INSTITUTE OF RADIO ASTRONOMY

KHARKOV

89

XXII IERAC

ACADEMY OF SCIENCES OF THE UkrSSR
INSTITUTE OF RADIO ASTRONOMY

XXII YERAC

Programme and abstracts

Monday, September 4 to Friday, September 8
1989

Kharkov — 1989

DEAR COLLEAGUE,

Welcome to the XXII Young European Radio Astronomers' Conference in Kharkov, Ukraine. It is for the third time that YERAC is held in the Soviet Union, being sponsorel this time by the National Council for Radio Astronomy of the USSR Academy of Sciences and the Institute of Radio Astronomy, Academy of Sciences of the Ukrainian SSR. Our sessions will last from Monday, September 4 through Friday, September 8, 1989.

This booklet contains the Conference Programme, paper abstracts and the list of participants, including their affiliations and addresses.

Along with scientific sessions, the Programme suggests a visit to the principal technical facility of the Institute of Radio Astronomy, the large decametre band radio telescope UTR-2. The four succesive sessions at this Conference will be Galactic Radio Astronomy, Extragalactic Radio Astronomy, The Sun and Solar System, and Observation Methods and Equipment. Each speaker will be given 15 minutes, of which 10 min to present his paper and 5 more to answer questions. Some of the papers will not be presented orally but appear as posters only.

We hope for your active and fruitful participation.

The Local Organising Committee:

Prof. Leonid N. Litvinenko, Chairman
Dr. V. I. Slysh, Vice-Chairman
Dr. A. A. Konovalenko, Vice-Chairman
Dr. L. I. Gurvits, Secretary

PROGRAMME OF YERAC-89

MONDAY 4th SEPTEMBER

8.30—13.00 Arrival and Registration
13.00—14.00 LUNCH
14.30—15.00 Welcome and Opening of Conference. Prof. L. Litvinenko, Prof. S. Braude

EXTRAGALACTIC

Chairman, Dr. *K. P. Sokolov*

15.00—15.15 VLBI Observation of the Fine Structure of a Compact Object with Active Nuclei. K. V. Bereza, Space Res. Inst., USSR
15.15—15.30 Polarization Asymmetry in Extragalactic Radio Sources. Gillian Holmes, Jodrell Bank, UK
15.30—15.45 Relations Between Radio Radiation of Galaxies and Star Formation. Jacek Stryczynski, Torun RAO, Poland
15.45—16.00 VLBI Results for the Pair of Quasars 1038 + 528 A, B Pedro Elosegui, Inst. de Astrof. de Andalucia, Spain
16.00—16.30 COFFEE
16.30—16.45 The Helical Structure of Radio—Galaxy Jets. S. G. Gestrin, V. M. Kontorovich, Inst. of Rad. Astr., USSR
16.45—17.00 High Resolution Observations of Narrow Angle Tail Radio Galaxy in Abell 115. M. Bondi, Inst. di Rad. Astr., Italy
17.00—17.15 Numerical Simulations of Head—Tail Radio Sources. Christopher Jan Cox, Mullard RAO, UK
17.15—17.45 Self—Similar Solutions for Regular Magnetic Field Transported by Turbulent Jet. S. S. Komissarov, Lebedev Ph. Inst., USSR
17.45—18.00 Sub-mm Cosmology Experiments with a Continuum Array Receiver. S. A. Torchinsky, Royal Observ. Edinburg, UK
18.00—18.15 Measurements of Intermediate Anisotropy of Microwave Background and Atmosphere Emission at 8 mm Wavelength. A. A. Brukhanov, I. A. Trifalenkov, D. P. Skulachev, I. A. Strukov, Space Res. Inst., USSR
18.30—19.30 DINNER
20.00—22.00 Evening session

TUESDAY 5th SEPTEMBER

8.00— 8.40 BREAKFAST

EXTRAGALACTIC

Chairman, Dr. *K. P. Sokolov*

9.00— 9.15 Binary Starbursts in Interacting Galaxies VLA Observations of a Complete Sample. Hazel Sopp, Paul Alexander, MRAO, UK
9.15— 9.30 Molecular Gas in Starburst Galaxies. Penelope Smith, Royal Observ. Edinburg, UK

9.30— 9.45 VLBI—Investigation of Quasars from the Source List of RADIOASTRON Project.
S. A. Primechaev, Space Res. Inst., USSR

GALACTIC

Chairman, Dr. *L. I. Gurvits*

9.45—10.00 The Draco Nebula: Collision of HVCs with Galactic matter?
Ignatios Souvatzis, Univ. Bonn, FRG

10.00—10.15 Low Frequency Recombination Lines: A Theoretical Description.
N. I. Rovenskaya, Inst. of Rad. Astr., USSR

10.15—10.30 Determination of Nebular Expansion Velocity from Radio Recombination Lines.
A. A. Ershov, Lebedev Ph. Inst., USSR

10.30—11.00 COFFEE

11.00—11.15 A Deep Survey of the Southern Galactic Plane for Pulsars.
Simon Johnston, Jodrell Bank, UK

11.15—11.30 Dynamic Autocorrelation Function of Pulsar's Micropulse Radio Emission.
K. S. Kozak, Space Res. Inst., USSR

11.30—11.45 The Equilibrium of the Return Current Sheet and the Structure of Pulsar Magnetospheres. Yu. E. Lyubarsky, Inst. of Rad. Astr., USSR

11.45—12.00 The Aberration and Retardation Effects in the Radioemission of PSR 0809+74.
O. M. Ulyanov, Inst. of Rad. Astr., USSR

12.00—12.15 Observation of Faint Supernova Remnant at 102.5 MHz towards PSR 1930 + 22.
A. V. Kovalenko, Lebedev Ph. Inst., USSR

12.15—12.30 A High Latitute Cloud with Enhanced Molecular Abundances.
Volkmar Grossmann, Univ. Bonn, FRG

12.30—14.30 LUNCH

Chairman, *Dr. L. I. Gurvits*

14.30—14.45 Investigation of the Linear Polarization of Radio Arc Region Radiation Near the Galactic Center at 7.6 cm wavelength.
I. L. Krainov, Radioph. Res. Inst., USSR

14.45—15.00 VLBI Observation of the Galactic Center at 1.3, 3.6 and 13 cm.
Maria J. Rioja, Inst. de Astrof. de Andalucia, Spain

15.00—15.15 Correlation Functions of Random Magnetic Field from the Observations of Intensity Variations of Background Radiation of Our Galaxy.
A. L. Lazarian, V. R. Shutenkov, Lebedev Ph. Inst., USSR

15.15.—15.30 Evaluation of Astrophysical Magnetic Fields on the Basis of Observed Emissions of Synchrotron Intensity.
G. V. Chibisov, A. L. Lazarian, Lebedev Ph. Inst., USSR

15.30—15.45 Infrared Objects Near Cederblad 110 in the Chamaeleon I Star Forming Region.
T. Prusti, Nat. Inst. for Space Res., Netherlands

15.45—16.00 Refraction in Strong Inhomogeneities of the ISM: Possibility of Observation with the Eearth — Space RADIOASTRON Interferometer.
A. K. Yangalov, Space Res. Inst., USSR

16.00—16.30 COFFEE

16.30—16.45 The Model of TMC-1 Based on HC_3N Observations.
D. A. Mitrofanov, Lebedev Ph. Inst., USSR

16.45—17.00 CO, HCO^+ and NH_3 Observations of the Interstellar Molecular Cloud L1155.
P. Harjunpää, T. Liljeström, K. Mattila, Univ. Helsinki, Finland

17.00—17.15 HCN Maser Observation.
A. V. Lapinov, I. I. Zinchenko, A. A. Krasil'nikov, E. P. Kukina, L. E. Pirogov, Inst. of Appl. Ph. USSR

17.15—17.30 Simulation of HCN Radiation in Dark Clouds.
A. V. Lapinov, Inst. of Appl. Ph., USSR

17.30—17.45 The J = 1—0 HCN, CO and HCO^+ Observations of the G 10.6—0.4 and G 35.2—0.74 Molecular Clouds.
I. I. Zinchenko, A. A. Krasil'nikov, E. P. Kukina, A. V. Lapinov, L. E. Pirogov, Inst. of Appl. Ph., USSR

17.45—18.00 J = 1—0 HCN and HCO^+ Survey of Molecular Clouds Associated with Sharpless Regions.
I. I. Zinchenko, A. A. Krasil'nikov, E. P. Kukina, A. V. Lapinov, L. E. Pirogov, Inst. of Appl. Ph., USSR

18.30—19.30 DINNER

20.00—22.00 EVENING SESSION

WEDNESDAY 6 th SEPTEMBER

8.00— 8.40 BREAKFAST

GALACTIC

Chairman, Dr. *L. I. Gurvits*

9.00— 9.15 Investigation of the Variability of Maser Emission of Molecules OH and H_2O in the Source VY CANIS.
F. S. Nazaretian, Univ. Erevan, USSR

9.15— 9.30 Properties of Cool HI in the Cygnus Rift. Christian Feldt, Univ. Hamburg, FRG

9.30— 9.45 Observations of the Linear Polarization of the Galactic Background at 2720 MHz.
Thomas Leiber, Univ. Bonn, FRG

9.45—10.00 Influence of Pre—Main Sequence Stars in the Surrounding Cloud.
A. Fuente, Centro Astr. de Yebes, Spain

10.00—10.15 Alternative Search for Artificial Cosmic Radio Emission.
A. V. Arkhipov, Inst. of Radio Astr., USSR

10.15—10.30 COFFEE

SUN AND SOLAR SYSTEM

Chairman,, Dr. *V. G. Sinitsin*

11.00—11.15 Characteristics of the Solar Wind Transsonic Region.
N. A. Lotova, Ye. P. Romashets, Ya. W. Pisarenko, IZMIRAN, USSR

11.15—11.30 The Sun and Solar Corona Observations.
A. I. Brazhenko, M. M. Glibitsky, A. A. Stanislavsky, Inst. of Rad. Astr., USSR

11.30—11.45 A Study of the Solar Wind at Decametric Wavelenghts.
V. A. Shepelev, G. S. Podgorny, A. D. Christenko, Inst. of Rad. Astr., USSR

11.45—12.00 The Dynamics of Microwave Bursts and the Relat ive Abundance of Electrons and Protons in the Solar Cosmic Rays.
V. F. Mel'nikov, Radioph. Res. Inst., USSR

12.00—12.15 On the Relationship Between the Harmonic Components of Plasma Frequency in the Radio Emission of Type IV Bursts.
L. G. Genkin, L. M. Erukhimov, B. N. Levin, Radioph. Res. Inst., USSR

12.15—12.30 Diagnostics of Eruptive Flare Plasma Using Microwave Emission.
A. D. Granat, A. V. Stepanov, L. I. Tzvetcov, CrAO, USSR

12.30—14.30 LUNCH
Chairman, Dr. *V. G. Sinitsin*

14.30—14.45 TM—Polarized Radioemission in Current Sheets on the Sun.
A. V. Denisov, Univ. Leningrad, USSR

14.45.—15.00 Interpretation of Solar Radio Burst Characteristics by Radiosource Inhomogeneous Model.
A. G. Stupishin, Univ. Leningrad, USSR

15.00—15.15 Radio Solar Eclipse Observations Today.
V. V. Komarov, V. M. Plotnikov, V. A. Shatilov, SAO, USSR

15.15—15.30 Compiling Solar Observation Catalogue at the RATAN—600.
V. V. Komarov, V. M. Plotnikov, V. A. Shatilov, SAO, USSR

15.30—15.45 On a Method of Separating the Radio Emission Level of a "Quiet" Sun Using Data from the SSRT.
B. I. Lubyshev, O. V. Nasonova, SibIZMIR, USSR

15.45—16.00 Radiosounding of Halley's Comet
V. E. Andreev, A. L. Gavric, IRE, USSR

16.00—16.30 COFFEE

16.30—16.45 Observations of DAM's Faraday Rotation. M. Y. Boudjada, Meudon, France

16.45—17.00 Jovian Decametric Radio Emission
A. V. Arkhipov, M. Yu. Lukyanov, Inst. of Rad. Astr., USSR

METHODS AND TECHNIQUES
Chairman, Dr. *V. G. Sinitsin*

17.00—17.15 The Ryle Telescope: A New Instrument for Microwave Background Astronomy.
Michael Jones, Mullard RAO, UK

17.15—17.30 Superconducting Devices for Millimetre Wave Astronomy.
Paul Kennedy, Mullard RAO, UK

17.30—17.45 Reduction of Interference Effects in Observations with Miyun Synthesis Radio Telescope.
Yang Yi—pei, Astron. Observ. Beijing, China

17.45—18.00 Radio Astronomy Investigations with Gee—Tee Radio Telescope.
T. S. Ravi Shankar, Raman Res. Inst., India

18.30—19.30 DINNER

20.00—22.00 EVENING SESSION

THURSDAY 7th SEPTEMBER

VISIT TO THE UTR-2 RADIO TELESCOPE

FRIDAY 8th SEPTEMBER

8.00— 8.40 BREAKFAST

METHODS AND TECHNIQUES
Chairman, Dr. *V. G. Sinitsin*

9.00— 9.15 Design of a Correlation Polarimeter and a Digital Backend For 37 and 22 GHz.
Kaj Wiik, Univ. of Technol. Helsinki, Finland

9.15—9.30 Application of On—Board Micro—Accelerometers for Orbit Determination of Space—VLBI Satellites.
Laszlo Szentpeteri, FOMI Satel. Gesod. Observ. Hungary

9.30— 9.45 The Use of Pulsars as Probes to Correct the Instrumental Polarization of Radiotelescopes.

POSTERS:

1. Low-noise cryogenical FET—amplifier for radio astronomy. A. V. Yaremenko, O. I. Lisunov, SRA «Saturn», USSR
2. Groove guide G-band receiver. A. G. Kochno, L. S. Nazarenko, A. P. Sklyarov, SRA «Saturn», USSR
3. Two-channel heterodyne-modulation based radiometry receiver. L. G. Gassanov, A. V. Sidorenko, M. I. Maloletov, V. G. Chibin, SRA «Saturn», USSR.
4. EHF input low noise arrangement for radiometry receiver. L. G. Gassanov, V. A. Maximenko, L. S. Nazarenko, A. A. Alesin, P. F. Korol, SRA «Saturn», USSR.
5. Spatial fluctuations of microwave emission of active regions. R. A. Sych, SibIZMIR, USSR
6. Solar radio image synthesis on the SSRT in observations with a knife-edge beam. A. L. Balandin, S. M. Kuznetsova, and A. G. Obukhov, SibIZMIR. USSR.
7. Polarization modulator of theeentimeter waverange. V. I. Abramov, V.V. Tagunov, Radioph. Res. Inst., USSR
8. Multichannel automatic radiometric complex for radioastronomical investigations of the cosmic radio emission. A. V. Vostokov, M. E. Miller, V. P. Syreishchikov, Radiophys. Res. Inst., USSR.
9. Straight correlation radio polarimeter, V. I. Abramov, V. V. Belikovich, A. V. Vostokov, V. V. Tagunov, E. V. Shirokova, Radiophys. Res. Inst., USSR
10. The local Heterodyne and Phase calibration Signal Synthesizing Systems of Radiointerferometer, E. B. Eryshev, V. V. Bychkov, N. Yu. Ogarkova.
11. Improving the sensitivity of millimetre wave receivers for radio astronomy, A. K. Blinov, L. B. Knyazkov, A. M. Korolev, V. I. Podyachii, Inst. of Rad. Astr. USSR.
12. The antenna amplification system of the UTR-2 radio telescope. V. V. Zacharenko, Inst. of Rad. Astr., USSR.
13. An interferometric radar ranger for use in reflector surface control systems. Yu. N. Shamanin, V. F. Isayev, V. N. Trofimov, Inst. of Rad. Astr., USSR.
14. Radioastronomical receivers calibration. E. A. Nagdalian, IRE, ArmSSR.
15. The experimental VLBI Observations of the NAVSTAR, T. A. Amindzanov, A. Egorov, I. Corennoy, L. Cuptsov, O. Sergeev, T. Tarasevich, N. Umarbaeva, Inst. of Appl. Astr., USSR.
16. Transponder Antenna for Phase Radio Range System of Radio Telescope RT—70. A. V. Kartsevich, Space Res. Inst., USSR.
17. System of Radioastronomical Data Transmission via Satellite Communication Channel. E. L. Gurevich, M. N. Kaidanovsky, D. A. Orlov, D. A. Fedorov, Inst. of Appl. Astr., USSR.
18. Molecular clouds in M81 and the M81 group of galaxies. N. Brouillet, A. Baudry, F. Combes, T. Jacq., C. Henkel, Univ. Bordeaux, France.
19. The low mass protostellar candidate NGC—1333/IRAS—1. Lewis B. G. Knee, Onsala Space Obs., Sweden.
20. Molecular clouds in the luminous merging galaxy NGC 3256. Susanne Aalto, Onsala Space Obs., Sweden.
21. The quasar population density as a result of the formation rate and the evolutionary pathes. Th. Boller, D. E. Liebscher, DDR.

22. Effects of tidal interaction on spiral galaxy star formation rates. J. Braine, F. Casoli, F. Combes, M. Gerin, E. Hummel, R. Wielebinski, J. van der Hulst. Laboratoire de radioastronomie millimetrique, Meudon, France.
23. HI in NGC 4736. P. S. Mulder, Kapteyn Astr. Inst., Netherlands.
24. HI observations of the high velocity system of NGC 1275. L. G. Sijbring, Kapteyn Astr. Inst. Netherlands.

9.45—10.15 DISCUSSIONS
10.15—10.30 CLOSING REMARKS
10.30—11.00 COFFEE
12.30—14.00 LUNCH
14.00—18.30 EXCURSIONS
18.30—19.30 DINNER
20.30—21..00 DEPARTURE

ABSTRACTS

VLBI OBSERVATION OF THE FINE STRUCTURE OF A COMPACT OBJECT WITH ACTIVE NUCLEI

K. V. BEREZA

Space Research Institute, USSR

The 22-m radiotelescope in Simeiz was equipped with new frontend for 92-cm wavelength, designed at VLBI Laboratory of IKI. The system has the following characteristics: radiometer noise temperature T_r = = 40 °K, efficiency $A_{off} = 0.47$, antenna HPWB = 3°.

The resulting sensitivity gives the possibility of investigations of the fine structure of compact objects with active nuclei.

Simeiz is associated member of EVN, that's why extensive VLBI observations are made with participance of EVN, India and China radiotelescopes.

POLARIZATION ASYMMETRY IN EXTRAGALACTIC RADIO SOURCES

GILLIAN HOLMES

Jodrell Bank, Manchester, UK

The effect of polarization asymmetry, whereby one component is markedly more polarized than the other, was first noted by Davis et al. in 1983. Subsequent observations by Laing and Garrington et al. of powerful, high luminosity (FRII) sources with one-sided jets revealed that in almost all cases, depolarization with increasing wavelength is weaker on the jet side than on the counter-jet side.

This depolarization is due to differential Faraday rotation in thermal gas which may be located either within or in front of the radio components. If the depolarization is internal then the asymmetry is an intrinsic property of the source, implying that the jets are also intrinsically one-sided. If however the depolarization is external, the asymmetry may be explained in terms of a geometrical effect: if the visible jet is relativistically beamed then this side of the source is seen through less of the depolarizing material than the counter-jet side. Thus the distinction between internal and external depolarization is a potentially powerful new method of settling the question of jet asymmetry.

Many low luminosity (FRI) sources have asymmetric jets and at present there is marginal evidence for depolarization asymmetry in such sources. A series of observations is being made using the VLA in order to investigate depolarization in these sources and to find out how any asymmetry correlates with jet asymmetry and other source parameters.

Until recently, most studies have concentrated on the depolarization between λ6cm and λ20cm. However in the larger sources little depolarization is expected between these wavelengths. Observations of various sources have been made with the WSRT of λ49cm and λ92cm,

these sources having previously studied at a number of shorter wavelengths. It is now possible to examine the depolarization characteristics and investigate polarization asymmetry at longer wavelengths and also to study the form of m (λ) (where m is the percentage polarization) out to long wavelengths and compare it with theoretical predictions.

References:

Davies R. J., Stannard D. Conway R. G. (1983) Mon. Not. R. Astron. Soc. 205 1267.

Garrington S. T., Leahy J. P., Conway R. G. Laing R. A. (1988) Nature 331 437.

Laing R. A. (1988). Nature 331 439.

RELATIONS BETWEEN RADIO RADIATION OF GALAXIES AND STAR FORMATION

JACEK STRYCZYNSKI

Torun Radio Astronomy Observatory, Poland

We reviewed quantitative relations between radio radiation and star formation in galaxies. For the ANS sample of galaxies we collect published radio observations. We computated spectral indices and ratio of thermal to nonthermal radiation and we infered star formation activity in the objects. The implications for the spectral evolution models of galaxies are shortly formulated.

MOLECULAR CLOUDS IN M81 AND THE M81 GROUP OF CALAXIES

N. BROUILLET, A. BAUDRY, F. COMBES, T. JACQ, C. HENKEL

Observatoire de Bordeaux, B. P. 89, F—33270 Floirac, France

A CO emission was detected in the spiral galaxy M81 with the NRAO 12 m radiotelescope (Brouillet et al., 1988). High spatial resolution observations of some particular fields with the IRAM 30 m radiotelescope in the CO (1—0) and CO (2—1) lines show little contrast in the cloudy structure. The extended map reveals: a weak molecular content, a CO depletion at the center of the galaxy and an annular distribution between 4 and 7 kpc from the center. Though the M81 arms are well traced by numerous HII regions, the weak CO luminosity implies that there may be an H_2 deficiency (less numerous or massive molecular clouds than in the Galaxy) or that the ratio of CO luminosity to H_2 mass may be different in M81 and in the Galaxy. A search for extragalactic H_2O masers in M81 towards the most intense CO emission regions did not show any detection. This seems to confirm the present small star formation activity.

M81 is the main member of a group of galaxies in which HI observations show the strong interaction between M81 and two companions galaxies, M82 and NGC3077 (van der Hulst, 1979, Cottrell, 1977). A model of tidal interactions restricted to the three-body problem (see Toomre and Toomre, 1972) has allowed us to simulate the deformation of the atomic gas distribution for different trajectories.

References:
Brouillet, N., Baudry A. and Combes, F.: 1988, Astron. Astrophys. 196, L17
Cottrell, G.: 1977, M. N. R. A. S. 178, 577.
Toomre, A. and Toomre, J.: 1972, Astrophys. J., 178, 623. van der Hulst, J. M.: 1979, Astron. Astrophys. 75, 97

VLBI RESULTS FOR THE PAIR OF QUASARS 1038 + 528 A, B

PEDRO ELOSEGUI

Instituto de Astrofisica de Andalucia, Spain

The angular separation on the sky of the pair of quasars 1038 + + 528 A, B is only 33 arcseconds. The compact structure of one of them, 1038 + 528 A, shows mild superluminal motion. We will present differential astrometric VLBI results to microarcsecond level accuracies for several epochs and wavelengths, as well as detailed analyses of rhe dependence of the relative angular determinations with Monte Carlo degraded radio structure maps.

THE LOW MASS PROTOSTELLAR CANDIDATE NGC—1333/IRAS—1

LEWIS B. G. KNEE

Onsala Space Observatory S—43900 Onsala, Sweden

A new low mass molecular cloud core in the NGC—1333 region has been discovered and mapped by means of millimetre spectral line observations An examination of the observational data in the millimetre, infrared, and radio continuum has been made in an attempt to discern the nature of the associated far-infrared source. Althought direct evidence of infall is lacking, it is concluded that the object is a promising protostellar candidate.

MOLECULAR CLOUDS IN THE LUMINOUS MERGING GALAXY NGC—3256

SUSANNE AALTO

Onsala Space Observatory S—43900 Onsala, Sweden

Optical and infrared data implies that the luminous peculiar galaxy NGC—3256 is a merger of two gas rich spiral galaxies. Extended strong infrared emission suggests that powerful star formation is occuring. We have studied the nature of the molecular cloud component by mapping the object in the J = 1 — 0 and J = 2—1 transitions of ^{12}CO and the J = 1 — 0 transition of ^{13}CO, using the Swedish-ESO Submillimetre Telescope (SETS) on La Silla, Chile.

THE HELICAL STRUCTURE OF RADIO-GALAXY JETS

S. G. GESTRIN and V. M. KONTOROVICH

Institute of Radio Astronomy, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR

Outstanding among the deversified structures encountered in radio jects (NGC31&, NGC6251, 3G273, 3C348) are the wavelike helical disturbances which some authors attribute to the hydrodynamic Kelvin—Helmholtz instability.

Another way is to suppose that the wave pattern we observe results from a nonpotential (rotational type) "wind" (shear) instability, which in a natural manner would establish a definite scale A_{max} for the most rapidly growing waves [I]. A resonance would appear between the surface wave and the eddies located close to the "layer of coincidence" z_c (z_c is the distance from the free interface between the media), the flow velocity V (z_c) being approximately the phase velocity of the wave. The wind instability growth rate will reach a maximum when the resonance layer lies at distances of order $\lambda/4\pi$ from the interface. This maximum in the growth rate could give the flow a wavelike pattern, much as observed in the jets of radio galaxies.

The motion in these jets is probably supersonic, significantly affecting the wave picture that should develop. Under suitable conditions the predominant helical perturbations $\sim \exp i\,(kx + m\varphi - \omega t)$ will have a nonzero azimuthal number$_{max}$, depending on the relationship between the characteristic parameters of the jet and the ambient flow. The dependence of twist angle of helix upon the ratio between the sound speed and Alfven speed in the stream is studied.

A helical structure of this sort has recently been detected in one of the two asymmetric jets in the radio galaxy Hercules A.

References:

I. S. G. Gestrin, V. M. Kontorovich. Wind instability and the helical structure of radio-galaxy jets. Pis'ma Astron. Zh. 12, 1986, 522—528.

HIGH RESOLUTION OBSERVATIONS OF THE NARROW ANGLE TAIL RADIO GALAXY IN ABELL 115

M. BONDI

Istituto di Radioastronomico, Bologna, Italy

Multi frequency VLA observations of the radio galaxy 0053 + 26B in Abell 115 are presented. The characteristics of the radio source are: a core coincident with the galaxy, an asymmetric jet with a bending at 6 kpc in the northern side, two tails of diffuse emission, and a low brightness feature which bends at 60 кpc in the direction opposite to the X-ray emission that is centered on the dominant galaxy of northern cluster subcondensation.

The radio morphology of 0053 + 26B suggests that the jets are only slightly deflected by the interstellar medium and that a conspicuous bending takes place only when they enter the intergalactic medium.The comparison between the internal energy density of radio emitting particles and the external pressure computed from the X-ray distribution shows that the low brightness regions are thermally confined. Due to the high velocity of the parent galaxy Ram pressure effects may explain the tail morphology, while Buoyancy effect may produce the north east bending of the tail.

NUMERICAL SIMULATIONS OF HEAD-TAIL RADIO SOURCES

CHRISTOPHER JAN COX

Mullard Radio Astronomy Observatory, Cambridge, UK

Over the past few years, numerical modelling has given considerable insight into the origins of the structure of axisymmetric radio galaxies. Head-tail sources have been neglected in comparison, since these require time-consuming 3-dimensional simulations. We are attacking this problem in two ways. Firstly, a fast processor allows us to solve the equations of fluid dynamics on grids containing up to 10^6 data points. Secondly, the development of a multigrid method has considerably speeded up the solution process for steady flows, by reducing the time requiered on an (N × N × N) grid from O (N^4) to O (N^3). We are using this code to investigate the structure of narrow-angle tailed radio sources, and the reasons for the different morphology of wideangle tails.

THE QUASAR POPULATION DENSITY AS A RESULT OF THE FORMATION RATE AND THE EVOLUTIONARY PATHES

BY TH. BOLLER AND D.-E. LIEBSCHER

Zentralinstitut für Astrophysik der Akademie der Wissenschaften der DDR

The continuity equation of Cavaliere et al. (1971) is generalized to age-dependent luminosity evolution. We show that some simple cases are integrable, and compare some important features of the resulting luminosity functions. Test criterions are used to compare the simulated with the observational results at different wavelengths.

References:
A. Cavaliere, P. Morrison, and K. Wood (1971): Astrophys. J. **170**, 223.

A SELF-SIMILAR SOLUTIONS FOR REGULAR MAGNETIC FIELD TRANSPORTED BY TURBULENT JET

S. S. KOMISSAROV

Lebedev Physical Institute, Moscow, USSR

A proposition of magnetic flux conservation is frequently used to estimate magnetic field or intensity evolution along extragalactic jets. However, this proposition is incorrect in the case of turbulent flows and special theoretical studies of magnetic field behaviour are needed. As the first step on the way we considered evolution of regular dynamically unimportant magnetic field transported by round turbulent jet of incompressible fluid. We found self-similar solutions

$$H_\theta = Az^{-d_i}X_i(\varphi),\ H_r = Bz^{-\beta_i}Y_i(\varphi),\ H_z = Cz^{-\beta_i}Z_i(\varphi)$$

where θ, r, z are cylindrical coordinates and $\varphi = r/az$. It is shown that radial profiles of the self-similar solutions form discontinuous spectra $\{X_i\}_{i=i}^{\infty}$, $\{Y_i,Z_i\}_{i=1}^{\infty}$ (Fig.1) of eigenfunctions of linear differential operators. Several corresponding eigenvalues α_i, β_i are listed in Table 1.

It is concluded that turbulent diffusion should result in simplification of magnetic field structure along get. If only closed lines of magnetic force exist then transition from predominantly axial magnetic field to predominantly toroidal one is possible along get.

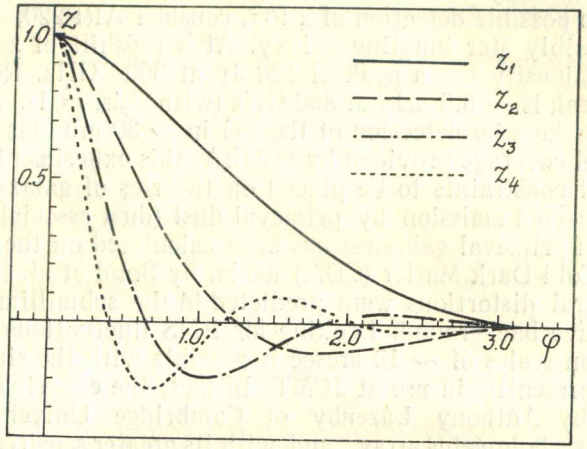

Table 1

i	1	2	3	4
α_i	2.0	5.6	11.	18.
β_i	2.0	4.1	8.1	14.

SUB-mm COSMOLOGY EXPERIMENTS WITH A CONTINUUM ARRAY RECEIVER

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The instrument

The Royal Observatory, Edinburgh is presently building an array receiver for the James Clerk Maxwell Telescope on Mauna Kea which will detect the submm continuum at 345 GHz (850 μm) and 660 GHz (450μm), and probably at two other channels: 430 GHz (700μm) and 860 GHz (350 μm). At the higher frequency there will be 81 bolometer-pixels in a hexagonal array with a 2 arcmin field of view. The lower frequency channel will have 37 pixels in the same field of view. The sensitivity of this Submm Common User Bolometer Array (SCUBA) will be roughly 50m Jy/$\sqrt{\text{Hz}}$ which is about ten times the sensitivity of the present single pixel continuum receiver at JMTC.

SCUBA will provide the best opportunities for ground based Cosmology, as it is so well suited to viewing the Cosmic Blackbody Radiation (peak at $\simeq$ 300 GHz). Experiments which look for Primeval Galaxies, Anisotropy, Sunyaev—Zel'dovich Effect, and Gravitational Lensing are possible and will be readily repeatable.

Primeval Galaxies and Dust Anisotropy

Primeval galaxies, which are generally thought to have a highly luminous phase due to an initial burst of star formation, have so far escaped detection in the optical and IR wavebands. This may be due to the PG being dusty and thus emitting its light in the Far IR. As an example of a possible detection of a PG, consider ARP220, a highly luminous, possibly star bursting galaxy. At a redshift of $z = 0.018$ its absolute luminosity has a peak of 120 Jy at 3000 GHz. Redshifted to $z \simeq 3$ the peak is $\sim$ 3.5 mJy at 860 GHz (with $\Omega_o h_o = 1$). SCUBA will be able to make a 5σ detection of the PG in $\sim$ 30 minutes. Due to the unique aeriel coverage provided by SCUBA, this experiment will enable fundamental constraints to be placed on theories of galaxy formation.

The expected emission by primeval dust (dust associated with star formation in primeval galaxies) has been calculated on the basis of the 'standard' Cold Dark Matter (CDM) model by Bond et al. [1, 2]. Significant spectral distortions were predicted in the submillimetre part of the microwave background. Looking for RMS fluctuations in the CBR of $\sim$ 1 % on scales of $\sim$ 10 arcsec is possible with the single element bolometer presently in use at JCMT. In fact, the experiment has been performed by Anthony Lazenby of Cambridge University (results pending). As a bolometer array, and with its greater sensitivity, SCUBA will be able to map a fully sampled region of about 2 arcminutes in about one tenth the integration time as one pixel element in Lazenby's experiment.

Sunyaev—Zel'dovich Effect

Occurring on larger angular scales, but somewhat more difficult to detect is the S—Z Effect. Compton Scattering of CBR photons through hot gas of galaxy clusters results in an increase of the intensity in the Wien end, and a decrease in the Rayleigh—Jeans end of the cosmic black body. Unfortunately, the low signal ($\Delta T/T \simeq 10^{-4}$) requires several hours integration time for a reasonable detection. The reward of a positive detection, however, is the possible direct measurement of H_0 when these observations are coupled with X-ray observations [3]. In addition, mapping will provide direct information on the gas in the cluster, and thus also its mass profile.

Gravitational Lensing

A lens in transverse motion between an observer and a uniform radiation source causes a distinct signature in the uniform background which is roughly proportional to the speed of the lens [4, 5]. If a galaxy cluster is used as the gravitational lens, and the CBR the uniform background, then a deviation in the CBR of $\Delta T/T \simeq 10^{-4}$ might be expected. A few hours integration with SCUBA would give a measurement of the cluster's transverse velocity.

Some cosmological theories require the existence of Cosmic Strings for galaxy formation. These objects would be very thin, very massive and under high tension; the vibrational velocity of a string might be close to the speed of light. Looking in the direction of a cosmic string would result in a dramatic, unmistakeable line, like discontinuity as it acts as a linear gravitational lens [6].

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EFFECTS OF TIDAL INTERACTION ON SPIRAL GALAXY STAR FORMATION RATES

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I will present the results of the currently unfinished survey of a complete sample of about 100 spiral galaxies observed both in CO (1—0) and CO (2—1). All of these galaxies have recession velocities between 300 and 1500 km/s, in order to make comparisons as reasonable as possible. The sample was taken from the catalog by Hummel et al (A&A Supp. 70, 517) of radio continuum observations and can be divided into three classes:

1. interacting galaxies (one third of sample)
2. Virgo cluster galaxies (one sixth)
3. isolated galaxies (one half of sample)

One can also divide the galaxies into sub—samples of barred/unbarred, LINERs and Seyferts, early/late type objects. The long term goal is to provide a statistically significant study of all the physical processes likely to induce a burst of star formation, as measured by the LIR/M (H_2) ratio.

Depending on the results and time available, I may also present a simple model of Giant Molecular Cloud emission, observed at galactic and extragalactic scales. I am particularly interested in the effect of small scale features on large scale emission.

MEASUREMENTS OF INTERMEDIATE ANISOTROPY OF MICROWAVE BACKGROUND AND ATMOSPHERE EMISSION AT 8 mm WAVELENGTH

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Recently Davies et al [1] claimed detection of microwave background anisotropy at angular scale 4 degrees:

$$dT/T = 3.7E - 5$$

The measurements were carried out with 8 degree beam, which essentially suppresses cosmological signal. Moreover, relativelty low fre-

quency of observations (10.5 GHz) does not allow separate cosmological signal emission from Milky way and point sources contribution.

We carried out the dT/T fluctuation measurements at 8 mm wavelength (frequence 35 GHz) with angular resolution 3 (FWHM). The observations were made in Shorbulak (Pamir mountains) at the height of 4300 m.

We estimated level of atmospheric fluctuations and put limit on possible microwave background fluctuations.

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BINARY STARBURSTS IN INTERACTING GALAXIES VLA OBSERVATIONS OF A COMPLETE SAMPLE

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We present 6 cm. D—array VLA observations of a complete flux-limited sample of IRAS galaxies. The fluxes produce a good fit to the FIR/radio correlation indicating star formation as the energy source. More importantly, the maps show an excess of nearby radio neighbours which were subsequently indentified on the Palomar Sky Survey. Out of 27 galaxies, I5 (55 %) have close optical neighbours, 9 (33 %) of which are also radio sources and 6 (22 %)are similar magnitude radio companions. These results provide further support for the strong link between active galaxies and interactions and show that, contrary to some previous thought, in many cases galaxy interactions induce star—forming activity in both the participants. This is discussed in the light of theories of tidal interaction.

MOLECULAR GAS IN STARBURST GALAXIES

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An important step towards an understanding of the global processes of star formation in galaxies would be the ability to accurately determine the mass of material (mostly H_2) in molecular clouds. Since molecular hydrogen is difficult to detect directly, current methods rely on the observation of 'tracers' — the most widely used being rotational transitions of the ^{12}CO molecule, or sub-millimetre continuum emission from dust grains re-radiating the stellar UV. The accuracy of both methods hinges on the assumption that the relevant conversion factors, $N(H_2)/I_{CO}$ and $N(H_2)/\tau(\nu)$, are constant. This appears to hold true in the Milky Way. However, serious doubts have arisen over the applicability of these conversion factors to extragalactic molecular clouds, where conditions may be very different. Of particular concern are 'starburst' galaxies, where very high rates of star formation, and the resulting large numbers of hot young stars may significantly influence conditions in the clouds.

If both CO lines and the sub—mm continuum are reliably tracing H_2 in extragalactic molecular clouds, then we should expect the morphology of CO and dust emission to be similar. We present results from an extensive programme of CO and sub—mm mapping of starburst galaxies which we are currently undertaking with the Nobeyama 45—m, the IRAM 30—m, and the JCMT 15-m telescopes. This programme was prompted by surprising results from 450 m observations of M82, a well-studied starburst galaxy. While CO maps show a double—peaked structure, interpreted as a 400 pc molecular ring enclosing the central starburst, our sub-mm data shows only a single peak, situated inside the 'ring'. It is apparent that, in this case at least, CO and dust cannot both be accurately tracing the molecular hydrogen. It seems likely that the CO emission is being affected by the vigorous nature of the star formation taking place in M82, with optical depth and excitation temperature variations across the galaxy. These results demonstrate that detailed knowledge of conditions in the molecular clouds are vital if we are to reliably determine gas masses by the CO method.

As a follow-up to our observations of M82, we present data from CO and sub-mm mapping of another IR- and CO-bright starburst, Maffei 2. Far-IR observations suggest a dust temperature gradient away from the nucleus of this galaxy, while sparse, large-beam CO observations imply significant optical depth variations on the scales of cloud ensembles. We show here high resolution observations of Maffei 2 in the $J = I — O$ and $J = 2 — I$ transitions of both ^{12}CO and ^{13}CO. Observations of two transitions in each of the two commonest isotopes of CO enables us to get a good handle on excitation temperature and optical depth variations across the starburst region. We have also mapped the sub-mm continuum emission at 80 μm, to give us an independant determination of the H_2 mass.

VLBI-INVESTIGATION OF QUASARS FROM THE SOURCE LIST OF RADIOASTRON PROJECT

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The paper presents a part of preparation of ground-space VLBI-project RADIOASTRON, dealed with technical and astrophysical aspects.

The first is connected with necessity of creating of software for postcorrelating of VLBI data. Well known Caltech packet [1] is taken as a prototype for this task. Main differences between the prototype and the created software are connected mostly with difference of hardware (the discussed packet is developed for ES computers, but the Caltech one — for VAX computers) and special patterns of including orbiting radio telescope in VLBI network.

The astrophysical aspect of the paper is connected with influences of cosmplogical evolution on fine structure of quasars. On the first step of this work data complitade from literature and obtained from interna-

tional VLBI network are used. Some special features of sub—sample of RADIOASTRON source list investigation are discussed.

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THE DRACO NEBULA: COLLISION OF HVCs WITH GALACTIC MATTER?

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The Draco Nebula is a dust and molecular cloud complex at high galactic latitudes (l = 89 —96°, b = 35°—40,° $V_{LSR} \approx -25$ km/s). Its distance has been estimated to be about 800 pc, leading to z ≈ 500 pc. It is associated with several high velocity clouds (HVC's: $V_{LSR} \approx \approx -140$ km/s).

The HI component of several fields at the low latitude edge was observed using the VLA D configuration and Effelsberg single dish short spacing data. These data show a velocity gradient at the edge: the radial velocity decreases towards low galactic longitude and latitude. The kinematics of the Draco as well as the high velosity component in connection with molecular observations indicate a collisional interaction of the hvc's galactic disk or low halo matter.

In this model, the Draco Nebula is identified with a dense intershock medium. The velocity gradient can be explained assuming an oblique shock.

LOW FREQUENCY RECOMBINATION LINES: A THEORETICAL DESCRIPTION

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The experiments of Konovalenko and Sodin [1] who observed recombination radio lines at decametre wavelengths ($T_e \simeq 100$ K and n = = 600 to 700), and Ershov et al. [2] (metre wavelengths, $T_e \simeq 100$ K and n = 500 to 600) have stimulated the interest of theorists toward low frequency lines generated in cold interstellar plasmas. Here we apply semiclassical techniques to calculating the recombination spectra with allowance for the spontaneous radiative transitions characteristic of the «optically thin» case.

The inelastic scattering rates are calculated analytically as functions of the quantum numbers n, l, and m in rhe range of scattering particle energies $\frac{2}{n^2} \ll \frac{E}{Ry}$, and the effective collisional line broadening is estimated.

The energy-dependent kinetic equations averaged over the quantum states of hydrogen—like atoms can be solved by a method extending the Wiener—Hopf technique. The limiting cases are the diffusion (Fokker — Planck) approximation for $\varepsilon \to 0$ ($n \gg 1$) and the asymptotic (saddle—point) solution for the model of spontaneous transitions alone. The results obtained may prove useful for interpreting the recombination spectra over a whole range of temperatures, particle densities and quantum mechanical state parameters.

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DETERMINATION OF NEBULAR EXPANSION VELOCITY FROM NARIO RECOMBINATION LINES

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A method is proposed of determining the expansion velocity of a compact HII region from observations of two Hnα radio recombination lines that are well separated in frequency, together with radio continuum observations.

The method is based on that the recombination line velocity of expanding HII region shifts toward more positive values with increasing frequency. Indeed, at the lower frequencies where the nebula is optically thick, one observes the approaching edge, and the receding parts are hidden by the continuum opacity. At the higher frequencies, the entire nebula is observed, and one detects the true radial velocity. This sort of change in radial velocity was first detected in the compact HII region W3(OH) by Berulis and Ershov (1983).

The method proposed is applied to observations of several HII regions. The expansion velocities ranging from 5 to 11 km/s are derived.

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A DEEP SURVEY OF THE SOUTHERN GALACTIC PLANE FOR PULSARS

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A deep survey for pulsars in the southern Galactic Plane is being carried out using the Parkes 64 metre telescope in New South Wales, Australia.The survey is a collaborative project between the NRAL, Jodrell Bank in the U. K. and the CSIRO Division of Radiophysics in Australia.

Previous surveys from the southern hemisphere have been carried out at low (408 MHz) radio frequencies and moderate sampling rates. This implies that such surveys have been insensitive to both the high

dispersion measure (and thus distant) pulsars and the fast period (Millisecond) pulsars. The present survey attempts to overcome some of the selection effects inherent in the older searches, through the use of a high observing frequency, a large overall bandwidth and a fast sampling rate.

The observing frequency of 1.5 GHz in itself provides a marked improvement in sensitivity over 408 MHz surveys due to the significant reduction in dispersion, interstellar scattering and Galactic background radiation at the higher frequency. Two separate systems receive signals from the telescope in parallel. The first system contains 80 IMHz filters for a total bandwidth of 80 MHz. The sampling rate is 0.3 milliseconds. This system is very sensitive to milliseconds pulsars. The second systems contains 64 5MHz filters for a total bandwidth of 320 MHz. The sampling rate for this system is 1.2 milliseconds, and is sensitive to normal, high dispersion measure pulsars. The galactic plane is being surveyed in the region $270° \leqslant l \leqslant 20°$ and $|b| \leqslant 4°$. Selected supernova remnants and globular clusters are also being surveyed. The survey generates a vast quantity of data and the subsequent analysis is presently being carried out using very efficient FFT algorithms on two supercomputers; a CYBER 205 and an AMDAHL VPI200. It is hoped that approximately 100 normal pulsars and a small number of millisecond pulsars will be found.

The discovery of distant and/or fast, young pulsars should enable us to improve the statistics of the spatial pulsar distribution in the Galaxy and of the pulsar period distribution. Detection of old, millisecond pulsars could lead to a better understanding of the evolution scenarios for such pulsars and can also place constraints on the neutron star physics, the pulse emission mechanism and magnetic field decay models.

An brief overview of the survey parameters will be presented along with the results to date and their implications.

DYNAMIC AUTOCORRELATION FUNCTION OF PULSAR'S MICROPULSE RADIO EMISSION

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Autocorrelation functions for pulsar's radio pulses are obtained and analysed for observation with resolution of 10 mks at 102.5 MHz. The microstructure scale behaviour is investigated in dependence of individual subpulse longitude relative to average profile. The nature of space-time structure of radio emission zone is discussed as a result of analisis for pulsar PSR 0809 + 74.

THE EQUILIBRIUM OF THE RETURN CURRENT SHEET AND THE STRUCTURE OF PULSAR MAGNETOSPHERES

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According to the Goldreich—Julian model, the current flowing out of magnetic poles of a rotating neutron star fills its magnetosphere with a plasma. The current flows along open magnetic field lines and re-

turns along the boundary between the open and closed parts of the magnetosphere. An equilibrium condition for this current sheet is obtained. The position of the boundary, as well as the structure of the magnetosphere are determined from this condition. In the axially symmetric case, the boundary of the closed part of the magnetosphere should intersect the equatorial plane at a right angle and further the current sheet should be situated in the equatorial plane. The structure of the magnetosphere is calculated numerically.

THE ABERRATION AND RETARDATION EFFECTS IN THE RADIOEMISSION OF PSR 0809 + 74

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Among the effects predicted in the Ruderman—Sutherland model of the pulsar radio emission [1] one is the possibility of observing aberration and retardation of the radiation. This was first noted by Cordes [2] who obtained upper estimates for the emission radii of several pulsars at different frequencies. Similar estimates were also obtained in [3]. The present paper analyses aberration and retardation corrections to the "apparent" dispersion measure. As has been found, the corrections can be determined if the observations are performed in at least two frequency ranges. The true dispersion measure proves to be higher than the "apparent" value. For several frequencies in the decameter wave band, the emission radii are estimated for the pulsar PSR 0809 + 74 and the frequency-longitude pattern of its radio emission is discussed.

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OBSERVATION OF FAINT SUPERNOVA REMNANT AT 102.5 MHZ TOWARDS PSR 1930 + 22.

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The resalts of radio observations of new faint supernova remnant G 57.3 + 1.2 at 102.5 MHz towards PSR 1930 + 22 carried out high sensibility are presented. Radiomap at 102.5 AHz is received. We showed that the SNR G 57.3 + 1.2 is a typical shell supernova remnant and not connect with PSR 1930 + 22. Distance of the SNR G 57.3 + 1.2 obtained from brightness — diameter relation is 2.4 kpc, but distance of the pulsar PSR 1930 + 22 obtained from dispertion measure is 12—14 kpc.

A HIGN LATITUDE CLOUD WITH ENHANCED MOLECULAR ABUNDANCES

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Some clouds at high galactic latitudes in the second galactic quadrant belong to the so—called Polar Loop, a ringlike expanding structure which is centered at galactic longitude $l \simeq 130°$ and galactic latitude $b \simeq 35°$. One of the densest knots at the rim of the loop, the molecular cloud MCLD123.5 + 24.9 — visible as a faint optical reflection nebula on the POSS — was observed in lines of different molecules such as ^{12}CO, ^{13}CO, H_2CO, NH_3 and HCO^+.

Although the cloud is easily seen in the IRAS 100μ band it is hardly discernible from the surrounding cirrus in its 60μ emission, thus indicating a low dust colour temperature of roughly 20 K.

The only molecular transition which was observed to study not only the cloud itself but also the environment of MCLD123.5 + 24.9 is the $J = 1 \rightarrow 0$ transition of ^{12}CO. These observations done with 4 arcmin resolution show that the cloud may be interacting with the expanding Polar Loop. The cloud itself was mapped in the ^{13}CO ($J = 1 \rightarrow 0$) transition (half power beam width HPBW = 4 arcmin) and in the 6.2 cm transition of H_2CO (HPBW = 3 arcmin).

From observations of the 1665 MHz and 1667 MHz main lines of the ground state of OH evidence can be found for main line anomalies. The OH line integral correlates very well with the IRAS 100 intensity.

The small-scale structure was observed using the (J, K) = (1, I) transition of ammonia (HPBW = 40 arcsec) and high resolution (HPBW = 1 arcmin) ^{13}CO ($J = 1 \rightarrow 0$) data. Both yielded evidence for clumping in MCLD123.5 + 24.9. A comparison of the column densities calculated for the observed molecules point to enhanced molecular abundances. In the case of OH the overabundance can be derived not only from a comparison between ^{13}CO and OH but also independently from the above mentioned relationship between W (OH) and the IRAS 100μ dust emission. One can arrive at the conclusion that MCLD123.5 + 24.9 is colliding with the expanding Polar Loop and that overabundances are the result of a shock moving into the cloud.

INVESTIGATION OF THE LINEAR POLARIZATION OF RADIO ARC REGION RADIATION NEAR THE GALACTIC CENTER AT 7.6. CM WAVELENGTH

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Polarization investigations at 3 cm wavelength [1, 2] detect the existence of three-component structure (nucleus and two symmetrically spaced lobes) located along the radio arc perpendicular to the galactic plane and crossing it at $l = 0°.16 - 0°.18$. To obtain an additional information on components of this structure, observations have been carried out at 7.6 cm wavelength of the region with coordinates $17^h40^m40^s \leqslant$

$\leqslant \alpha\,1950 \leqslant 17^h45^m40^s$, $-29°19'\,20'' \leqslant \delta 1950 \leqslant -28°\,19'\,20''$ by the North sector of RATAN-600 with the resolution 1×20. A radio polarimeter with the instrumental polarization < 0.1 % and the sensitivity ~ 3 mK has been used in the measurements. The instrumental linear polarization has been measured over the HII region of Omega.

The obtained characteristics of S—E polarized lobe «C» at 7.6 cm wavelength show that the maximal degree of polarization in the lobe «C» reaches $p \approx 1$ %, its angular dimension over α at the level $p = 0.5$ % amounts 2, the antenna temperature is equal to $T_A^p = 80$ mK. The maximal degree of polarization taking into account the directivity pattern width is $p \approx 8$ %.

A comparison with [1, 2] testifies on the existence of the Faraday depolarization of the region «C» radio emission and on the shifting of its maximum away from the galactic plane with an increase of the wavelength.

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VLBI OBSERVATIONS OF THE GALACTIC CENTER AT 1.3, 3.6 and 13 Cm

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We expect to be able to present latest results on VLBI observations of the compact radio source at the Galactic Center made at 1.3, 3.6 and 13 cm wavelength, and to provide the first accurate determination of the absolute position of this radio source in the astrometric frame defined by the quasars. We will also describe our plans for further investigations of this source with VLBI at 1.3 cm wavelength.

CORRELATION FUNCTIONS OF RANDOM MAGNETIC FIELD FROM OBSERVATIONS OF INTENSITY VARIATIONS OF BACKGROUND RADIATION OF OUR GALAXY

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Because of the intensity of synchrotron radiation depends on the strength of magnetic field it is possible to study magnetic field in the halo of our Galaxy by observing the variations of intensity of background radiation. Chibisov and Ptuskin [1] have got a relations between the correlation function of the intensity of background radiation and the correlation functions of the random magnetic field h in the halo. Than Lazarian and Chibisov [2] have solved the inversed problem and have showed that the problem of definition of parallel B_l and transversal B_t correlation functions of the magnetic field can be solved exactly.

The correlation function of the intensity of background radiation have been found by Dagkesamanskii and Shutenkov [3] for the area of the sky which is situated in the field of minimum radio brightness of the galactic background radiation near the North Galactic Pole. Using this data and the theory [2] we have constracted the difference $B_l - B_t$. Supposing that magnetic field is solenoidal, functions B_l and B_t have been found separatly. Then energy spectrum have been constracted. Using this spectrum it is possible to make a conclusion about the turbulence in the area that have been studied.

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EVALUATION OF ASTROPHYSICAL MAGNETIC FIELDS ON THE BASIS OF OBSERVED EMISSIONS OF SYNCHROTRON INTENSITY

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The main items of the statistical method of investigating regular and random magnetic fields are given in this report. It is shown that the inverse problems can be solved analitically on the basis of the correlation functions of the intensity of a diffuse sinchrotron radiation in the case of our Galaxy as well as in the case of a distant prolonged object (supernova remnant, galaxy). That means that we can find out the correlation functions of random magnetic field from the data on the variations of sinchrotron intensity (Furie transformation of the correlation functions of random magnetic field gives us the spectrum of the magnetic turbulence) [1, 2].

The influence of the telescope directivity diagram on the results of statistical data processing is discussed as well as some other effects, which result in the additional anisotropy of the correlation function of intensity [3]. The algorithms of data processing are developed.

The method in question is very informative, because it gives us a unique opportunity to obtain the correlation functions of a random magnetic field from the observations data. Furthermore, the intensity measurements are relatively simple (in comparison with polarization measurements).

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INFRARED OBJECTS NEAR CEDERBLAD 110 IN THE CHAMAELEON I STAR FORMING REGION

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The molecular cloud Chamaeleon I contains many low mass young stellar objects in various early stages of star formation. Several fields within the cloud were extensively observed with IRAS, not only in the survey mode, but also using special pointed observations that enhanced the spatial resolution and the sensitivity.

E. g. the reflection nebula Cederblad 110 (within Cha I) was observed with the CPC instrument which provided maps with higher spatial resolution at 50 and 110 micrometer. These maps reveal a group of at least three embedded infrared sources. I observed these objects in the near infrared with the ESO 2 2-m telescope and the surrounding molecular gas was mapped with the SEST in CO in order to find high velocity components. The current picture of the stars in this group will be presented.

REFRACTION IN STRONG INHOMOGENEITIES OF THE ISM: POSSIBILITY OF OBSERVATION WITH THE EARTH-SPACE RADIOASTRON INTERFEROMETER

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Recent observations have show that the interstellar space contains localized plasma clouds which density is much higher than the average density of the interstellar medium. Such a plasma cloud should refract the rays from distant sources situated behind it along the line — of— sight. The effect of radio source angular displacement is inversely proportional to the squared observaton frequency. The ground-space «Radioastron» radiointerferometer will operate at four frequencies: 0.327, 1.67, 4.83, 22.2 GHz. This paper shows that, in principle, observation of refraction effects using the ground-space «Radioastron» radiointerferometer are possible.

THE MODEL OF TMC—1 BASED ON HC_3N OBSERVATIONS

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The characteristic feature of interstellar medium is unbalanced populations of rotation levels of molecules. Therefore, for correct interpretation of molecular radiolines observations strict consideration of every process influating the levels' populations is indispencible. The Monte—Carlo technique [1], foundating the solution procedure of multilevel problem of the radiation transferance without LTE, requires no simplification to obtain the dependence of intensity and molecular lines' prophiles on physical conditions in the radiating area.

The author applied Monte-Carlo technique to determine physical conditions in TMC—1 obtained from HC_3N observations of it. It has been constructed a model of cloud with essentially ingomogeneous conditions in it. It followes that TMC—1 is a flattenned contracting spheroid. The gas temperature increases from 8K in the centre to 20K at the border of the cloud. The H_2 density is equal to $2 \cdot 10^4$ см$^{-3}$ in the cloud's centre and varies inversely with the distance from it. Turbulent motions in TMC—1 are subsonic.

The given model substantionaly differes from the model of L. W. Avery et al [2] and successfully corresponds the observations data.

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CO, HCO^+ AND NH_3 OBSERVATIONS OF THE INTERSTELLAR MOLECULAR CLOUD L1155

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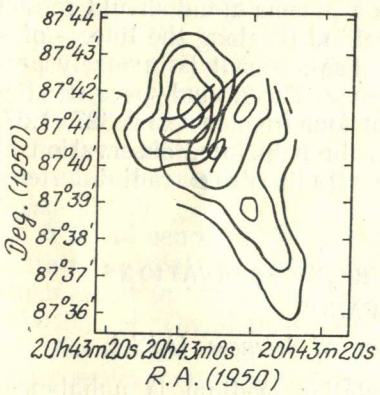
The central area of L1155 (l = 102.54°, b = 15.32°) has been mapped in the J = I — 0 transition of ^{12}CO and $H^{12}CO^+$ with the Metsähovi 14 meter radio telescope. Selected positions have also been measured in the ^{13}CO (J = I — 0) and $H^{13}CO^+$ (J = I — 0) lines. We have used the Effelsberg 100—m telescope to observe the NH_3(1,1) and (2,2) transitions towards this cloud.



The $H^{12}CO^+$ and NH_3 observations reveal two cloud clumps. The maxima of the $H^{12}CO^+$ (J = I — 0) and NH_3 (1,1) radiation temperature maps coincide with each other thus the clump centers indicate a density enhanced HCO^+ emission. In the front between these two dense clumps is a third HCO^+ maximum, which may arise from a third dense cloud clump or from shock enhanced HCO^+ emission possibly due to a collision of the two dense cloud clumps.

The roundish NE clump has quite constant $H^{12}CO^+$ and NH_3 line velocities: 2.5 km/s and 2.9 km/s, respectively. The elongated western cloud component has a velocity gradient ranging from 0.7 km/s in the north to 1.6 km/s in the south for HCO^+, and from 1.3 km/s to 1.8 km/s for NH_3, respectively. This velocity gradient may indicate cloud rotation.

The kinetic temperature of the central region is found to be 11—12 K, the number density of H_2 is $1.8 \cdot 10^4$ cm^{-3} for the NE clump and $2.0 \cdot 10^4$ cm^{-3} for the western clump, and the upper limits to the relative electron abundance for the NE and western cloud clumps are $7.2 \cdot 10^{-7}$ and $1.2 \cdot 10^{-6}$, respectively.

HCN MASER OBSERVATIONS

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By means of an apparatus developed at the Institute of Applied Physics of the USSR Academy of Sciences a search for the J = 1 — 0 HCN (02°0) masers was performed at the 22m radiotelescope of the Crimean Astrophysical Observatory. These masers ware recently discovered in CIT 6 [1] and 7 other C-rich stars [2]. Observations were performed in June — July 1987 and in June 1988 in the direction of 18 C—rich and O—rich stars. The J = 1 — 0 HCN (02°0) emission was readily detected only in CIT 6 and seemingly in CRL 2688. For CIT 6 the velocity integrated flux density was 126 2 ± 10.6 Jy km/s in June 1987 and 29.1 ± ± 4.8 Jy km/s in June 1988. In CRL 2688 these values were, respectively, 36.2 ± 5.3 Jy km/s and a 3σ upper limit of 18.5 Jy. These results imply the variability of HCN maser sources.

Besides, the J = 1 — 0 HCN (100) line (C—N stretching mode) was detected in CIT 6. The measured values in July 1987 and in June 1988 were 43.9 ± 7.9 and 23.7 ± 6.1 Jy km/s, respectively. Observations of the J = 1 — 0 HCN (001) line, which yielded 27.9 ± 6.4 Jy km/s in 1987, resulted in the determination of only a 3σ upper limit of 18.2 Jy in June 1988.

Possible mechanisms of maser excitation are briefly discussed.

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SIMULATION OF HCN RADIATION IN DARK CLOUDS

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In order to explain anomalous relative intensities of hyperfine components in the J = 1 — 0 HCN transition, observed in cold ($T_k \simeq$ $\simeq$ 10 K) interstellar clouds [1, 2], the radiation transfer was simulated for a spherical cloud model by a Monte-Carlo method. The level populations were determined from the excitation of molecules by their own radiation field, the background radiation and collisions with H_2 molecules. The Monteiro and Stutzki HCN—He collisional rates [3] were used in the computations. The simulations were performed for the density

falling outwards as $n(H_2) \propto r^{-2}$ with several variants of the kinetic temperature radial dependence, for several collapse velocities and for various HCN relative abundances. All possible overlaps (local and non-local) of hyperfine components were taken into account.

The simulation shows that in most cases there is good agreement between the calculated and observed ratios of hyperfine components except for the TMC—1 cloud which has the greatest anomalies. The dependence of the relative intensities of the HCN hyperfine components on model parameters is investigated and the uncertainties resulting from the replacement of HCN—H_2 collisional rates by the HCN—He ones are discussed.

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THE J= 1—0 HCN, CO AND HCO^+ OBSERVATIONS OF THE G 10.6—0.4 AND G 35.2—0.74 MOLECULAR CLOUDS

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In 1985—1987 at the 22m radiotelescope of the Crimean Astrophysical Observatory the G 10.6—0.4 and G 35.2—0.74 (north and south components) molecular clouds were mapped in the J = 1 — 0 HCN line by means of an apparatus developed at the Institute of Applied Physics of the USSR Academy of Sciences. Central positions were also observed in the J = 1 — 0 $H^{13}CN$ and HCO^+ lines. The HCN column densities determined from $\int T_R(HCN)dv$ (when the optical depth $\tau < 1$) are $2 - 8 \times 10^{15}$ cm^{-2}, $0.9—8 \times 10^{15}$ cm^{-2} and $0.7 - 3 \times \times 10^{15}$ cm^{-2} for central positions of G10.6—0.4 and G35.2—0.74 (—N and —S), respectively.

Besides, detailed J = 1 — 0 CO observations of these sources performed in June—July 1988 made possible a more accurate determination of molecular sizes and large—scale kinematics.

The observation results are discussed taking into account model calculations of the observed sources. Simultaneous 3.5 mm continuum observations are analysed.

J = 1—0 HCN AND HCO^+ SURVEY OF MOLECULAR CLOUDS ASSOCIATED WITH SHARPLESS REGIONS

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In 1985—1988 we surveyed at the 22m radiotelescope of the Crimean Astrophysical Observatory the molecular clouds associated with Sharpless regions in the J = 1— 0 HCN and HCO^+ lines. The goal of this work was to study the high density ($\geq 10^5$ cm^{-3}) regions of these clouds. We surveyed 104 objects in the HCN line. HCN emission was detected in 56 clouds. 37 objects of them were observed in the HCO^+ line. Besides, 15 sources with the strong HCN emission were observed in the J = = 1 — 0 $H^{13}CN$. We selected the initial sample of objects according to the criterion T (CO) > 10 K [1]. The detection rate of clouds with T (HCN) > 1 K decreases with increasing galactocentric distance. The HCN, HCO^+ line temperatures correlate with the kinetic temperatures of the clouds. The HCN, HCO^+ peak line temperatures are 3—10 times less than kinetic temperatures. A uniform density distribution of the objects filling the telescope beam implies an upper limit on the cloud density of about 3×10^4 cm^{-3}. If the clouds are clumpy, the density of the clumps may reach 3×10^5 cm^{-3}. Higher densities do not agree with the observed intensity ratios of the J = 1 — 0 HCN hyperfine components. Using the IR data [2], the H_2 column densities and relative abundances X_{HCO+} and X_{HCN} in some clouds were estimated. The values $X_{HCO+} \geq (3 - 30) \times 10^{-11}$ and $X_{HCN} \sim (3—60) \times 10^{-10}$. Electron abundances X_e determined from the X_{NCO+} estimates do not exceed $10^{-7}—10^{-6}$. The CO and HCN integrated intensities correlate with IR luminosities. The CO and HCN line widths are close to each other. This phenomena and the observed relations of radiation temperatures and line widths of HCN and $H^{13}CN$ can be better explained in clumpy models of molecular clouds.

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INVESTIGATION OF THE VARIABILITY OF MASER EMISSION OF MOLECULES OH AND H_2O IN THE SOURCE VY CANIS MAJORIS

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Results of observations of the source VY CMa, made from June 1985 to December 1988 with the RATAN-600 at OH and H_2O lines are presented. The radiotelescope has the following resolution 2.6′ × 45′ × × 5.4 km/sec at 1665 and 1667 MHz and 11″ × 3′ × 0.4 km/sec at 22.2 GHz.

Part of the results are published [1, 2].

For the VY CMa were made thirteen series of observations at 1667 MHz and nine series at 1665 MHz and six series at 22.2 GHz. The spectral coverings are obtained in the ranges from —87 km/sec to + +126 km/sec for OH and from +10 km/sec to +26 km/sec for H_2O.

The profiles of OH and H_2O emission lines for VY CMa are presented and the time variation of the flux density are discussed as well.

VY CMa shows more intensive time variations of H_2O emission than that of OH.

It is made an attempt to explane the results of the observations.

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PROPERTIES OF COOL HI IN THE CYGNUS RIFT

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A 2 × 2 degrees area in the Cygnus X-Region has been mapped in the 21 cm line with the DRAO—Synthesis Telescope (resolutions 1′ × × 1.5′, 2.6 km/s) and with the Effelsberg 100 m—dish (resolutions 9.3′, 0.7 km/s) providing the zero—spacings for the interferometer data.

From visual seearch of about 4000 spectra the statistics of the HI self—absorption properties in the local arm (—15 km/s < v (LSR) < < +15 km/s) show a dominance of small angular sizes down to the resolution limit (ca. 1.5′) and of low optical depths down to 0.05. The linewidths indicate spin temperatures of about 50 K. The column densities of these features are about 1.6×10^{19} cm^{-2}. Assuming spherical geometries the volume densities turn out to be around 10 cm^{-3}. Masses are in the range of 0.1 M (sol) then.

The number density of these objects seems to be as high as 100 per square degree.

In the observed field (l = 80 deg., b = 0 deg.) the distances of the absorption regions are difficult to derive from the radial velocity. At a mean distance of 2 kpc the resolution limit corresponds to a diameter of 0.6 pc. As many of the absorptions should be caused by the Cygnus Rift (distance 0.7 kpc) the sizes are down to 0.2 pc.

The derived distribution of angular sizes of HI self—absorption regions seems to continue the distribution found by Bania and Lockman (1984) to smaller sizes.

We suggest however that those self—absorption components are not distinct clouds but show the inner structure of larger HI clouds and can therefore be interpreted as inhomogeneities or fragments.

OBSERVATIONS OF THE LINEAR POLARISATION OF THE GALACTIC BACKGROUND AT 2720 MHz

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Full sampled observations, (with a HPBW of 19′) of the linear polarization of the galactic background where made with the 25 metre Stockert radio telescope of Bonn University.

Elimination of spurious instrumental polarization will be described in terms of the instrument tensor.

The influence, characteristics and correction of the thermal radio emission of the atmosphere, which becomes polarized through reflection on the ground, will be discussed.

Observations in the perseus — region will be presented.

INFLUENCE OF PRE—MAIN SEQUENCE STARS IN THE SURROUNDING CLOUD

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In the last three years we have been carrying out an observational program with the aim of estimating the influence of pre—main sequence stars in the surrounding molecular clouds. We have selected three Herbig Be stars, BD404124, HD200775 and LKHA198. We presents maps of the globules associated with these stars in ^{12}CO (J = 2 — 1), ^{13}CO (J = 2 — 1), ^{12}CO (J = I — 0), ^{13}CO (J = 1 — 0) with a 2 minute beam, and in the inversions transitions (1,1), (2,2) of NH_3 with a 40 seconds beam. While BD404124 and LKHA198 are associated with a small dense clump, i. e., they are buried inside them, HD200775 have no dense material around it. This is probably due to being in a different stage of evolution. In HD200775 we have seen heating by the UV radiation from the star. We have also found an excess of 12 micron emission which is probably caused by PAH emission.

ALTERNATIVE SEARCH FOR ARTIFICIAL COSMIC RADIO EMISSION

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According to the classical point of view, some radio emission of an extraterrestrial civilization (ETC) must be narrowband, variable and received from a sun—like star direction. This hypothesis is quite acceptable for ETC developed like the human civilization. But the radio emission from a highly developed ETC can be considederably different from the classical model prediction. Consequently, it is necessary to search for some alternative SETI strategies.

For example, a highly developed ETC can possess a lot of radiotransmitters. The integrated radio emission can be almost continuous, both in time and frequency coverage. We can observe such a civilization as a discrete radio source at different frequencies in the vicinities of some yellow dwarf (Arkhipov, 1988). According to this model, the SETI promising objects were picked out.

Recently some unidentified sporadic narrowband radio—bursts were registered by several SETI—groups (for example: Dixon, 1985). This emission is not in accordance with the classic ETC model prediction. That is why investigators are skeptic in their discussions about those results. But it is probable that some bursts can be intersections of the radar or communication narrow radio—beams emitted by extra-

terrestrial spacecrafts dispersed in the interstellar medium. Therefore, simultaneous observations by several radiotelescopes are necessary for indentification of such signals.

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CHARACTERISTICS OF THE SOLAR WIND TPANSSONIC REGION

LOTOVA N. A., ROMASHETS Ye. P., PISARENKO Ya. W.

The typical peculiarities in the structure of the solar wind transsonic region are discussed. It has been found that in the radial profile of the turbulence level, the wide region of strong turbulence, $\Delta R \sim 10 \div 16\ R_\odot$, is preceded by a comparably narrow region, $\sim 4R_\odot$, of very low turbulence. A similar structure is observed in the radial dependence of the mean electron concentration. The spatial position of the low turbulence region coincides with a sharp growth of the solar wind velocity and, on the contrary, the region of high turbulence level coincides with a decrease of the velocity gradients or a change of their sign.

THE SUN AND SOLAR CORONA OBSERVATIONS

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Observations of the Sun and solar corona at decametre wavelengths by means of a special set of equipment based on the UTR-2 radio telescope are regularly carried out in the RIAN USSR.

One of the aims of these observations is studying the heliolongitude dependence of the frequency drift velocity for type III radiobursts. In the decametre band such investigations are practically not conducted. The results of the investigation, based on a large amount of experimental data, of the heliolongitude dependence of the frequency drift velocity of type III radiobursts are presented.

Also there are the results of data processing of observations of the point source (Taurus—A) decametric radiation scattered on the solar corona in dependence of the angular distance from the Sun. Such observations are of particular interest because the scattering magnitude is proportional to the square of wavelength, which allows to rather effectively detect the transitional region by changes in the image of the source.

The results of simultaneous observations of polarization, spatial, dynamic and temporal characteristics of type III bursts of the June 1984 radiostorm are also presented. The polarization degree dependence of type III bursts upon the reception bandwidth is discussed.

A STUDY OF THE SOLAR WIND AT DECAMETRIC WAVELENGTHS

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The apparent angular diameter of a radio source increases when the latter is viewed through an inhomogeneouse medium. This effect is due to scattering of the radio waves by electron density irregularities, and its study can provide information on the structure of the solar wind. Such investigations have been carried out by many authors. At angular distances of a few tens of solar radii, interferometry of the Crab nebula is used for the purpose. At greater distances the interplanetery scintilation method is preferred, since the scattering angle is small. However, at low frequencies the scattering angle is not so small because it is directly proportional to the wavelength square. Using a high resolution interferometer operating at a low enough frequency one can measure the increased angular diameter of the sufficiently compact radio source and study the scattering effect.

For this purpose the decametric interferometer URAN—1 operated at 25 MHz with the 42,3 km baseline has been used for observations of the compact feature in the Crab nebula (the angular diameter about 2′ and the flux density 1000 jy at 25 MHz).

We observed fringes from this source within a wide range of elongations from 22 to 180 degrees. The obtained «scattering angle versus elongation» dependence differs from that computed on the assumption of a sperically symmetric model of the solar wind with a power law decrease of the electron density with the distance from the Sun. We believe that the possible cause for these differences is the anisotropy of the electron density inhomogeneities. In the framework of a model taking this anisotropy into account, parameters of the interplanetery plasma can be determined with a rather good accuracy.

THE DYNAMICS OF MICROWAVE BURSTS AND THE RELATIVE ABUNDANCE OF ELECTRONS AND PROTONS IN SOLAR COSMIC RAYS

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A relation between the parameters of microwave bursts and the relative abundance of energetic electrons and protons (e/p—ratio) in solar cosmic rays is discussed. It is shown that short (impulsive) microwave bursts correspond to events with a higher e/p—radio. It is shown also that the duration of bursts is in a good correlation ($r = 0.90$) with times of exponential decrease of their intensity. Such behaviour of e/p—ratio is explained by the difference of the electron and proton lifetimes in flare loops of different size. The dynamics of energetic electrons and protons is considered in the framework of different pitch—angle diffusion regimes which take place in high and compact coronal loops.

A conclusion is made that for the explanation of the proton rich events which are accompanied by the long buration flares, there is no need to make suggestions on the second phase acceleration.

ON THE RELATIONSHIP BETWEEN THE HARMONIC COMPONENTS OF PLASMA FREQUENCY IN THE RADIO EMISSION OF TYPE IV BURSTS

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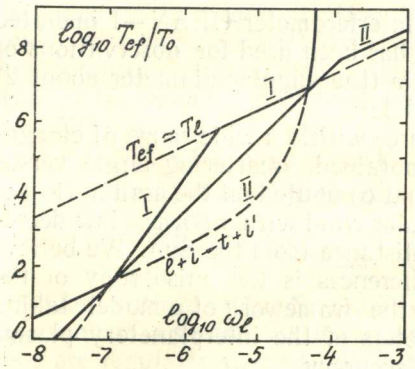
The definition of the generation frequency is important for the diagnostics of the corona parameters over the solar sporadic radio emission. Type IV radio bursts are assumed to be the result of radiation of the plasma (Langmuir) turbulence developed in the coronal magnetic loops. Thus, the frequency of type IV burst radiation can be equal both to the fundamental and the second harmonic of the local plasma frequency.



It is shown in the paper that under the condition of the developed Langmuir turbulence, the thermal plasma stratification leads to the variation of the fluctuation density spectrum close to the zero frequency. According to the calculations an increase of the conversion effectiveness close to the fundamental caused by the thermal plasma stratification results in the domination of the radiation of the fundamental (I) over the radiation near the second harmonic of the plasma frequency (II) for any turbulence level (the effective temperature T_{ef}, Langmuir turbulence density W_l (see Fig.). Indices $l + i \rightarrow t + i'$ in the Figure indicate the relation T_{ef} (ω_L), being associated with conversion by thermal plasma ions. So, the second harmonic in type IV radiation can be observed only outside the directivity pattern of the fundamental.

DIAGNOSTICS OF ERUPTIVE FLARE PLASMA USING MICROWAVE EMISSION

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The small event of 2 November 1988, 0956 UT having the form of five elementary flare bursts was recorded by new four—wavelength polarimeter (λ = 1,95; 2,25; 2,8 and 3,5 cm) of the 22-m radiotelescope (RT—22) of the Crimean Astrophysical Observatory. The first elementary flare burst with microwave pover—law index $\alpha \approx (-3{,}2 \div -3{,}4)$

and largest amplitude can be considered as a direct consequence of primary energy release in the flaring loop.

The four succeeding bursts are characterized by power—law index $\alpha \approx -(3{,}5 \div 3{,}7)$ and form relaxational time profile with a period of about $\tau \sim 15$ s and modulation depth less than 30 %. Such a time profile can be driven by Alfvenic oscillations of a single flaring loop which arises due to the filling up of the loop by hot chromospheric plasma [1]. Using the period $\tau = L/Ca$, quality $Q \sim 2\pi m_i/\tau\nu_{ei}\, m_e$ and modulation depth $\Delta F/F \sim \beta/2$, $\beta = 8\pi nT/B^2$ one can estimate the density $n = 2 \cdot 10^{11}$ cm^{-3} and temperature $T \sim 1{,}6 \cdot 10^7$ K of eruptive plasma as well as the mean value of the flaring loop magnetic field $B \sim 300$ G. The electron plasma frequency to the gyrofrequency ratio is $f_p/f_b \simeq 5$. Under such condition the most probable mechanism of the mcw—emission of hot eruptive plasma in flaring loop is collisional bremsstrahlung one.

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TM-POLARISED RADIOEMISSION IN CURRENT SHEETS ON THE SUN

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TM—polarised plane wave propagation through the plasma layer characterized by parameters corresponding to current sheets on the Sun is considered. The electron density profile as a function of height is assumed to be parabolic. The magnetic field is not taken into consideration. The coefficients of penetration and reflection for an arbitrary angle of incidence are found by means of joining appropriate solutions.

INTERPRETATION OF SOLAD RADIO BURST CHARACTERISTICS BY RADIOSOURCE INHOMOGENEOUS MODEL

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This work devoted to interpretation of dependence of radiobursts parameters versus position on solar disc. Statistical analysis showing the differences between bursts at the limb and at the center of disc (maximum frequency of burst spectrum, for example, is higher at the limb than at the disc). For observing differences interpretation we use the radioburst source model as magnetic loop with field and magnetic particles density both inhomogeneous. We suppose a gyposynchrotron genesis of burst radioemission and spectral maximum due to self-absorbtion. Numerical calculations showed satisfactory explanation of observing center—to—limb variations in bounds of proposed model. From analysis of model parameters estimations for bursts average observing characteristics one get strong variation of magnetic field from loop top to feet; it leads to weak (few tens of Gauss) fields in the loop top and hence to the high loops, while nonthermal particles occupied about half of loop length.

COMPILING SOLAR OBSERVATION CATALOGUE AT THE RATAN—600

V. V. KOMAROV, V. M. PLOTNIKOV, V. A. SHATILOV

At present the solar spectral polarization analysis with the RATAN-600 radiotelescope are carried out simultaneouslyusing 10 radiopolarimeters, freguencies ranging from 1 GHz to 37,5 GHz, primary feeds for the longest wavelengths being combined in a single phase centre [1].

The high angular resolution of the RATAN-600 gives a possibility to obtain detailed maps of the Sun. The primary data processing allows to organize the basic archive, which becomes the foundation for the solar graphic catalogue. It contains the one—dimentional scans of the total solar radioemission flux (the Stokes parameter I) and the left — and right—handed circular polarization (the Stokes parameter V) for each registered wavelength.

The first sample of the catalogue is discussed.

Reference

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RADIO SOLAR ECLIPSE OBSERVATIONS TODAY

V. V. KOMAROV, V. M. PLOTNIKOV, V. A. SHATILOV

Solar eclipse observations with the small radiotelescope at centimeter wavelengths give solar active region picture with the angular resolution about several arcseconds.

It equals or exceeds the possibility of modern large antenna systems (VLA, RATAN-600). Therefore, solar eclipse radioreseach remains actual today:

the active region structure data obtained are unique, while transportation of an effective small radiotelescope to any spot on the globe requires modest expenses.

The wide spectrum range olservations are necessary to understand the physical phenomena in an active region responsible for its radio emission. It is possible to gain when using modern radiopolarimeters with multiwave primary feeds combined in a single phase centre [1].

The results of three solar eclipse radioobservation are presented. These data could be obtained at present only from eclipse observations, implying essential value of this method for solving problems of solar physics.

Reference

1. Komarov V. V., Bogod V. M., Dikij V. N. Multiwave primary feed with the single focus for radioastronomical researches. Abstracts of the Young European Radio Astronomers Conference, 1984, pp. 63—64.

ON A METHOD OF SEPARATING THE RADIO EMISSION LEVEL OF A «QUIET» SUN USING DATA FROM THE SSRT

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In order to separate the radio emission of active regions on scans obtained at the SSRT at 5.2 cm wavelength, if the radio telescope operates in the one-dimensional mode, it is necessary to know the radio emission level of a «quiet» Sun.

A number of methods are currently applied to separate the radio emission level of a «quiet» Sun such as filtering methods, determination of a mean—statistical contour of a «quiet» Sun according to the «lower envelope» principle, and utilization of data in periods of decreased solar activity.

In this paper the «quiet» Sun is approximated by a convolution of the radio telescope beam with a uniformly illuminating disk. For that purpose the beam and the radio emission of the «quiet» Sun are expanded into Fourier series. In this case the SSRT beam in the frequency region has the form of a line function decreasing uniformly to higher frequencies and with equidistant harmonics, and the radio emission of the «quiet» Sun in this region is described by Bessel's function of the first kind. Such a representation makes it possible to construct a rather simple calculation algorithm and does not require a large amount of memory and computer time.

An investigation made of this algorithm in periods when a small number of active regions were present on the solar disk showed good agreement of the calculated contour and of the curve obtained at the SSRT output.

RADIOSOUNDING OF HALLEY'S COMET

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Radiosounding of Halley's comet has been carried out during Vega's—1 and Vega's-2 fly by using radiowaves at $\lambda_1 = 32$ cm and $\lambda_2 = 5$ cm. We have obtained time dependences of frequencies $f_1(t)$ and $f_2(t)$ and then the frequency differences were formed:

$$\delta f(t) = \frac{p}{p^2-1}[p \cdot f_1(t) - f_2(t)];$$

$$\Delta f(t) = \frac{1}{p^2-1}[p \cdot f_2(t) - f_1(t)]; \quad p = \lambda_1/\lambda_2.$$

Thus it was possible to investigate both the plasma and gas-dust envelope of comet at cometocentric distances from $\sim 8 \cdot 10^3$ km to $\sim 200 \times \times 10^3$ km. A quasi-periodical oscillations of signals frequencies were observed during crossing the cometopause by spacecraft Vega-1 ($R \sim \sim 150 \cdot 10^3$ km — inbound, $R \sim 10^5$ km — outbound) with the period of 30 s.

The dependence of the electron density at cometocentric distances R may be considered as the R^{-2} function at distances range from 15×10^3 km to 10^5 km. The local maximum of the electron density ($N_{max} = 4000 \pm 200$ cm^{-3}) at $R \simeq (11{,}7 \pm 0{,}75) \cdot 10^3$ km from the nucleus has been observed in course of the radiosounding seance of 1986 March 6 and the maximum ($N_{max} = 3800 \pm 2000$ cm^{-3}) has been registered in 1986 of March 9 at distance $R \simeq (9{,}7 \pm 0{,}75) \times 10^3$ km. The two—dimensional spectral density of electron concentration fluctuations may be approximated by expression

$$G_p(\nu) \sim \nu^{-(2,7 \pm 0,2)}$$

as for the two-dimensional spectrum of density fluctuations of neutral components the expression is

$$G_n(\nu) \sim \nu^{-(2,8 \pm 0,2)}$$

in the frequency range between $2{,}4 \cdot 10^{-3}$ and 0,2 Hz.

OBSERVATIONS OF DAM'S FARADAY ROTATION

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Jovian decametric emission (DAM) is known to exhibit, contrary to other low-frequency planetary radio emission, a high degree of linear polarization. As it travels through the Io plasma torus and the terrestrial ionosphere, DAM undergoes an important Faraday rotation that may reach up to $\sim 10^2$ radians at 30 MHz. We report recent observations of DAM's Faraday rotation obtained with the 144 log-periodic antennas decametric array in Nancay (France) coupled to a wide band (10-40 MHz) sweep frequency polarimeter.

The study of the Faradey effect on Jovian emission shows that the usual simple approximation where the rotation of the polarisation plane varies as the inverse of the frequency squared ($1/\nu^2$) cannot explain the observations. A second order term proportional to ($1/\nu^4$), resulting from the difference between the X- and O- mode ray paths and the high density gradients of the ionosphere, must be considered in order to account for the observations.

We show that the determination of the initial orientation of the DAM polarization ellipse is strongly conditioned by the important amount of Faraday rotation at the observed frequencies.

JOVIAN DECAMETRIC RADIO EMISSION

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High-sensitivity observations of the Jovian decametric emission (DAM) were performed with the radio telescope UTR-2 in 1980—1982 at frequencies from 10 to 23 MHz. Some interesting results follow from the observational data analysis.

For example, it was shown that the S-emission was emitted generally from the southern part of the Jovian magnetosphere (at the frequencies $\sim$ 20 MHz). For the first time the average peak flux density spectra of the L and S-emission (separately) of different Jupiter's radio sources were obtained. The Jovian decametric radiation patterns were investigated also. According to model calculations, the refraction of DAM in the inner Jovian magnetosphere could explain some properties of DAM spectra and radiation patterns.

On the basis of the last experimental data on the S-emission, a new generation mechanism is also suggested. The electron beam moving along the Io magnetic flux tube excites plasma waves having anomalous dispersion in the warm Jupiter's ionospheric plasma. The quasilinear relaxation of the beam-type instability results in formation of a stationary oscillation spectrum. This mechanism allows to explain the intensity, frequency and some properties of the radiation pattern of the Jovian S-emission.

THE RYLE TELESCOPE: A NEW INSTRUMENT FOR MICROWAVE BACKGROUND ASTRONOMY

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A new instrument which will revolutionise microwave background astronomy is currently being commissioned in Cambridge. The Ryle Telescope is a high-bandwidth, aperture-synthesis array operating at 5 and 15 GHz with excellent sensitivity ($\sim$ 100 μK in 12 h) on angular scales up to several arcmin and with considerable immunity to systematic errors. It will enable maps of cosmic microwave background anisotropies to be made with sensitivities far exceeding current limits. The telescope's technical features are described and preliminar: results presented.

SUPERCONDUCTING DEVICES FOR MILLIMETRE WAVE ASTRONOMY

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The design and construction of an experimental 100 GHz reciever base on a superconductor-insulator-superconductor (SIS) tunnel junction mixer is described. The use of niobium as the superconducting material, together with a novel reciever construction, overcomes some of the problems associated with previous designs based on lead alloy junctions. An efficient computer model of the performance of these junctions is also described and the predictions of the model are compared with experiment.

REDUCTION OF INTERFERENCE EFFECTS IN OBSERVATIONS WITH MIYUN SYNTHESIS RADIO TELESCOPE

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Mane-made interference of various kinds has an increasingly negative impact on radio science. Many, if not all radio astronomical observing sites have experienced some types of effects degrading the observations. To cope with interference effects in the observation data, a new technique is developed in MSRT (Miyun Synthesis Radio Telescope) of Beijing Astronomical Observatory.

Different from the most present calibration procedures in which severely «polluted» data are used to be deleted, the new method keeps all observation data and separates useful radio information from noisy background.

In astronomical observations radio sources are regularly moving across the sky, while most interference sources are still (such as ground-sited) or move in different ways (such as satellites). The difference of moving mode causes different spectrum behavious in outputs of the telescope, that offers us possibility to remove interference effects by frequency filtering method. Some experimentes were done in MSRT and effective results are obtained.

RADIO ASTRONOMY INVESTIGATIONS WITH GEE-TEE RADIO TELESCOPE

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GEE-TEE is a low frequency radio telescope operating at 34.5 MHz. It is situated 80 kms north of Bangalore City, in South India, Longitude 77° 26′ 07″ E, Latitude 13°, 36′, 12″ N. The telescope has 1000 dipoles. 640 dipoles are along 1.37 kms E-W arm and 360 of them along 0.45 kms south arm. The telescope can be configured as a single beam instrument or as one dimensional synthesis instrument along the meridian producing 90 simultaneous beams.

A continuum survey of the sky covering declenation range $\delta = -36°$ and $\delta = +64°$ with resolution of $26' \times 40'$ and sensitivity 5 Jy has just been completed.

Eight pulsars have been observed using this telescope.

A 128-channel spectral line receiver has been used to observe recombination lines of carbon in the direction of Cas A.

Design and development of spectral line receiver for observing spectral lines corresponding to 8 consecutive principal quantum numbers simultaneously is under progress.

DESIGN OF A CORRELATION POLARIMETER AND A DIGITAL BACKEND FOR 37 AND 22 GHz

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In a correlation polarimeter two orthogonal polarizations are correlated directly and in quadrature. As a result, all Stokes paremeters can be measured simultaneously and good time resolution can be achieved. The polarimeter is first realized as a total power radiometer for Sun measurements and later it can be expanded into a full two-beam quasar receiver.

The digital backend is an integral part of the polarimeter. The backend supplies all the timing signals for calibration and beam switching. Furthermore, the output signals from the polarimeter receiver are all digital, thus reducing distortion and eliminating the effect of ground currents. The beam switching is done by software with the MicroVAX computer.

APPLICATION OF ON-BOARD MICRO-ACCELEROMETERS FOR ORBIT DETERMINATION OF SPACE-VLBI SATELLITES

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Two dedicated space-VLBI projects are in preparation for the mid-90's. One is the Soviet Radioastron, the other is the Japanese VSOP. Some scientists pointed out the potential applications of space—VLBI in the field of astrometry and geodynamics.

Because both applications need very precise orbit determination, we proposed some techniques and some on-board instruments to reach the required (sud-meter) orbit determination accuracy.

The dominant part of orbital errors in the case of space-VLBI satellites originates from errors in the non-gravitational force models. An on-board micro-accelerometer can measure directly these forces. In this paper results of preliminary investigations are presented on the use of on-board micro-accelerometer for orbit determination of space VLBI satellites.

The usefullness of micro-accelerometers for orbit determination was investigated by two different methods.

1) We compared the orbit determination accuracy of satellites with and without on-board micro-accelerometers, For this study Doppler broadcast ephemeris data of two «traditional» — Transit type and two Nova — type NNSS-Doppler satellites have been used for a one year period.

2) Using the ORBADJ (ORBit ADJusting) Program of SGO, we simulated the effects of non gravitational forces for a satellite on Radioastron orbit. On this — hypothetical — satellite we modelised cases when we have and have not an accelerometer on board.

The results indicate that an on-board micro-accelerometer can improve the orbit prediction accuracy by one or two orders of magnitude. We hope that, some on-board micro-accelerometer together can assure the needed accuracy.

THE USE OF PULSARS AS PROBES TO CORRECT THE INSTRUMENTAL POLARIZATION OF RADIOTELESCOPES

The aim of this work is to investigate the use of radiopulsars as probes for the calibration o. the instrumental polarization introduced to the insident beam of a radiotelescope.

Instrumental polarization may occur as a result of pointing error, change in front-end gains due to zenith angle, calibration from using continuum sources and feed turnstile misalignement. Especially feed imperfections or misalignement result in a transformation of the true Stokes vector S (I, Q, U, V) into the measured one S′ (I′, Q′, U′, V′).

This effect can be expressed as nonorthogonality and ellipticity of the expected circular responce of the two input channels. Nonorthogonality results to a misestimation of total power with respect to linear power and ellipticity results to the crosscoupling of linear and circular power. The distortion to the input polarization vector can be described by a Muller matrix. A determination and an inversion of such a matrix and further multiplication to the input vector can correct the instrumental effects.

The importance of correction for the instrumental polarization arises from the fact that polarization characteristics of the input radiation provide the only derectly measurable parameter for determining the magnetic field distribution of radio sources.

The advandage of using pulsars for such a reduction is that the polarization angle of the linear polarization very often, intrincicaly varies by a significant amount within the pulsar profile. Furthermore pulsars exhibit a significant amount of linear polarization which can allow for the crosscoupling effect to be measured. Continuum radiosources normaly do not exhibit great polarization angle variation so that they have to be tracked for a long time to allow for parallactic angle variation.

By using pulsars one avoids the tracking of the calibration source for a long time.

Such a scheme was used for the reduction of 21 radiopulsars at 1720 MHz, observed with the Bonn radiotelescope. The main calibrator was PSR 1929 + 10. An Arecibo digitized calibrated profile was used to determine the polarimeter matrix.

LOW NOISE CRYOGENICAL FET-AMPLIFIER FOR RADIO ASTRONOMY

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Highest sensibility of the microwave radiometries are achived to maximum reducing of the input devices inherent noise and frequency stabilization. The cool-down to the 15 ÷ 20 K cryogenic FET-amplifier satisfy to the both requirements. The massive amplifiers cooling is realizied by relabively thin copper strands. Microwave signal injection is realized by germetic low heat conduction tract. This way by heat damping the termostabilization is realized on the level ±0,1 K and better. In the similar devices, especially with coaxial inputs, the task of keeping the noises redusing coefficient on the cooling is paticular complication.

Due to using the special constraction of the germetic tracts with low loss and FET-amplifiers cooling, the cooling receivers noises are achived to the level 110—150 % of the cooling to 20 K FET-amplifiers inherent noises in the range from 1,3 to 23 GHz.

In the realizing construction, the effective input noise temperature is:

on the range 1,3 ÷ 1,7 GHz — 9 ÷ 15 K
2,2 ÷ 2,6 GHz — 15 ÷ 22 K
21 — 23 GHz — 110 ÷ 115 K

The ways of schee decisions and methods of tune in offer the considerable complication in likeness devices, guaranteing stability strengthening and absence of regeneration effects trat agravate noise temperature on cooling connected with essential increasing of FET-amplifiers and agravate of inverse losses. Attain results, show the possibility of direct unite sour stage the guaranteing strengthening 25 ÷ 35 dB.

GROOVE GUIDE G-BAND RECEIVER

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The application of new transmission lines are of present interest becouse of the using of the higher frequency regions for a number of radio astronomy problems. These lines should be more technological and low-lossed in comparison with standart rectangular waveguide. One of the more perspective lines for frequency region above 100 GHz is a groove guide wich combines singlemode operation and oversized dimensions [1]. These features are of great importance in particulary for designing of short millimeter and submillimeter receivers.

The theoretical and experimental results of some groove guide receiver subassemblies (mixer, detector, local oscillator, sideband rejection filter, ferrite isolator) are presented in report. The conversion losses 12—15 dB were obtained for a number of frequencies of the region 100—200 GHz with the local oscillator power 10 mW. Some ways of operation frequency rising and conversion losses improvement are discussed.

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TWO-CHANNEL HETERODYNE-MODULATION BASED RADIOMETER RECIEVER

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A millimetre-wave radiometer was designed and tested. The results gave a weak dependence from external noise sources level changes. The last are usually coursed by radiation fluctuations of the atmosphere, which are similar to moving irregular semitransparent screen between the radiotelescope and objects and also by a background radiation of far out-of-galaxy radiofrequencies sources [1].

The radiometer is based on the superheterodyne reciever with the input RF-amplifier and has two spreaded irradiators, which are connected up to RF-block by turns. The sensitivity (1 second time constant) is 0,1 °K. Such a decision has permited to decrease greatly the influence of atmosphere fluctuations by means of simultaneous of two signals from adjacent directions.

The difference of the signals is registred at the reciever's output. So, the spatial antenna characteristics are various for the useful signal and for an interference that's why the last be supressed.

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EHF INPUT LOW NOISE ARRANGEMENT FOR RADIOMETRY RECEIVER

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Extension of regular radiometry observation frequency range is of great importance for radioastronomy.

Recent achievements in semiconductor technology field and science of materials allowed to realize a FET low noise amplifier with noise parameters no worse than that of parametric amplifier [1], [2]. It gives a possibility to reconstruct receiving radioastronomy apparatus and to produce extremely-highfrequency (EHF) high-quality noiseless Dicke radiometer.

The results of the development of HEF module for radiometric receiver, which consists of the block of FET-S low noise amplifiers, detector on basis of shottky-barrier-diode and low frequency preamplifier, placed into hermetic housing, are presented in report. The noise figure is 3,4 dB with 55 dB gain in frequency range more than 2500 MHz on module input. The fluctuation sensitivity is 0.015 °K with signal integration time equal to 1 sec.

Ways and perspectives of performance improvements are also discussed.

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SPATIAL FLUCTUATIONS OF MICROWAVE EMISSION OF ACTIVE REGIONS

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A processing technique for one-dimensional responses of the Siberian Solar Radio Telescope to the radio emission of active regions is presented. For obtaining fluctuation spectra of fluxes and positions of local sources (LS), a spectral analysis algorithm for non-equidistant counts of the initial sequence is developed. A representation of spatial variations of LS in the form of «structure—time» maps is realized. The difference of LS fluctuations depending on their activity is demonstrated. Fluctuations of the core component of a LS without its structural changes are observed with increasing magnetic flux of a sunspot group and with increasing complication of their configuration. An increase in activity which is manifested in the form of weak flares, is accompanied by substantial changes in the LS structure. Activity manifests itself also in peripheral pearts of the active region. It is found that the fluctuation spectra of the radio flux and of the brightness center contain the same components, having 99 % - significance.

SOLAR RADIO IMAGE SYNTHESIS ON THE SSRT IN OBSERVATIONS WITH A KNIFE-EDGE BEAM

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One of the pressing problems of radio astronomy is that of studing the detailed spatial structure of the Sun, and this requires construction of a two-dimensional radio image map.

This paper considers a synthesis algorithm for solar radio images from the Siberian Solar Radio Telescope (SSRT) operating with knife-edge beams; the algorithm is based on spatial reconstruction of Fourier-spectra.

A digital processing system for observational results is proposed. The system includes a radio image synthesis program system and a pretreatment system (smoothing, referencing of the position of each scan, and correction for a change in scanning direction).

An algorithm has been developed for correction of radio maps. It is based on the regularization method in which an operator in the dialog mode can select parameters of an adaptive filter that compensates for distortion effects and ensures the stability of solution.

POLARIZATION MODULATOR OF THE CENTIMETER WAVE RANGE

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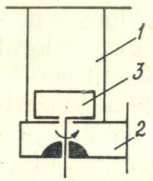
The paper describes the polarization modulator [1] the use of which as an input plumbing permits one to transform the ordinary switched radiometer into the polarimeter which measured the Stokes parameters I, Q and U.

The Figure shows schematically the polarization modulator (I is the circular waveguide, 2 is the rectangular waveguide, 3 is the rotating frame).:



The modulation of the Stokes parameters Q and U of the received radiation is made at the second harmonics of the frame 3 rotation frequency with the shift of the phase $\pi/2$. Averaged in the frequency range 3.7 — 4.2 GHz values of the spurious modulation of the Stokes parameters I, V < 0.1 %, the maxima deviation of the measured positional angle from the real one is $\pm$ 0.5°. At present, the radio polarimeter is realized by the radiotelescope RATAN-600 which contains a polarization modulator with the sensitivity 3 mK, registering the Stokes parameters I, Q, and U in parallel, the absolute error of measurements of the degree of the parameter polarization $|\Delta p| < (0.2 \div 0.5)$ %, the position angle $|\Delta x| < (0.5 \div 1.5)°$.

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MULTICHANNEL AUTOMATIC RADIOMETRIC COMPLEX FOR RADIOASTRONOMICAL INVESTIGATIONS OF THE COSMIC RADIO EMISSION

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Successive observations with a change of the feeds and radiometer are carried out for the solution of a wide range of radioastronomical and applied problems (investigations of the cosmic radio emission, antenna calibration). However, in a number of cases it is reasonable to make simultaneous radiometric measurements at different frequencies to increase the informativity and to make shorter the time of investigation. The report presents the results of development the antenna aperture complex of the decimeter wave range consisting of a multichannel automatic radiometer and a set of vibrational feeds with the mutual phase center.

The radiometric complex includes a universal 6-channel control desk and a set of moduli which are the completed radiometers. The moduli have the heat setting device, high-frequency and low-frequency sub-blocks and intended for the installation directly in the focal container of the antenna. HF-sub-block is built over the design of the modulational radiometer of the direct amplification. LF-sub-block includes the electronic input attenuator, synchronous filter and detector, retuned electron integrator, output amplifier, reference voltage generator. A possibility is provided for the remote manual and automatic programmed control by the computer over the interface KAMAK with the digital indication of the measured signals, time, chosen operation regimes. The control desk contains also the electron timer with the programming unit of the given time and the power unit with the automatic protection. The given radiometric complex operates with the antenna equiped with the feed system which is a set of two—three wave range vibrator feeds with the mutual phase center.

STRAIGHT CORRELATION RADIO POLARIMETER

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The peculiarities of the polarization characteristics of the radiotelescope RATAN-600 impose higher requirements to the parameters of the radio polarimeter [1].

The parer describes a model of the correlation polarimeter of the direct amplification providing the operation in two regimes: 1) the regime of the linear polarization measurements (the Stokes parameters Q and U); 2) double-beam regime of the intensity measurement (I).

The correlation polarimeter includes the input and output microwave polarization plumbing, two amplification channels, low-frequency units.

The input polarization pluming contains a circular ortomode transducer with spaced linear orthogonal channels which are transformed remotely (by the crane switch) into 0 — π hybrid bridge [2].

The output polarization plumbing contains the microwave correlator assembled of three-stub 3-dB quadrature bridges, the phase modulator $0 \rightarrow \pi$, made of coaxial-wave transit, elements adjusting the amplitude and phase in channels.

The coupling coefficients of the Stokes parameters averaged in the frequency range of 3.7 $\div$ 4.2 GHz amount: $\leqslant 0.1$ % (for I $\rightarrow$ Q and I $\rightarrow$ U), $\leqslant 0.25$ % (V $\rightarrow$ U), $\leqslant 0.5$ % (V $\rightarrow$ Q). The measurement error of the positional angle does not exceed $\pm$ 1°.

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THE LOCAL HETERODYNE AND PHASE CALIBRATION SIGNAL SYNTHESIZING SYSTEMS OF RADIOINTERFEROMETER

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The systems synthesizing 335 MHz local oscillators and 291 MHz phase calibration cophased signals have been realized for the three-antenna variable base interferometer. The local oscillator synthesizing system consists of quartz frequency standard $f_0/2 = 167{,}5$ MHz and two additional oscillators $f_1 = 55$ MHz, $f_2 = 75$ MHz, located at the ends of the TEM-line, connecting all antenna points. Two pairs of signals with frequencies $(f_0/2 - f_1)$; f_1 and $(f_0/2 - f_2)$, f_2 respectively are transmitted in opposite directions along this line. The frequencies $(f_0/2 - f_1)$ and $(f_0/2 - f_2)$ are produced by mixing the standard and additional generator signals. Transmitted voltages are filtered at antenna points by directional couplers and diplexers and synthesized into local oscillator frequency signal by the algorithm:

$$V(f_0) \sim \{[V(f_1) \times V(f_2)] \times [V(f_0/2 - f_1) \times V(f_0/2 - f_2)]\}$$

Neglecting dispersion effect in TEM-transmission line the synthesized voltages have equal phases independently on transmission line length time variations. The phase errors due to the irregularities of the TEM-line and synthesis units instabilities are minimized to 0.5° by precise matching of components introduced to TEM-line (directional couplers, multiplexers) and using phase-stable elements (mixers, amplifiers, filters) in the synthesis scheme.

The phase calibration system is similar to the described one, but the small amplitude of synthesized signals has allowed one to exclude the amplifiers from synthesis units, thus providing the phase instability less, than 0.1°.

IMPROVING THE SENSITIVITY OF MILLIMETRE WAVE RECEIVERS FOR RADIO ASTRONOMY

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The advance of the millimetre wave radio astronomy observed over the last decade has been greathy conditioned by technical improvements in the receivers and antenna systems employed, specifically the considerable increase in sensitivity. The rise in the receiver sensitivity is associated with

i) cryogenic cooling of Schottky mixers;

ii) employment of low-noise preamplifiers (in particular, maser amplifiers characterized by extremely low noise temperatures approaching the quantum limit);

iii) the advent of SIS-mixers whose noise temperatures are close to such of masers.

A funther increase in sensitivity can be achieved by combining the advantages of cooled receives with masers. This provides for considerably broader instantaneous bandwidths of the system and overall SSB noise temperatures within several tens Kelvin.

Many of these approaches are implemented in the receivers of the Institute of Radio Astronomy, Ukrainian Academy of Sciences. E. g., cooled Schottky mixer receivers have been designed for 3 mm and 7 mm wavebands. Cavity masers are designed and tested for the frequency ranges of 40 to 45 GHz (the gain is 20 dB, the bandwidth 100 MHz and the noise temperature 25 K) and 86 to 88 GHz (the noise temperature is 40 K and the gain-bandwidth product 650 MHz). Radiometers are also combined with masers. New prospective ways of improving the sensitivity of receivers are also being explored.

THE ANTENNA AMPLIFICATION SYSTEM OF THE UTR—2 RADIO TELESCOPE

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The distributed antenna amplification system is one of the principal in UTR — 2 radio telescope, largely determining its efficiency. To improve the threshold sensitivity of the instrument and extend its dynamic range, a new antenna amplification system has been designed. The dynamic range characteristic is particularly important because of the considerable «loading» of the decameter band with intense interfering signals. To extend the dynamic range, the frequency interval between 8 and 40 MHz has been divided into four independent amplification bands less than one octave in width. The signal spectrum is divided and summed up with the aid of frequency selective devices, each consisting of two identical antimetric bandpass filters of even order and two hybrid adders. Within each of the bands, the signal is amplified in multistage amplifiers with a deep linear frequency independent negative feedback in each stage. The stage gain factors are chosen so as to provide the maximum possible dynamic range and maximum sensitivity. The frequency bands are allocated to the amplification stages so as to optimize the resulting transmission function.

AN INTERFEROMETRIC RADAR RANGER FOR USE IN REFLECTOR SURFACE CONTROL SYSTEMS

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A promising way to improve the serial profile precision is to design a reflector composed of controlled panels, provided that the panel position will be «on — line» adjusted by a computer-aided surface surveying system. As a first step in developing a controlled reflector surface an in-

terferometric radar ranger breadboard model was built and tested under laboratory conditions at RIAN.

The ranger consists of a phase-locked Gunn-diode oscillator working at 8-mm wavelength and a two-channel coherent receiver with mixers at inputs.

The phase shifts of an emitted CW-signal and the echo amplitude-modulated by a remote responder are transferred to the same intermediate frequency by corresponding channels of the receiver. The phase difference of two output IF signals is directly proportional to the electrical length of the measured path.

During the tests, the responder displacements of ±2 mm were measured to within 30 μm rms.

RADIOASTRONOMICAL RECEIVERS CALIBRATION

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A radioastronomical Dicke receiver with postdetection gain modulation is described. Original calibration technique is given, which does not require the input calibration system with hot and cold reference loads or any special calibration noise source [1]. The preliminary calibrated inner noise of Dicke radiometer reference channel is used to provide both relative and absolute calibration procedure. Even absolute calibration procedure does not violate the radiometer input matching conditions, since the antenna is always connected to the receiver input during this procedure.

The advantages of this calibration technique are discussed and error sources are analyzed.

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THE EXPERIMENTAL VLBI OBSERVATIONS OF THE NAVSTAR

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The complex of created apparatus for Very Long Baseline radio Interferometri (VLBI) observations of the navigation Earth satellites in the range from 1.2—1.7 GHz is described.

The methods of primary processing and results of experimental VLBI observations of Earth satellites NAVSTAR are given.

The method of processing for temporal delay and frequency of interference refinement are discussed.

TRANSPONDER ANTENNA FOR PHASE RADIO RANGE SYSTEM OF RADIO TELESCOPE RT-70

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A modulating reflector is one of most important part of the surface measuirement system of radiotelescope.

Transponder antenna design is presented in this paper. This design satisfies for the conditions of operation, and metrological demands of the measuring system.

Horn-parabolic antenna (HPA) was choosen as transponder antenna. Phase centres are defined (for different temperature conditions). A space padiation pattern of HPA is calculated. Results of natural modeling and electrical testing are presented.

SYSTEM OF RADIOASTRONOMICAL DATA TRANSMISSION VIA SATELLITE COMMUNICATION CHANNEL

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The defect in the technique of independent recording the VLBI data is the impossibility of real-time operation of such an interferometer, because the time interval from data receiving to data processing is several weeks and more.

For the VLBI operation in real-time it is necessary to create a data transmission channel from the points of observation to the point of data processing. As such a channel, the satellite channel was shosen.

The radioastronomical data are transmitted in the digital form, according to the standard MARK-III. For simultaneous transmission of radioastronomical data from several interferrometrical stations in one channel of the satellite transponder, the frequency-division multiplex is used.

The results of the experimental data transmission in the frequency-division multiplex are given. The total data rate is 27 Mbit/s, the error probability being about 10^{-3}—10^{-4}.

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Molecular Outflows and Herbig-Haro Objects Asociated with Regions of Star Formation

C.J. Davis

Herbig-Haro objects, the rather strange semi-stellar emission nebulae first observed by Herbig in 1951 and Haro a year later, show a persistent presence near regions of star formation and outflow. An understanding of the Herbig-Haro (HH) phenomenon is thus vital for a full comprehension of the processes and timescales involved during stellar birth.

Recent observations of the HCO^+ J = 3–2 rotational emission from HH1 and HH2, combined with a study of other recent observations of these HH regions; in molecular hydrogen (Harvey et al., 1986), ammonia (Marcaide et al., 1988; Martin-Pintado et al., 1987; Torrelles et al., 1985) and carbon monoxide (Edwards and Snell, 1984) have enabled us to match data with currently available models for HH objects. The displacement of the HCO^+ emission peak from the optical (Herbig and Jones, 1981) and H_2 knots found in HH2 combined with the near-zero LSR radial velocity measured for the HCO^+ clump strongly suggests that HH2 represents a stationary, ambient, dense clump that is shock excited by an advancing wind, the wind most probably originating from the radio continuum source known as VLA1 (Pravdo et al., 1985). In such a model, a bow shock is produced by a high velocity outflow ploughing into stationary, dense clumps of ambient material whilst a second *cloudlet* shock propagates into each clump resulting in a general heating of the gas but also an enhancement of the HCO^+ emission (Schwartz, 1978). As this cloudlet shock wave forges deep into the ambient surroundings, it looses momentum, the shock velocity falls and less energy is thus available for the higher energy processes resulting in the HCO^+ emission being seen on the *leeward* side of the clumps. Whether the shocks from the wind enhance the abundance of HCO^+ in these dense HH2 clumps, or the clumps represent regions compressed beyond a critical density for excitation of HCO^+ so that emission at the HCO^+ J = 3–2 line becomes detectable is not yet clear. Observations of these shocked regions in other molecules, N_2H^+ and HCS^+ for example (both structurally similar to HCO^+ and excited at the same critical H_2 densities) should illustrate whether the former is the case – perhaps a reaction specific to ionic molecules (compare with HCN emission), whilst observations in CS, now widely regarded as a useful density indicator, would help to show the clumpy structure of the regions and establish the validity of the latter case.

Contrary to the above discussion, papers by Hartigan et al. (1987) and Böhm and Solf (1985) suggest that HH1 is an example of either Norman and Silk's "Interstellar Bullet" (1979) or Dyson's (1984) later "Jet" model. In both cases, bow shocks are directed away from the exciting source, the shocking being a result of either *i)* a dense clump of material ploughing into the ambient cloud or *ii)* the head or "working surface" of an outflow burrowing into the surrounding medium producing the observed emissions — the HH objects. The Jet model specifies a two shock system, the bow shock accelerating ambient material in its path and preceding a Jet shock where deceleration of the high density jet itself takes place. As a result, radiative cooling occurs within the cold, high density gas between these two shocks producing the observed HH phenomena. The Bullet model requires similar bow shock features, and indeed when we consider the curvature of the bow shown in CCD images of HH1 (Herbig and Jones, 1981), it does seem to have a structure that fits the requirements of either Jet or Bullet model. In either case, however, high radial velocities are required by both models as the HH objects are part of the actual outflow or jet.

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The Molecular Spiral Arms of NGC 6946

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A current interest in the study of star formation in galaxies has centered around the possible relationship between spiral density waves and the star formation efficiency. It is believed that in our galaxy most of the massive star formation occurs in spiral arms (Georgelin and Georgelin 1976). Recently, there has been a series of studies completed which suggest that the primary effect of a spiral density wave is to organize the ISM into a global spiral pattern (*e.g.* Scoville, Sanders, and Clemens (1986)), and thus that the observed spiral variation in the OB star formation efficiency on the spiral arms both in our galaxy and in other galaxies is due to orbit crowding in the spiral potential. In this picture the concentration of molecular gas is a purely kinematic concentration, and star formation in the arms results from cloud-cloud collisions (Scoville and Hersh (1979); Kwan and Valdes (1983)).

From ^{12}CO(J=1→0) observations at 45″ resolution Tacconi and Young (1989) have found evidence for enhancements in both the CO emissivity and the massive star formation efficiency (MSFE) on optical spiral arms of the bright spiral galaxy NGC 6946. For example, in the optically luminous and well-defined spiral arm in the NE quadrant, there are enhancements in both the H_2 surface density and MSFE relative to the interarm regions. In contrast, a large, poorly defined arm in the SW quadrant shows no arm-interarm contrast in the MSFE.

To further investigate the molecular gas content in these two spiral arms, we have made ^{12}CO J=2→1 and 3→2 observations with the James Clerk Maxwell Telescope (JCMT). In the J=2→1 line, we have made observations of both the northeast and southwest spiral arm and interarm regions in 4×9 10″ spaced grids (full sampling), for a total of 36 points per grid. Because of the decreased sensitivity in the J=3→2 line, we were limited to mapping the two arm regions in 2×3 10″ spaced grids for a total of 6 points per grid. The centers of each of the grids lie 2.4′ to the northeast and 2.3′ to the southwest of the nucleus of NGC 6946.

With the CO J=2→1 data, we are able to fully resolve the two observed spiral arms in NGC 6946. In both cases the CO emission is largely confined to the optical spiral arm regions with the peak observed T_A^* being up to 4 times higher on the spiral arms than in the interarm regions. Typical J=2→1 integrated intensities ($\int T_A^* dv$) on the bright northeast spiral arm are 7 K km s^{-1}, dropping to <1.5 K km s^{-1} in the interarm regions. For the southwestern arm region, J=2→1 integrated intensities of 4.5 and 2.1 K km s^{-1} are typical for positions which are on and off the spiral arm, respectively. For the higher transition J=3→2 emission, peak antenna temperatures (T_A^*) observed on the northeast spiral arm are 2–3 times higher than those on the southwest arm.

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CO Observations of Star-forming Regions in External Galaxies

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Supernova explosions and stellar winds from massive young stars are commonly seen to be most responsible for acceleration of relativistic electrons within galaxies. Strong infrared emission corresponding with synchrotron radiation in galactic disks indicate regions of strong star formation. CO observations of three galaxies, where both strong IR emission and extended radio emission at cm wavelengths have been detected, are presented.

M82 (NGC 3034) was observed with the IRAM 30-m MRT in ^{12}CO(2-1), ^{13}CO(2-1) and C^{18}O(1-0) with a resolution of 200 pc, resp. 400 pc. NGC 3628 was also observed with the 30-m telescope in the transitions ^{12}CO(2-1) and ^{12}CO(2-1) with a resolution of ~400 pc. The large southern barred spiral galaxy NGC 2442 was mapped with the 15-m SEST dish in La Silla in ^{12}CO(1-0). The results of the dynamical study as well as estimations of excitation conditions and star-formation efficiency within the galaxies will be presented.

Rapid Variability of Extragalactic Radio Sources

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Variability of extragalactic radio sources (quasars and BL Lac objects) has been found on timescales down to a few hours with amplitudes up to $\sim 25\%$ using the Effelsberg 100 m telescope. These observations are the most accurate flux density measurements ever made in radio astronomy; the r.m.s. errors are $\sim 0.3\%$. Correlated variations of the polarization make an explanation intrinsic to the sources very likely. This supposition is supported by a multifrequency study using Effelsberg, the VLA, and the 60 cm optical telescope on Königstuhl (Heidelberg) simultaneously. The observational data are presented and discussed in the framework of the relativistic jet model. The apparent brightness temperature of more than 10^{18} K derived for 0917+624 using the light travel time argument places stringent conditions on any specific models, calling for the presence of shocks travelling in a highly relativistic jet. Alternate explanations (e.g. scattering in the interstellar medium) are discussed shortly.

A Map of Orion A in the 64α Recombination Line

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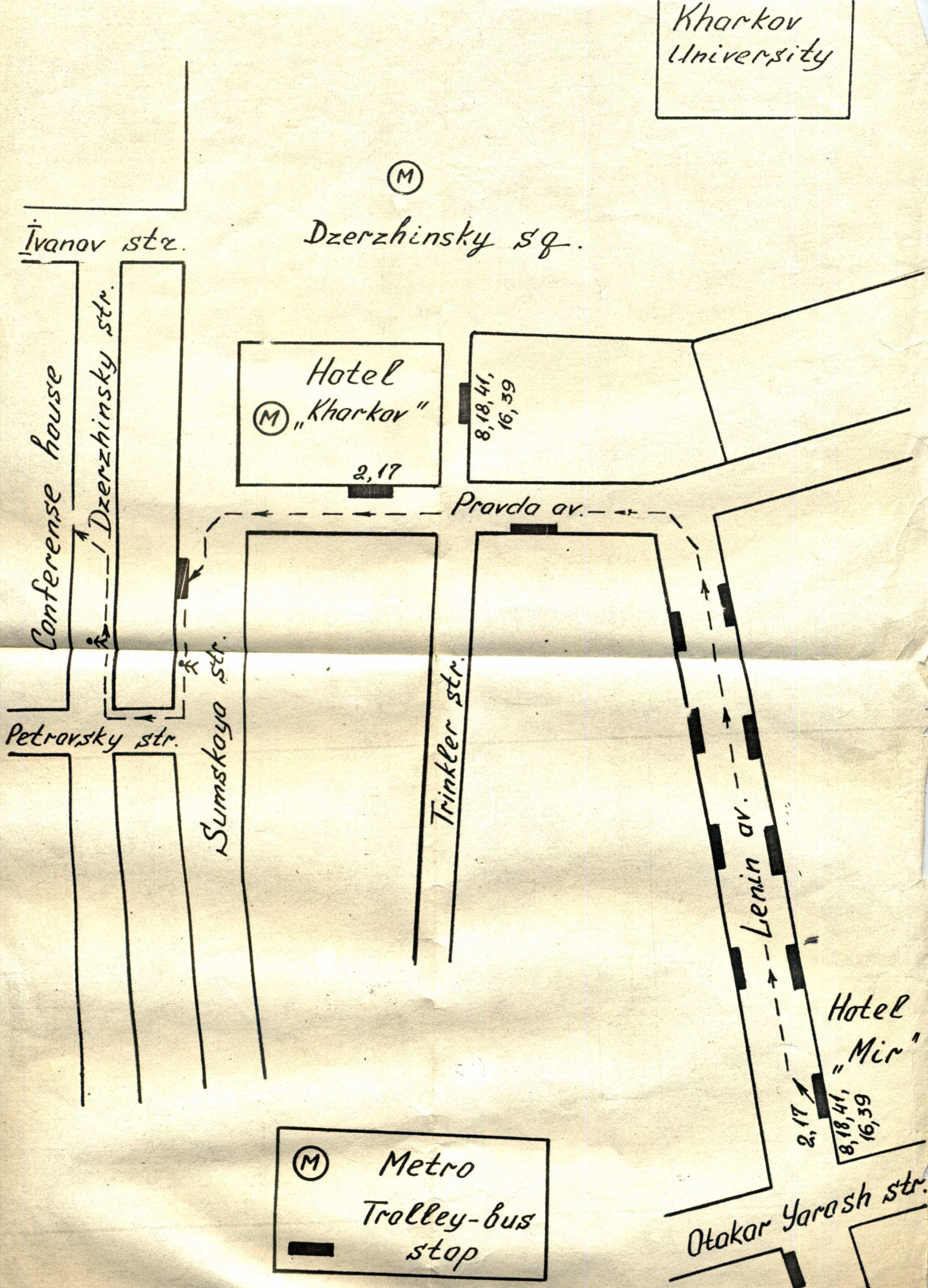
The inner 5:5 x 6:5 region of Orion A was mapped in the 64α transition of hydrogen, helium and carbon with the 100-m telescope at Effelsberg.
The observations were carried out with an angular resolution of 40". 260 spectra were taken with a 20"-40" spacing. Maps of radial velocities V_{LSR} and integrated brightness temperature $\int T_L dv$ have been constructed for the three recombination lines.
Furthermore, the derived electron temperature distribution of the emission nebula assuming LTE conditions will be presented. The dynamical model of the nebula which results from these observations is consistent with that of Pankonin et al. (1979) and can qualitatively explain the observed flows in the neighboorhoud of the Trapezium stars.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