanol) in the Sgr B2 massive star-forming complex. A total of 18 compact regions showing maser emission are found, which are spread over a 2.1 pc × 4.3 pc ($\alpha \times \delta$) region. Many of these are offset far from known molecular cores and ultracompact HII regions and may trace the interaction region of a cloud-cloud collision. There is no spatial coincidence between 44 GHz and 6.7 GHz CH_3OH masers in this region, as expected because the pumping mechanisms for these two transitions are different. Isotropic maser luminosities range between 1×10^{-6} and 2.1×10^{-5} $L_\odot$. In addition, 17 regions with broad-linewidth quasi-thermal 44 GHz CH_3OH emission are identified, many of which are close to known molecular hot cores, in particular those associated with the Sgr B2(N) and Sgr B2(M) continuum sources. In Sgr B2(N), quasi-thermal emission appears to be associated with two 10″ diameter ionized shells. These ionized shells may have swept up and shocked molecular material as they expanded. Also, a quasi-thermal core is observed to be coincident with a source of continuum emission from dust and emission from more complex species. In Sgr B2(M), CH_3OH quasi-thermal emission arises predominately from the western portion of this region. The CH_3OH fractional abundance in most of the quasi-thermal cores appears to be quite high at $\sim10^{-6}$. It is argued that grain-surface chemistry is responsible for this high abundance.

Accepted by ApJ
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ftp://ftp_astro.uiuc.edu/pub/dmehring/sgrb2/preprint.tar.gz

The Dark Mass Concentration in the Central Parsec of the Milky Way

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H. Kroker & L.E. Tacconi-Garman

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We report ∼1″resolution K-band (2μm) imaging spectroscopy of the central parsec of our Galaxy. The derived radial velocities for 223 early and late type stars probe the nuclear mass distribution to spatial scales of 0.1 pc. We find a statistically very significant increase of projected stellar velocity dispersion from about 55 km/s at p∼5 pc to 180 km/s at p∼0.1 pc. The stars are also rotating about the dynamic center. The late type stars follow general Galactic rotation, while the early type stars show counter- rotation. Fitting simultaneously the observed projected surface densities and velocity dispersions we derive the intrinsic volume densities and radial velocity dispersion as a function of distance from the dynamic center for both types of stars. We then derive the mass distribution between 0.1 and 5 pc from the Jeans equation assuming an isotropic velocity field. Our analysis requires a compact central dark mass of 2.5 to 3.2×10^6, at 6 to 8σ significance. The dark mass has a density of 1-9 $M_\odot pc^{-3}$ or greater and a mass to 2 μm luminosity of ≥100. The increase in mass to luminosity ratio can be reduced but not eliminated even if extreme anisotropic velocity distributions are considered. The dark mass cannot be a cluster of solar mass remnants (such as neutron stars). It is either a compact cluster of 10-20 $M_\odot$ black holes or a single massive black hole.

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The First Mid-Infrared Detection of a Source Coincident with Sagittarius A*

Susan R. Stolovy, T. L. Hayward & Terry Herter

Department of Astronomy, Cornell University

We present the first mid-infrared detection of a source coincident with the black hole candidate Sgr A* in a deep image of the inner parsec of the Galaxy. These data were obtained with SpectroCam-10 at the 200-inch Hale telescope. The source was detected at 8.7 μm on two separate occasions using different observing techniques. The spatial resolution is ∼ 0.″7 and the noise level is 1.6 mJy beam^{-1} in the combined mosaic near Sgr A*. A source at Sgr A* is weakly apparent in the raw data, but is difficult to identify due to strong diffuse dust emission with a mean flux density of 500 mJy arcsec^{-2}. Several deconvolution techniques were applied to achieve the diffraction limit of 0″44, all of which revealed a peak on a narrow NW-SE ridge of emission. The peak is coincident with Sgr A* within the ±0″3 uncertainty in locating Sgr A* relative to IRS 7. We estimate the flux density of the Sgr A* source above the ridge to be 25 ± 5 mJy. The extinction-corrected 8.7 μm flux density of ∼ 100 mJy is significantly greater than what is predicted by dustless accretion disk models. The excess emission is best explained by warm dust which may be associated with Sgr A* or heated by local stellar sources.

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Conference Announcements

Preliminary circular: IAU Symposium No. 184

Central Regions of the Galaxy and Galaxies

- Place: Kyoto, Japan
- Date: 1997 August 18-22 (beginning of the General Assembly of IAU, Kyoto, Aug. 17-30)
- Proposed/sponsored by IAU Division X and Commission 40 (Radio astronomy), Supported by Commissions 28 (galaxies), 33 (structure & dynamics of galactic systems.

Purpose

Understanding the general characteristics of dynamics, mass and ISM distributions, evolution, activities including outflow/inflow, shocks, and starformation, in the central regions of the Galaxy and galaxies. Highlights also on black holes and related activity.

For efficient inter-comparison among the phonemena in the central regions, speakers/attendants from radio, IR/FIR, optical, X-rays would be requested to present their data in a coherent manner (e.g. in scales, units). Theorists would be requested to interpret and unify the data toward a general view of the central regions.

Topics to be Covered

- STELLAR CLUSTERS AND STAR FORMATION
  Nuclear star clusters in M.W. and galaxies
  Star formation
  IR spectroscopy and imaging
  Masers in the GC
  Bulges
- NUCLEAR INTERSTELLAR MEDIUM
  Neutral ISM in the GC
  Molecular gas in nuclei of galaxies
  Gas dynamics in the GC (from kpc to pc)
  IR observations of the central parsecs
  X-ray observations and High-energy phenomena
  Outflow and high-temperature gas
  Radio continuum and Magnetic Phenomena
  Elements and spectroscopy in nuclear gas
- CENTRAL ACTIVITY AND BLACK HOLES
  Black holes in galaxies
  Case for black hole in the GC
  Nature of compact radio sources
  BH powering of AGN and jets

Science Organizing Committee

Y. Sofue (radio; chair),
R. Genzel (IR; co-chair),
M. Morris (radio; co-chair),
F. Combes (galaxies, theory),
J. Binney (dynamics, theory)
N. Scoville (radio),
J. Kormendy (optical),
M. Tsuboi (radio)

Contact person: Yoshiaki Sofue
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Institute of Astronomy, University of Tokyo, Mitaka, Tokyo 181, Japan

Local Organizing Committee

Local organization (lodging etc.) will be made by a common LOC of the General Assembly in Kyoto 1997, and announced in the IAU bulletin, etc.

Some deadlines (tentative)

- Call for papers: announced till 1996 Sept-Oct
- Submission of title and abstract: 1997 March Registration: same as for GA Kyoto: see above.

A Specialized Mini-Workshop will be held at UCLA on September 19 & 20, 1996 *on:*

QPS: A Rosetta Stone for Understanding Large-Scale MHD Activity near the Galactic Center?

QPS is the Quintuplet(AFGL2004)/Pistol(G0.15-0.05)/Sickle (G0.18-0.04) complex located at the intersection of the Radio Arc with the Galactic plane. At the present time, a number of groups are studying this fascinating region with a variety of techniques, so we propose to have an informal meeting of minds about the nature of the interactions taking place there. The discussion will be focussed on four areas:

- The nature of the stars in the Quintuplet, and their winds,
- The physical conditions in the HII regions and in the neighboring molecular clouds, and the constraints they pose on the ionization mechanism and the source of ionization,
- The evidence for magnetic fields and the constraints on the magnetic field geometry, both inside and outside of the dense clouds there, and
- The mechanisms for generating the nonthermal radio filaments of the Arc.

Related topics, such as the neighboring "radio arches" and the possibly associated stellar cluster can also be addressed, time permitting.

If you wish to attend, please send a message to Mark Morris (Morris@astro.ucla.edu), stating whether you wish to present a 15-to-30 minute paper, and if so, what its title will be. We can help with hotel reservations in Westwood, with sufficient advance notice, so please state which nights you would like to have a room. The schedule will only be set after we have assessed the response to the announcement. Friday afternoon, September 20 will tentatively not be scheduled, unless the response is quite strong. We now expect 15 to 25 attendees.

Further information will be sent to those who respond to this announcement. Please note that this meeting is unfunded, so we will not be offering assistance for travel or subsistence.

Organizing committee: Mark Morris, Don Figer, Cornelia Lang, Gene Serabyn.

Other Announcements

- The next GCNEWS letter abstract deadline is Friday, Sept 27. However, you can submit an abstract at any time and it will be sent out later that week as an email message: our 'Newsflash' service.
- Be sure to check the GCNEWS web site for the papers you are interested in, many of them are linked. If you'd like information about how to make your paper available over the web, let us know. The more papers that we can make electronically available the more useful this newsletter service will be to everyone involved.
- Remember HST proposals are due September 13th. You can request proposal quidelines and instrument manuals over the web at http://www.stsci.edu/ftp/proposer/phase1-hardcopy-request.html.

GCNEWS Subscriptions and Submissions

There are several ways to subscribe to GCNEWS all of which are presented at the web site. For those without access to the web, simply send us an empty email message with the Subject keyword "subscribe". A subscription form will be sent to you automatically. Fill out the form and return it to become a part of our service or just send us a postcard.

To submit an abstract, the easiest way for you is to simply mail us the text of your paper (TeX/Latex, any style) *in the same format you used for the journal submission.* We would actually prefer to receive the whole paper, without any special modifications, rather than only the abstract — we are using a script that extracts the abstract almost automatically. You can help us a little bit by mailing us your abstract with the following Subject line:

Subject: submit filename *reference*
for example
Subject: submit sgrapaper.tex *ApJ, in press*

If you have an E-Print server number for your paper (astro-ph/#######) or a web-link, please include this information in the first lines of your submission (e.g. %http://www.sgr.edu/paper.ps). For more information about submitting a paper, please visit the web site.

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Comments and suggestions are welcome.

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