

**A91-11369** Optical switches, transistors, and multivibrators tolerant to signal phase instability (Opticheskie perekliuchateli, tranzistory i mul'tivibratory, ustoiichivye k nestabil'nosti fazy signala). A. A. MAIER, *Akademii Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 312, No. 4, 1990, pp. 855-859. 11 Refs.

The method of optical switching in tunnel-coupled waveguides proposed by Maier (1982) provides a way to create switching elements for optical computers, transistors, multivibrators, and other devices. Here, an application of the method is examined whereby the output characteristics of a switch are independent of the input signal phase. Optical switches and transistors with output characteristics independent of the input signal phase are described, as are optical multivibrators in which the output wave intensities are independent of the signal phase taper in the feedback circuit.

**A90-43021** Integrated optics and magnetic optoelectronics (Integral'naia optika i magnitnaia optoelektronika). V. D. TRON'KO and N. V. SHIMANSKAIA, *Optoelektronika i Poluprovodnikovaia Tekhnika* (ISSN 0233-7577), No. 17, 1990, pp. 1-10. 31 Refs.

The magneto-optic properties of ferrite-garnet single crystals and single-crystal films and the electrodynamics of wave propagation in planar magnetic structures are investigated. Integrated devices based on ferrite-garnet films and their applications are discussed. The factors that currently limit the use of magneto-optic materials in integrated optics are examined, and specific fundamental and applied problems are identified in which the use of magneto-optics would be beneficial.

**A90-26413** A finned dielectric line and some devices based on it (Reberno-dielektricheskaia liniia i nekotorye ustroistva na ee osnove). V. I. GVOZDEV, E. I. NEFEDOV, T. I. CHERNIKOVA, and V. A. SHEPETINA, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 35, Feb. 1990, pp. 298-305. 12 Refs.

A method for the rigorous electrodynamic analysis of a finned dielectric line (a type of guide structure for microwave integrated circuits) is developed. The approach used is based on the method of partial domains and systems of integral equations which are algebraized using the Galerkin method. Experimental results are presented concerning regular finned dielectric lines and a number of elements based on them (e.g., loads, excitation devices, and directional couplers).

**A90-39487** Waveguide mode diffraction by a finite system of ribbons in a layered dielectric (Difraktsiia volnovodnykh voln na konechnoi sisteme lent v sloistom dielektrike). V. A. KUZNETSOV, A. M. LERER, and G. N. SHELAMOV, *Radiofizika* (ISSN 0021-3462), Vol. 33, April 1990, pp. 479-487. 12 Refs.

The paper is concerned with the problem of electromagnetic wave diffraction by an arbitrary number of strips in a metallic waveguide filled with a layered dielectric and by strips located on the surface of a plane dielectric waveguide. The problem is solved by the partial domain method, avoiding the need for considering in explicit form the continuous spectrum for open structure and attenuating modes for closed structures. The results of the study have been used in the synthesis of strip filters based on inductive strips fabricated by integrated circuit technology.

**A90-39454** The fin-slot line—Theory, experiment, and devices (Reberno-schелеvaia liniia—Teoriia, eksperiment i ustroistva). V. I. GVOZDEV, G. A. KUZAEV, and V. A. SHEPETINA, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 35, May 1990, pp. 954-958. 9 Refs.

A transmission line with orthogonal dielectric and plane conductor layers is proposed in which the fins of the conductor layers form a slot structure in the center. The electromagnetic fields of the structure are modeled using a simple method that does not require the full solution of the complex boundary value problem. Based on the results of theoretical and experimental studies, three-coordinate power dividers and three-dimensional radiating structures have been developed.

**A90-30391** State of the art and development prospects of neuro-computer technology (Sovremennoe sostoiianie i perspektivi razvitiia neirokomp'uternoi tekhniki). A. V. KALIAEV and G. A. GALUEV, *Elektronnoe Modelirovanie* (ISSN 0204-3572), Vol. 12, Mar.-Apr. 1990, pp. 14-19. 17 Refs.

A neurobionic approach to creating data processing systems is considered. Three possible ways of development are discussed: creating neurocomputers serving as general-purpose computers, employing neurocomputers as coprocessors for general-purpose computers, and designing neurocomputers as parallel neurolike structures. Several types of neurocomputers developed mainly in the U.S.A. and Japan are described and future trends in this field are indicated along with possible application areas.

## Japanese Aerospace Literature This month: *Astronomy*

**A92-43720** A survey of CCS, HC3N, HC5N, and NH<sub>3</sub> toward dark cloud cores and their production chemistry. HIROKO SUZUKI, SATOSHI YAMAMOTO, MASATOSHI OHISHI, NORIO KAIFU, SHIN-ICHI ISHIKAWA, YASUHIRO HIRAHARA, and SHURO TAKANO, *Astrophysical Journal, Part 1* (ISSN 0004-637X), Vol. 392, No. 2, June 20, 1992, pp. 551-570. Research supported by Morino Science Foundation. 92 Refs.

Survey observations of CCS, HC3N, HC5N, and NH<sub>3</sub> were carried out toward 49 dark cloud cores to examine the existence of a systematic relation between the chemical evolution and the physical evolution of dark clouds. The CCS radical was revealed to be abundant in cold and quiescent dark cloud cores, while it is much less abundant in star-forming regions. The column density of CCS shows a good positive correlation with those of HC3N and HC5N, indicating that the production chemistry of CCS is closely related to those of other carbon-chain molecules in dark clouds. On the other hand, the column density of CCS shows no correlation with that of NH<sub>3</sub>; NH<sub>3</sub> tends to be abundant in star-forming regions. A possible chemical model for the production of CnS (n = 1-3) is proposed. Pseudo-time-dependent calculations based on the proposed model show that the calculated abundance of CCS in the early stage of chemical evolution agrees mostly with the observed value in TMC-1. The relations among the observed column densities are qualitatively interpreted as an effect of chemical evolution of dark clouds on the basis of simulation of the molecular synthesis; carbon-chain molecules including CCS are abundant in the early stages of chemical evolution, whereas NH<sub>3</sub> is abundant in the later stages.

**A92-37742** Canonical time variations of X-rays from black hole candidates in the low-intensity state. SIGENORI MIYAMOTO, SHUNJI KITAMOTO, SAYURI IGA, HITOSHI NEGORO, and KENTARO TERADA, *Astrophysical Journal, Part 2—Letters* (ISSN 0004-637X), Vol. 391, No. 1, May 20, 1992, pp. L21-L24. 20 Refs.

The power spectrum density functions of X-rays and the phase lags of the time variations between different energy X-rays were investigated for several black-hole candidates (Cyg X-1, GX 339-4, and GS 2023 + 338) in their low-intensity state, to determine whether these density functions were different for different X-ray sources and at different occasions for the same source. The results suggest that, in these black hole candidates in the low-intensity state, the X-ray production process and the dynamics of accreting matter behavior are the same except for the processes which correspond to the Fourier frequencies below about 0.2 Hz.

**A92-42964** A systematic survey for dense cores in nearby star formation regions. YASUO FUKUI, A. MIZUNO, T. NAGAHAMA, K. IMAOKA, and H. OGAWA, *Societa Astronomica Italiana, Memorie* (ISSN 0037-8720), Vol. 62, No. 4, 1991, pp. 801-812. 20 Refs.

Some of the first results of a survey for dense cores in the C(O-18) J = 1-0 and CS = 2-1 emission in nearby star formation regions are presented. CS J = 2-1 maps covering the Ori A cloud including L1641 and the Rho Oph main cloud, and a C(O-18) map of Taurus as well as C(13)O maps are provided. High star formation efficiency is found in regions with remarkable concentrations of dense molecular gas; they are the Ori KL region and the Rho Oph main cloud. In low mass dense cores, isolated stars or small low mass clusters appear to be formed. Two stellar clusters with 10-20 low mass members are known to exist in L1641 from near IR studies by Chen et al. (1991). They are associated with L1641-North and L1641-Center outflows, respectively, and are accompanied by low-intensity CS clumps of about 1-2 K km/s peak intensity.

**A92-26621** 3.3-micron spectra of four IRAS sources. HIROSHI SUTO, KOHEI MIZUTANI, and TOSHINORI MAIHARA, *Astronomical Journal* (ISSN 0004-6256), Vol. 103, March 1992, pp. 927-930. 16 Refs.

The spectra between 3.15 and 3.45 microns are presented for four IRAS sources; IRAS 05355 + 3039, 06294 + 0352, 06335 + 1057, and 06210 + 1432 which possess IRAS spectra similar to reflection nebulae. The prominent emission feature at 3.3 microns of the order of 10 exp -19 W/sq cm has been detected in the four sources, and the adjacent feature at 3.4 microns in two of them. The 3.3-micron band strength is used to derive the contribution of small dust to the overall energy spectrum, which is about 20 percent in the 1-100-micron IR region.

**A92-24453** The evolution of a black hole's force-free magnetosphere. ISAO OKAMOTO, *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 254, Jan. 15, 1992, pp. 192-220. 49 Refs.

The structure of a stationary axisymmetric force-free magnetosphere of a Kerr black hole, and the hole's evolution due to extraction of rotational energy by the Blanford-Znajek process is examined. It is proposed that there is an 'effective' ergoregion inside the static-limit surface where the densities of 'energy at infinity' and angular momentum off the field are negative. In the outer half of the charged magnetosphere, a pulsar-type centrifugal slingshot wind blows outward, whereas in the inner half, a similar centrifugal slingshot wind blows inward.

**A91-44968 Multifunctional use of a ring-type optical device (Mnogofunktsional'noe ispol'zovanie kol'tseвого opticheskogo ustroistva).** S. V. SOKOLOV, *Priborostroenie* (ISSN 0021-3454), Vol. 34, No. 1, 1991, pp. 68-74. 5 Refs.

A ring-type optical circuit is proposed which makes it possible to solve a variety of practically important problems in applied mathematical analysis without the use of coherent optics. In particular, the ring circuit can be used to solve systems of linear nonstationary differential equation, Fredholm integral equations of the second kind, and Fokker-Planck-Kolmogorov partial differential equations. A functional diagram of the optical computing device is presented.

**A91-39190 Macromodels for the design of superfast circuits based on (Schottky field-effect transistors Makromodeli dlia proektirovaniia sverkhkorostnykh skhem na PTSh).** O. N. GORDIN and V. N. RUDNITSKII, *Elektronnoe Modelirovanie* (ISSN 0204-3572), Vol. 13, Mar.-Apr. 1991, pp. 37-40. 6 Refs.

An approach to the design of macromodels of superfast circuits based on Schottky field-effect transistors is proposed which allows for the influence of transmission lines between the components and some electrical parameters of the circuit elements on the circuit characteristics. The use of macromodels provides a factor of 5-10 saving in computer time over component models with only a 15-percent maximum tradeoff in modeling accuracy. The method proposed here makes it possible to construct macromodels for the analysis and design of superfast integrated circuits.

**A91-39173 Principles of constructing the Hopfield neuronal network using three-dimensional echo holograms (Printsipy postroeniia neironnoi seti Khopfilda pri pomoshchi ob'emnykh ekho-gologramm).** E. A. MANYKIN and M. N. BELOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 18, Feb. 1991, pp. 245-249. 12 Refs.

Properties of photon echo used as a method of dynamic holography in a three-dimensional medium are examined theoretically. It is shown that it is feasible to use this method for constructing the Hopfield (1985) optical neuronal network. The possibilities of using photon echo holography for other types of optical neuronal network implementation, such as the construction of multilayer networks are discussed.

**A91-38463 Collinear interaction of the optical waveguide modes and surface magnetostatic waves in a  $\text{Lu}_{2.14}\text{Bi}_{0.86}\text{Fe}_{0.94}\text{Mg}_{0.06}\text{O}_{12}$  film.** V. V. MATIUSHEV, A. A. STASHKEVICH, and J. M. DESVIGNES, *Journal of Applied Physics* (ISSN 0021-8979), Vol. 69, pt. IIB, April 15, 1991, pp. 5972-5974.

Experiments on the interaction of optical waveguide modes with magnetostatic waves in ferrimagnetic films have obtained the greatest maximum diffraction efficiency/unit microwave power value to date, using a  $\text{Lu-Bi-Fe-Mg-O}$  film grown on a gadolinium gallium garnet substrate. Optical mode spectrum measurements indicate extreme values of the TE-TM mode birefringence, due to film and substrate lattice parameter mismatching. Parallel interaction exceeded antiparallel interaction, as predicted by theory.

**A91-25276 Optical switches and transistors with high sensitivity to changes in signal intensity and stable against signal phase instability (Opticheskie perekliuchateli i tranzistory s povyshennoi chuvstvitel'nost'iu k izmeneniiu intensivnosti signala, ustoiichivye k nestabil'nosti ego fazy).** A. A. MAIER, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 315, No. 1, 1990, pp. 95-98. 11 Refs.

In optical computers consisting of switching elements, the independence of the output characteristics of a switching element from the input signal phase is an essential requirement. It is also important that optical switches and transistors have higher sensitivity to changes in the input signal power than to changes in the pump power. It is shown here that, if the signal coupling coefficient is less than the pump coupling coefficient (the pump and signal are orthogonally polarized with respect to each other and have different carrier frequencies), then the signal gain coefficient in an optical transistor and the sensitivity of a switch to changes in signal intensity are higher than in the case of equal signal and pump coupling coefficients.

**A91-18786 An interference grating (Interferentsionnaya reshetka).** V. M. OSIPENKOV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 35, Oct. 1990, pp. 2054-2061. 8 Refs.

An interference grating (IG) is proposed which can serve as a transmission-line intersection device or as a directional coupler. Since the this IG can be easily realized on the basis of a transmission line with a sandwich dielectric, it can be used as the base element of a bulk integrated circuit. The IG is shown to have superior electrical properties.

**A91-11368 A new method of hologram recording in planar glass waveguides (Novyi vid zapisi gologramm v planarnykh volnovodakh na steklakh).** L. B. GLEBOV, N. V. NIKONOROV, G. T. PETROVSKII, and M. V. KHARCHENKO, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 312, No. 4, 1990, pp. 852 and 854. 6 Refs.

A new method of hologram recording in planar waveguides is demonstrated which is based on the interference of waveguide modes. In the experiments reported here, holograms were recorded through the decoloration of radiation color centers in a commercial sodium-silicate glass. The new hologram recording method can be used in the development of various functional waveguide elements for integrated optics.

**A91-25106 Spatial-multimode squeezed states of light and the quantum noise of optical images (Prostranstvenno-mnogomodovye szhatye sostoiianiia sveta i kvantovye shumy opticheskikh izobrazhenii).** M. I. KOLOBOV and I. V. SOKOLOV, *Akademiia Nauk SSSR, Izvestiia, Seriya Fizicheskaiia* (ISSN 0367-6765), Vol. 54, Dec. 1990, pp. 2328-2332. Refs.

It is shown that spatial-multimode squeezed states of light make it possible to reduce the natural (photon) noise of extended radiation wavefronts. This phenomenon makes it possible to develop new techniques of optical image recording and transfer and optical data processing. The possibility of using squeezed light for holographic measurements that are nonnoisy on the quantum level is briefly discussed.

**A91-11432 Excitation of a semiconductor GaAlAs laser by picosecond pulses from an optoelectronic switch (Vozbuzhdenie poluprovodnikovogo GaAlAs-lazera pikosekundnymi impul'sami ot optoelektron-nogo perekliuchatelia).** H. BERGNER, P. P. VASIL'EV, D. GROSENICK, E. KLOZE, A. V. KONIASHCHENKO et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, June 1990, pp. 705, 706. 15 Refs.

An analysis is made of picosecond light pulses generated by a semiconductor injection laser excited by an optoelectronic switch, the switching being realized by a picosecond YAG laser. Electrical pulses shorter than 40 ps FWHM were obtained when Cr:GaAs switches with the gap partially filled with a dye were used. Single optical pulses (without relaxation oscillations) 40 ps in duration corresponded to these electrical pulses.

**A90-48254 Optical processing of signals of adaptive receiving antenna arrays (Opticheskaiia obrabotka signalov priemnykh adaptivnykh antennykh reshetok).** L. D. BAKHRAKH, N. N. EVTIKHIEV, and V. V. PEREPELITSA, *Radiotekhnika* (ISSN 0033-8486), May 1990, pp. 50-62. Refs.

Various techniques of optical signal processing for adaptive antenna arrays are examined. Three types of optical processors are examined: analog, dual-mode, and digital. It is shown that all three have the ability to process large streams of input data, a feature particularly advantageous for adaptive antenna arrays.

**A90-48153 Optically controllable millimeter-wave devices (Optich-eski upravliaemye ustroistva millimetrovogo diapazona).** S. S. GIGOIAN and B. A. MURMUZHEV, *Radiotekhnika* (ISSN 0033-8486), April 1990, pp. 72-74. Refs.

Experimental results demonstrate that it is possible to implement optical control of the amplitude-frequency response of millimeter-wave (36-50 GHz) devices containing resonators or electromagnetically coupled strips of polycrystalline mirror waveguide (PMW) and silicon mirror waveguide. Devices with a rectangular silicon resonator without illumination can function as a rejector filter whose amplitude-frequency response is regulated by a change between the PMW and the resonator. When the resonator is illuminated, the rejection level of this filter can be regulated in the 12.5 dB dynamic range.

**A90-44972 Evaluation of the optical strength of diffused planar Rb:KTP waveguides (Otsenka opticheskoi stoikosti diffuzionnykh planarnykh Rb:KTP-volnovodov).** K. S. BURITSKII, E. M. DIANOV, V. A. MASLOV, S. V. TSYGANKOV, V. A. CHERNYKH et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, April 1990, pp. 494, 495. 7 Refs.

Diffused planar waveguides in a KTP crystal have been prepared by means of ion exchange from an  $\text{RbNO}_3$  melt. Their optical strength was measured at wavelengths of 0.488 and 0.514 micron. The strength of these waveguides is shown to be not less than two orders of magnitude higher than that of planar  $\text{Ti:LiNbO}_3$  waveguides.

**A90-43026 Spectroscopy of waveguide polaritons as a method of studying thin films (Spektroskopiia volnovodnykh poliaritonov kak metod issledovaniia tonkikh plenok).** I. I. BURSHTA, E. F. VENER, and O. V. SNITKO, *Optoelektronika i Poluprovodnikovaya Tekhnika* (ISSN 0233-7577), No. 17, 1990, pp. 77-79.

A method is proposed whereby the parameters of thin films, their thickness, and the effective permittivity are determined from the dispersion dependences of waveguide polaritons of the E and H types. The efficiency of the method proposed here is demonstrated for the system thermal oxide-silicon carbide with unknown oxide parameters. The accuracy of the method is evaluated by comparing results with measurements obtained by other methods.

**A90-27938 Integral optical digital computers.** VALERII M. EGOROV and EDUARD G. KOSTSOV, *Applied Optics* (ISSN 0003-6935), Vol. 29, March 10, 1990, pp. 1178-1185. 26 Refs.

The specific features of optical digital computers in integrated circuit form, whose principle of operation is based on electrooptic light modulation, are considered. The design of an array processor unit is described. It is shown that the optical communication channels introduced into integrated circuit structures with the help of thin film light modulators enable one to reduce, compared to electronics with equivalent functional capability, the total number of device components by 2 orders of magnitude, the interconnections area by an order of magnitude, and to increase performance by a factor of  $m$  ( $m$  is the image dimension). The experimental results of studying a cell of dynamic memory constructed with the above components are presented.

**A92-43754 Detection of SiO emission in the L1157 dark cloud.** HITOMI MIKAMI, TOMOFUMI UMEMOTO, SATOSHI YAMAMOTO, and SHUJI SAITO, *Astrophysical Journal, Part 2—Letters* (ISSN 0004-637X), Vol. 392, No. 2, June 20, 1992, pp. L87–L90. 22 Refs.

Intense thermal emission lines of SiO ( $v = 0$ ,  $J = 1-0$  and  $2-1$ ) are detected in a low-mass star-forming region, L1157. The emission is confined to a compact region toward the blue lobe of the CO outflow, where shock heating due to interaction between the outflow and dense gas has been found. In contrast, the emission of SiO is not detected toward the IRAS source and the red lobe. The distribution of SiO is different from that of CS; the intense CS line is observed in the vicinity of the IRAS source. The peak fractional abundance of SiO is estimated to be about  $10 \exp -7$ . This value is higher than a typical upper limit in quiescent dark clouds by a factor of about 10,000. These results suggest that SiO is produced in the shocked region probably through grain destruction processes. (Author)

**A92-43753 The outflow in the L1157 dark cloud—Evidence for shock heating of the interacting gas.** T. UMEMOTO, T. IWATA, Y. FUKUI, H. MIKAMI, S. YAMAMOTO, O. KAMEYA, and N. HIRANO, *Astrophysical Journal, Part 2—Letters* (ISSN 0004-637X), Vol. 392, No. 2, June 20, 1992, pp. L83–L86. Research supported by Japan Society for the Promotion of Science. 19 Refs.

In the L1157 dark cloud, a well-collimated bipolar CO outflow associated with a cold IRAS source 20386 + 6751 was discovered. The gas temperature toward the blue lobe of the outflow rises to about 30 K from the temperature of the surrounding gas (not greater than 10 K); this high temperature region is very localized within the blue lobe. The HCO(+), HCN, and NH<sub>3</sub> lines show blueshifted and broad-line profiles toward the blue CO lobe. Furthermore, their distributions are similar to that of the blue lobe. Analysis of the energy of the outflow and dense gas suggests that a strong shock caused by the outflow is responsible for the temperature enhancement. Such shock heating has rarely been observed in low-mass star-forming regions. These data show that the outflow has an influence on the thermal properties of the parent cloud at least locally through shock processes in its early evolutionary stage.

**A92-34094 The 'inner-horizon thermodynamics' of Kerr black holes.** ISAO OKAMOTO and OSAMU KABURAKI, *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 255, April 1, 1992, pp. 539–544. 16 Refs.

The thermodynamics of the event horizons and of the inner horizons are described in a unified manner by using a dimensionless parameter  $H$ . It is defined by  $h = a/rH = h+$  on the event horizons, and varies in the range of 0 to 1, while it is also given by  $h = rH/a = a/r = h-$  on the inner horizons in the range of 1 to infinity, where  $a = J/Mc$  is the angular momentum radius and  $rH = r+$ ,  $r-$  are the radii of the outer and inner horizons respectively. Every thermodynamic variable, other than the mass  $M$  and the angular momentum  $J$ , is also defined on both the outer and inner horizons, and its values form a pair of the roots of a quadratic equation with  $M$  and  $J$  contained in the coefficients, similar to the horizon radii  $r+$  and  $r-$ . It is also shown that this pair of each variable constitutes mirror images of each other with respect to the extreme Kerr state.

**A92-24244 Accretion in a Kerr black hole magnetosphere—Energy and angular momentum transport between the magnetic field and the matter.** KOUICHI HIROTANI, MASAOKI TAKAHASHI, SHIN-YA NITTA, and AKIRA TOMIMATSU, *Astrophysical Journal, Part 1* (ISSN 0004-637X), Vol. 386, Feb. 20, 1992, pp. 455–463. 23 Refs.

An MHD interaction between accreting matter and magnetic field in a stationary and axisymmetric magnetosphere surrounding a Kerr black hole which will exist in AGN is investigated. The critical condition that the MHD ingoing flows must pass through the fast magnetosonic point is analyzed in detail under the assumption of a magnetically dominated limit. This condition is found to restrict the shape of the magnetic field lines threading the event horizon. For example, cylindrical field lines must be bent into radial or paraboloidal ones. The plasma is expected to be injected from a thin disk into the magnetosphere and accretes to the event horizon. The fluid's energy and angular momentum are calculated both at the injection region and at the event horizon to investigate their MHG transport along the field lines. It is shown that the fluid's energy and angular momentum at the event horizon do not depend so much on the initial conditions at the injection region, but rather vary with the field line geometry near the event horizon. It is concluded that the transport process between the fluid and the magnetic field should be sufficiently effective in the accretion.

**A92-17317 Quasi-periodic oscillations in the X-ray flux from Centaurus X-3 observed with Ginga.** TOSHIKI TAKESHIMA, TADAYASU DOTANI, KAZUHIISA MITSUDA, and FUMIKAI NAGASE, *Astronomical Society of Japan, Publications* (ISSN 0004-6264), Vol. 43, No. 4, 1991, pp. L43–L50. 26 Refs.

Results are presented of observations of the 4.8 X-ray binary pulsar Centaurus X-3 from March 22 to 24, 1989. In addition to coherent 4.8-s pulsations, clear quasi-periodic oscillations (QPOs) were detected in the X-ray flux during a portion of the observations. The centroid frequency and the width of the QPOs were  $35 \pm 2$  mHz and  $10 \pm 1.5$  mHz, respectively. The centroid frequency of the QPOs was stable during that portion of the observation, and no correlation was found between the QPO amplitude and the X-ray energy. Constraints on QPO models, such as the Kepler frequency and beat frequency models, are discussed on the basis of the present observations of QPOs from Cen X-3.

**A92-27439 Ginga observations of the old nova GK Persei in quiescence and outburst.** M. ISHIDA, T. SAKAO, K. MAKISHIMA, T. OHASHI, M. G. WATSON, A. J. NORTON, M. KAWADA, and K. KOYAMA, *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 254, Feb. 15, 1992, pp. 647–654. 26 Refs.

Ginga observations of the old nova GK Persei in quiescence, as well as a brief scanning observation during an outburst are reported. The X-ray spectrum in quiescence is well fitted by thermal bremsstrahlung emission of very high temperature (approximately 30 keV), plus an iron emission line. The outburst spectrum is complex and comprises two continua with different column densities (about  $10 \exp 23$  and about  $10 \exp 24/\text{sq cm}$ ). The 351-s spin modulation of GK Per was clearly detected in the quiescence observation, which confirms the results of previous Exosat observations. The folded light curve shows two peaks that are not separated by 180 deg in phase, which is quite different from the Exosat outburst data. It is similar to the Exosat observation at a similar flux level.

**A92-27337 The molecular hydrogen emission around L1551 IRS 5—Shock-heated molecular gas at the base of the molecular outflow.** TAKUYA YAMASHITA and MOTOHIDE TAMURA, *Jet Propulsion Lab., California Inst. of Tech., Pasadena. Astrophysical Journal, Part 2—Letters* (ISSN 0004-637X), Vol. 387, March 10, 1992, pp. L93–L96. Research supported by MOESC. 25 Refs.

Spatially resolved observations of the  $v = 1-0$  S(1) molecular hydrogen emission toward L1551 IRS 5 using the grating spectrometer at KPNO are presented. The S(1) emission consists of a ridge component extending toward west along the optical jet from its peak on IRS 5 and a diffuse component which traces the innermost region of the cavity enclosed by the molecular outflow. The ridge component represents shock-heated molecular gas at the root of the optical jet. The diffuse component is too bright to be of scattered origin; it most likely arises from shock-heated gas within the cavity and could represent an acceleration process of the molecular outflow.

**A92-24541 Measurement of Jovian decametric lo-related source location and beam shape.** K. MAEDA and T. D. CARR, *National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD. Journal of Geophysical Research* (ISSN 0148-0227), Vol. 97, Feb. 1, 1992, pp. 1549–1556. 22 Refs.

The paper presents new information on the locations of the lo-related sources A and C (i.e., lo-A and lo-C) and on the shapes of their emission beams on the basis of measurements of the Jovian decametric activity that was recorded by Voyager 1 and 2. In two instances, the same dynamic spectral arc event in the recorded data of the two spacecraft was recorded, providing in each case an opportunity to observe the same emission beam over a wide range of frequencies from two considerably different directions. The propagation-corrected centroid times of each of the Voyager-1 arcs are found to be coincident with those of the corresponding Voyager-2 arc in a particular frequency range, but not at other frequencies. The hypothesis that emission beams are in the form of thin, almost conical sheets, the cone opening angle decreasing with increasing frequency, is confirmed. It is demonstrated that both the lo-A and lo-C sources were located near the northern foot of the magnetic flux tube that was connected to lo.

**A92-12214 A search for galaxies behind the Milky Way between  $l = 230$  and  $250$  deg.** MAMORU SAITO, HIROSHI OHTANI, AYUMI BABA, HIDEAKI HOTTA, SEIJI KAMENO, SADAOK KUROSU, KENICHI NAKADA, and TADAFUMI TAKATA, *Astronomical Society of Japan, Publications* (ISSN 0004-6264), Vol. 43, No. 3, 1991, pp. 449–468. 28 Refs.

A systematic search for galaxies behind Milky Way is carried out by means of film copies at an effective wavelength of 790 nm. Visual inspection was made of 14 films; a total of 4633 galaxies were detected with diameters greater than 0.1 arcmin. The detected galaxies were cataloged with regard to position, size, galaxy type, and cross identification. More galaxies were detected at regions with less H I column densities in the Milky Way; the characteristics of the Galactic extinction are similar to those found in the first investigation between  $l$  of 210 and 230 deg. A superposition of some clusters of galaxies is seen around  $l$  of 240 deg, and  $b$  of 4 deg over about 15 deg in angular size; the clusters are distributed from 50 to 350 Mpc. A nearby cluster of galaxies is also at a distance of about 35 Mpc around  $l$  of 243 deg and  $b$  of -6 deg, with an elongated structure nearly vertically against the Galactic plane linking the Antlia cluster to the Lepus cloud.

**A92-12213 Extraction of rotating energy from a black hole by a frozen-in magnetic field in accretion flow.** MASAYOSHI YOKOSAWA, TOSHIHISA ISHIZUKA, and YOICHI YABUKI, *Astronomical Society of Japan, Publications* (ISSN 0004-6264), Vol. 43, No. 3, 1991, pp. 427–447. 30 Refs.

The nonstationary magnetic field produced by stationary accretion is investigated in order to examine the possible structure of the magnetic field formed around a black hole. A strongly winding field is formed around the event horizon. This horizon is observed as being wrapped by a bundle of magnetic field lines, although the toroidal component of the field in a comoving frame of particles is not in excess of the radial one. The nonstationary solution of the magnetic field is used to discuss the dynamical evolution of the energy density distribution of the field as well as energy transfer through the surface of a stretched horizon. The electric energy generation caused by the interaction of an infalling magnetized plasma with the accretion disk is also discussed.



**A92-17481 Kiso survey for ultraviolet-excess galaxies.** BUNSHIRO TAKASE and NAGAKO MIYAUCHI-ISOBÉ, *Japan, National Astronomical Observatory, Publications* (ISSN 0915-3640), Vol. 2, No. 2, 1991, pp. 239-265.

The 14th list and identification charts of the UV-excess galaxies detected on the multicolor plates taken with the Kiso Schmidt telescope for 10 survey fields are presented. In the sky area of some 300 sq deg, about 470 objects are cataloged down to the photographic magnitude of about 17.5.

**A92-17479 A search for cool carbon stars. V—Perseus-Camelopardalis (I about 150 deg) region.** TAKAO SOYANO and HIDEO MAEHARA, *Japan, National Astronomical Observatory, Publications* (ISSN 0915-3640), Vol. 2, No. 2, 1991, pp. 203-223. 15 Refs.

A search for cool carbon stars has been consecutively made using the 4-deg prism spectra of the Kiso 105-cm Schmidt telescope. The surveyed area in this paper is the 235-square-degree area in the Perseus-Camelopardalis region ( $l = 132$  to  $158$  deg,  $b = -8$  to  $7$  deg). The celestial position, V magnitude, is presented, and the finding chart of 226 cool carbon stars derived from V-band plates. Many stars in this list are identified with carbon stars in Stephenson's (1989) general catalog, and with sources in the IRAS catalog. The distribution and the variability of cool carbon stars are briefly discussed.

**A92-17316 Discovery of strong absorption in the X-ray spectrum of Seyfert 2 galaxy NGC 4507.** HISAMITSU AWAKI, HIDEYO KUNIEDA, YUZURU TAWARA, and KATSUJI KOYAMA, *Astronomical Society of Japan, Publications* (ISSN 0004-6264), Vol. 43, No. 4, 1991, pp. L37-L42. 23 Refs.

An obscured nucleus was discovered in Seyfert 2 galaxy NGC 4507 with the Ginga satellite. The 2-10 keV X-ray luminosity is  $3.2 \times 10^{43}$  erg/s, and the continuum radiation is well described by a power law model with a photon index of  $1.34 \pm 0.28/0.25$ . The column density of the obscuring matter is  $(4.9 \pm 0.7) \times 10^{23}$  cm<sup>2</sup>, which is sufficiently thick to hide the broad-line region and the nucleus. An iron line with equivalent width of  $420 \pm 100/110$  eV has also been detected in the X-ray spectrum. In order to explain the large equivalent width, a large covering factor for the matter around the nucleus is needed. The obscuration can be naturally explained in terms of a torus in the unified Seyfert model.

**A92-17086 Space astrophysics in Japan.** KAZUO MAKISHIMA, *Astronomical Society of Australia, Proceedings* (ISSN 0066-9997), Vol. 9, No. 1, 1991, pp. 57-59. 6 Refs.

The overview of Japanese space programs describes long-term strategies and missions dedicated to the study of solar physics, cosmic X-ray astronomy, IR astronomy, or radio astronomy. Collaboration with the U.S. is noted for the shuttle-assisted Infrared Telescope in Space which requires a small unmanned space platform. Five satellite projects under development are mentioned, four of which are dedicated exclusively to astronomical observations, and the basic parameters are given of astronomical satellites already launched.

**A92-14647 Merging of two galaxies with central black holes.** T. EBISUZAKI, J. MAKINO, and S. K. OKUMURA, *Nature* (ISSN 0028-0836), Vol. 354, Nov. 21, 1991, pp. 212-214. Research supported by MOESC. 22 Refs.

Simulations are presented of the merging of identical galaxies with and without central black holes. It is found that, when black holes are included, the merged galaxy acquires an isothermal core comparable in mass to the sum of the two initial black holes. Furthermore, the ratio of the core radius to the half-mass radius is about the same as the ratio of the black hole mass to the total galaxy mass, a result also consistent with observational evidence. These results, which can be understood by means of simple analytical arguments, suggest that most elliptical galaxies contain central black holes with masses comparable to the mass of their cores.

**A92-11649 A study of the spatially-resolved T Tauri system.** TOSHINORI MAIHARA and HIROKAZU KATAZA, *Astronomy and Astrophysics* (ISSN 0004-6361), Vol. 249, No. 2, Sept. 1991, pp. 392-396. 18 Refs.

High precision visibility curves for the T Tau system have been obtained in the K-band by speckle interferometric observations using a 32-element linear array detector. It is confirmed that the T Tau system consists of three infrared sources, which are a central optical/infrared star: T Tau (O), an infrared object: T Tau (S) at 0.6 arcsec south, and a faint stellar object: Tau (O-prime) at 0.4 arcsec north. Based on the present observations, as well as on published photometric data, decomposed spectral energy distributions of the individual sources are proposed. A predominant role for accretion disk luminosities is suggested.

**A91-40345 The effects of black hole rotation on line profiles from accretion discs.** YASUFUMI KOJIMA, *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 250, June 1, 1991, pp. 629-632. 12 Refs.

The fluorescent line emitted from an accretion disk around a rotating black hole is examined. The line profiles for various models with inclination angle, Kerr parameter, and disk parameters are given. If the emitting region is highly localized to the inner part,  $r$  less than  $20 GM/c^2$ , the difference due to the black hole rotation appears in the line profiles. Otherwise, the difference is hidden due to photons emitted from larger radii, where the propagation of the radiation and the disk structure are almost independent of the Kerr parameter.

**A91-49260 Statistical circumstances of comet discovery.** HIROKI KOSAI and TSUKO NAKAMURA, *Japan, National Astronomical Observatory, Publications* (ISSN 0915-3640), Vol. 2, No. 1, 1991, pp. 63-101. 14 Refs.

Various data characterizing discovery and recovery conditions of about 300 comets which appeared during 1964 through 1988 are presented. Most of those values are recalculated from new orbital elements now available. Based on the results, some statistical aspects of discovery and recovery observational are discussed.

**A92-12211 Radio continuum observations of the Sagittarius C complex at 22 GHz.** MASATO TSUBOI, HIDEYUKI KOBAYASHI, MASATO ISHIGURO, and YASUHIRO MURATA, *Astronomical Society of Japan, Publications* (ISSN 0004-6264), Vol. 43, No. 3, 1991, pp. L27-L35. 18 Refs.

The 22.3-GHz continuum emission of the Sgr C complex was observed using the Nobeyama Millimeter Array. It was found that the Sgr C complex has a U-shaped ridge comprising several clumpy features as well as shell-like features. The spectral index of these features suggests optically thin thermal emission embedded in the nonthermal component. A barlike structure, noticed in a previous 1.7-GHz continuum observation, is already very weak at 22.3 GHz. The steep spectrum of this barlike structure is consistent with a nonthermal origin. The Sgr C complex is located at the end of the elongated molecular cloud in the Galactic center region. The close relations of morphology and velocity between the Sgr C complex and the molecular cloud suggest that the Sgr C complex is an H II region physically interacting with the molecular cloud in the Galactic center region.

**A91-56059 GINGA observations of the Shapley supercluster.** C. S. R. DAY, A. C. FABIAN, A. C. EDGE, and SOMAK RAYCHAUDHURY, *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 252, Oct. 1, 1991, pp. 394-402. Research supported by Royal Society. 28 Refs.

The results of scanning and pointed X-ray observations of a region of about 40 square degrees in the vicinity of the rich cluster Shapley 8, in the Shapley Supercluster of galaxies are presented. The Shapley Supercluster is the richest known supercluster, and Shapley 8 is classified optically as richness class 4. No evidence is found for excess diffuse emission associated with the supercluster and obtain a strong limit on the total mass of X-ray emitting gas. Several new point sources have been discovered in the region, and the X-ray properties of Shapley 8 have been measured for the first time. Despite its apparent high optical richness, Shapley 8 is not exceptionally luminous in X-rays, being about one third of the luminosity of the highest luminosity clusters known. It is suggested that its high optical richness is in part due to neighboring clusters, four of which are now resolved in X-rays within 2 deg of Shapley 8.

**A91-53487 The Astro-D mission.** H. INOUE, *Advances in Space Research* (ISSN 0273-1177), Vol. 11, No. 8, 1991, pp. 259-264. 12 Refs.

The X-ray astronomy mission is described in terms of the primary features and capabilities of the Astro-D with attention given to observational sensitivity. The satellite observatory is designed to support nested thin-foil X-ray mirrors, CCD cameras, and imaging gas-scintillation proportional counters. The thin-foil telescopes afford a large effective area over the energy range 1-12 keV which can image X-ray sources with a spatial resolution similar to that of the IPC at the Einstein Observatory. Improvements are noted in the CCD energy range and the background rejection rate of the spectroscopic observatory. It is concluded that the Astro-D can make significant contributions to the investigation of the cosmic X-ray background and particularly its extragalactic isotropic component.

**A91-52202 Is the bulge of our Galaxy triaxial?** Y. NAKADA, T. ONAKA, I. YAMAMURA, S. DEGUCHI, O. HASHIMOTO, H. IZUMIURA, and K. SEKIGUCHI, *Nature* (ISSN 0028-0836), Vol. 353, Sept. 12, 1991, pp. 140, 141. 18 Refs.

It is reported that the distribution of IRAS bulge stars in the Galaxy shows an asymmetry with respect to the Galactic center, providing clear evidence of triaxiality. This asymmetry may indicate that the bulge of the Galaxy is barlike.

**A91-49259 Kiso survey for ultraviolet-excess galaxies. XII, XIII.** BUNSHIRO TAKASE and NAGAKO MIYAUCHI-ISOBÉ, *Japan, National Astronomical Observatory, Publications* (ISSN 0915-3640), Vol. 2, No. 1, 1991, pp. 7-61. 16 Refs.

Presented here are the twelfth list and identification charts of the ultraviolet-excess galaxies which have been detected on the multi-color plates taken with the Kiso Schmidt telescope for 10 survey fields. In the sky area of some 300 square degrees 564 objects are catalogued down to the photographic magnitude of about 18.

**A91-47615 Evaluation of seeing on a 62-cm mirror.** M. IYE, T. NOGUCHI, Y. TORII, Y. MIKAMI, and H. ANDO, *Astronomical Society of the Pacific, Publications* (ISSN 0004-6280), Vol. 103, July 1991, pp. 712-722. 6 Refs.

A 62-cm active optics telescope model with a Shack-Hartmann wavefront analyzer was used to measure the mirror seeing effect. The degradation of the imaging quality due to the generation of microthermal convection was quantitatively evaluated from diurnal monitoring measurements over 90 days and nights. The dependence of mirror seeing on the temperature difference between the mirror and the ambient air and the effect of flushing flow to blow away the microthermal turbulence were measured.