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INTERNATIONAL ASTRONOMICAL
UNION

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PART 2

**REPORTS ON
ASTRONOMY**



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TRANSACTIONS
OF THE
INTERNATIONAL ASTRONOMICAL UNION
VOLUME XVIIIA - PART 2

REPORTS ON ASTRONOMY

Edited by
EDITH A. MÜLLER
General Secretary of the Union



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TRANSACTIONS
OF THE
INTERNATIONAL
ASTRONOMICAL UNION
VOLUME XVIIIA - PART 2
REPORTS

PREFACE

Three years ago the Reports on Astronomy were for the first time published in three separate parts whereby related astronomical topics were collected in one volume and each volume was kept to a size of no more than about 250 pages. The aim was to facilitate a wider distribution of individual volumes among astronomers and other scientists interested in specific subjects of astronomy.

The same system was adopted for the present volume A of the IAU Transactions which covers the activities in astronomical research from January 1976 to December 1978. The Commission Presidents were invited to restrict their reports, to present a selection of the most important developments in the field of astronomy covered by their Commission, and to avoid overlaps with other Commission reports. As a result of the restriction in the number of pages some Commissions present a large, concentrated list of references with little discussion, whereas others review some of the most exciting recent research developments in their subject.

The distribution of the Commission Reports into the three parts of volume XVII A is as follows:

VOL. XVII A - PART 1

Commission	4.	Ephemerides
"	5.	Documentation
"	6.	Astronomical Telegrams
"	7.	Celestial Mechanics
"	9.	Instruments and Techniques
"	14.	Fundamental Spectroscopic Data
"	15.	Physical Study of Comets, Minor Planets and Meteorites
"	16.	Physical Study of Planets and Satellites
"	-	Working Group on Planetary System Nomenclature
"	17.	The Moon
"	19.	Rotation of the Earth
"	20.	Positions and Motions of Minor Planets, Comets and Satellites
"	21.	Light of the Night-Sky
"	22.	Meteors and Interplanetary Dust
"	31.	Time
"	38.	Exchange of Astronomers
"	41.	History of Astronomy
"	46.	Teaching of Astronomy
"	49.	The Interplanetary Plasma and the Heliosphere
"	50.	Identification and Protection of Existing and Potential Observatory Sites.

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See the Contents for this volume, p. vii

Commission	28.	Galaxies
"	33.	Structure and Dynamics of the Galactic System
"	34.	Interstellar Matter and Planetary Nebulae
"	37.	Star Clusters and Associations
"	40.	Radio Astronomy
"	44.	Astronomical Observations from outside the Terrestrial Atmosphere
"	47.	Cosmology
"	48.	High Energy Astrophysics

In order to minimize the price of each volume the method of offset printing was used which required the preparation of the typescripts of the reports ready for photographic reproduction.

On behalf of the IAU I thank all Presidents of Commissions and all Colleagues who contributed to the reports for the wealth of interesting and useful information they have collected and presented in this volume.

Thanks are also due to the Secretaries of the Commission Presidents for their careful preparation of the camera-ready typescripts. My personal thanks go to my secretaries Mme R. Bertschi and Mme R. Läubli for their most valuable editorial help.

EDITH A. MÜLLER
General Secretary

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8. POSITIONAL ASTRONOMY (ASTRONOMIE DE POSITION)

PRESIDENT: R.H. Tucker

VICE PRESIDENT: E Høg

ORGANIZING COMMITTEE: C.A. Anguita, S. Débarbat, W. Fricke, B.L. Klock,
E. Marcus, A.A. Nemiro, J.L. Schombert, K.N. Tavastsherna,
G. Teleki, G. van Herk, H. Yasuda.

1. Introduction

We commemorate four well-known positional astronomers deceased since the last Report:

B.V. Novopashenny (Odessa), A.K. Korol (Goloseevo), Y.E. Gordon (Nikolaiev) and L.S.T. Symms (Herstmonceux).

The following have notified their retirement from the Commission:

W. Dieckvoss, R.H. Stoy, J.L. Schombert, P. Rybka, A. Bohrmann, and A.N. Adams.

The Commission members have displayed their interest in discussing the role of the Commission, debating whether it should become an actively interventionist body or a medium for exchange of information.

Cooperation with other Commissions and bodies has continued in connection with several activities, notably the IAU/IGGU Symposium on Refraction, the Vienna Colloquium on Astrometry, (which recommended a Working Group on Stellar Position Programmes) and the ESA Astrometry Satellite. Accounts of these will be found at the end of this Report.

2. Reports from Observatories and Commission Members

As in the last Report, these are presented under national headings.

A. AUSTRALIA

At Sydney the zones from $-38^{\circ}30'$ to -76° have been photographed. Measurements of the $-53^{\circ}30'$ zone have been reduced using Perth 70 catalogue places. The final solution awaits the SRS catalogues (W.H. Robertson).

B. CHILE

The Santiago Astrolabe (ESO/University of Chile) is completing a second catalogue containing 358 FK4 stars and 164 FK4 Suppl stars. The planet Uranus has been observed on 185 occasions, including 67 double transits. (F. Noël).

C. DENMARK

At Brorfelde the automation of the Meridian Circle continues. Computer-controlled setting to an accuracy of 2 arc seconds takes an average setting time of 10 seconds. The circle scanners have been fitted with stepping motors, and the electronics made more reliable. First stellar observations with the slit micrometer are expected in the autumn of 1978. Planning for moving the MC to La Palma is now well advanced, with a target date of 1980. 50,000 differential observations are being prepared for publication ($\epsilon \alpha \cos \delta = 0''.190$, $\epsilon \delta = 0''.218$). Observations of 1617 NPZT stars have been reported to H. Yasuda. Høyer has determined proper

motions for 8000 GC stars in Perth 70, and confirmed that Perth 70 has negligible magnitude equation. Høg has constructed the multislit micrometer for the MC (see above) and made a study of aerodynamic and thermal conditions in a MC pavilion. L. Lindegren (Lund, Sweden) has reduced 530 planetary observations made by the Hamburg-Perth expedition. The phase corrections applied included geometrical and limb-darkening components. (Fogh Olsen, Høg).

References

Catalogue of 257 FK4 stars and 712 others: 1977 (041.025).
Theory, phase corrections of planets: A & A 57, 55, 1977.
Kinematic mounting: A & A 41, 107-109, 1975.
Positions, 54 southern circumpolar FK4 stars: Mitt. A.G. Nr. 38, 178-181, 1976.
Perth 70 Catalogue: Abh. Hamburg Sternw. 9, 40 + 334 pp, 1976.
Survey of Future: Highlights of Astronomy, 4, Part I, 361-367, 1977.
Photoelectric observations of planets: A & A Suppl. 30, 125-129, 1977.
Review: Colloquium on European Satellite Astrometry, Padova, 1978.

D. FEDERAL REPUBLIC OF GERMANY

At Hanover, Pilowski has studied the possibility of setting up an absolute fundamental catalogue based on observations of AGK3 stars with a transportable zenith camera. He assumes that geographical coordinates and polar motion are accurately known, and shows that absolute proper motions are only required if intervals of a century or more are in question. At Munich Observatory, observations of absolute declinations of FK4 stars and of planets were continued. Work on catalogues containing measurements dating from 1957 was completed. At Hamburg, the radio-source optical-position programme continues. Results for 17 sources have been published, and a catalogue of secondary reference stars for 34 fields is being prepared. The general rigorous block-adjustment computer program is being used in a study of the original AGK2 and AGK3 plate measurements. Error propagation in large block areas is under examination. Further investigations for the proposed new four-fold coverage of the northern hemisphere continue, and a decision on the realization of this project is expected in 1979. (Pilowski, Schmeidler, de Vegt).

References

Transportable zenith camera: Astr. Station Hannover Tech. Univ. Monograph, 1973
Supp I, No. 9, 1974 Supp II, No. 10, 1976.
Supp III in preparation.
Pilot investigation, 17 sources: A & A 67, 5, 1978.
Rigorous block-adjustment: MNRAS, 167, 169, 1974.
Completion: A & A Suppl. 32, 141, 1978.
Fourfold coverage (AGK4): Trans. IAU, XVII, 181.

E. FRANCE

At Paris, the Astrolabe group continues to provide observational results for the BIH and the SIMP, 400 groups having been observed since September 1976. There is collaboration with CERGA and Nice Observatory for astrolabe observations of the Sun. A campaign of observing the radio-source β Persei has continued for some years. Variation of the instrumental zenith distance during observations can now be taken into account. An analysis of the first 18 years of Paris latitude observations has been published. Astrolabe observations of planets have continued at Paris, San Fernando, and CERGA (Mars, Jupiter and Saturn) and at Santiago de Chile (Uranus). Earlier campaigns, revised where necessary, are described in CERGA publications. A study of the Mars observations has revealed discrepancies in the different ephemerides. Results of five Saturn campaigns at Paris are in press. A general review has been published. (Chollet, Débarbat).

References

Paris astrolabe observations: A & A Suppl. 29, 241, 1977.
Sun observations with astrolabe: A & A 56, 207, 1977.
Control of astrolabe zenith distance variation: IAU Symp. 78, Kiev, 1977 and IAU Symp. 82, San Fernando, 1978.
18 years, Paris latitude: Wiss. Z. Tech. Univ. Dresden, 25, H1, 1976.
Mars observations: A & A Suppl. 28, 305, 1977 and 32, 335, 1978.
Bol. Obs. San Fernando, Ser C, No. 79, 1977.
A & A Suppl. 32, 331, 1978.
A & A Suppl. 31, 171, 1978.
Saturn observations: A & A Suppl. 25, 365, 1976.
Bol. Obs. San Fernando, Ser C, No. 78, 1976, and No. 79, 1977.
A & A Suppl. 32, 323, 1978.
A & A Suppl. 31, 167, 1978.
Jupiter observations: Bol. Obs. San Fernando, Ser C, No. 79, 1977.
A & A Suppl. 31, 169, 1978.
Uranus observations: A & A Suppl. 30, 189, 1977.
Older observations: A & A Suppl. 32, 325 and 327, 1978.
Mars analysis: A & A 64, 281.
General synthesis: Vistas in Astronomy, 21, 93, 1977.

F. GREAT BRITAIN AND CAPE

The results of the Cape TC observations of the SRS zones have been sent to USNO Washington. Observed mean positions for stars on the FK4 and BS lists have been sent to AR-I Heidelberg and to Kiev. The planet observations await reduction.

At Herstmonceux, regular observations of Sun, Moon, major and minor planets, and fundamental stars are continuing. Nine more minor planets have been added to the observing list, which previously contained only the four brightest minor planets.

Observations of zodiacal stars and the NPZT stars are continuing, but both programmes are practically exhausted. Most of the results for the NPZT stars have been sent to Tokyo.

The investigation of the Herstmonceux instrumental system has now been completed. Corrections have been adopted for diurnal variation of various parameters, clamp effects and observer effects. New places and proper motions have been adopted for the azimuth and clock stars, independent of the periodic terms in FK4, but with FK4 equinox, to provide the basis of the local system of RA. The local declination system is based on revised values of flexure and latitude, and is independent of FK4. The reduction of the first sixteen years of Herstmonceux TC observations on the Herstmonceux system is now ready to proceed.

Progress with the modernisation of the Cooke TC continues to be disappointing. The promised Electronic Circle Reading system has not been delivered, and even further delay appears likely, because of staff changes at the laboratory where the equipment is being prepared. A stepping-motor drive has been installed for the RA micrometer, and a Helipot recording system on the declination micrometer. A new control panel has been installed, and new computer programs for data acquisition have been developed.

Work continues on the preparation of catalogues for publication, and on the computer handling of catalogue data used in determination of proper motions.

Detailed planning for the collaboration with the Copenhagen University Observatory in Meridian Astronomy on La Palma is now at an advanced stage, but further progress awaits the signature of the formal international agreement on

the NHO. (Tucker).

G. JAPAN

At Tokyo, regular observations of the Moon and planets referred to the FK4 system have continued with the Gautier MC. There are seven minor planets on the list. Results for solar system bodies from 1974 to 1977 were published. The error in relative positions determined by the Tokyo MC was estimated by comparing with the photo-electric observations of the occultation of SAO 158687 by Uranus.

Systematic differences (Tokyo-FK4) were derived with an accuracy of ± 0.01 . The Tokyo catalogue magnitude equation was demonstrated. The programme of OB stars was completed in the middle of 1978.

A preliminary NPZT catalogue is being compiled from results received from Abbadia, Bordeaux, Copenhagen, Herstmonceux, San Fernando, Belgrade and Tokyo. A catalogue of PZT stars for epoch 1958 is being compiled from Herstmonceux, Hamburg, Tokyo and Washington results.

At Mizusawa, ten years of astrolabe observations were used to correct FK4 and FK4 Supp star positions, including the systematic errors depending on RA. A general least-squares estimation process including star positions and motions and short-period latitude and longitude variations, was developed, and applied to past ILS data. Corrections to the declinations and proper motions are obtained with mean errors of 0.01 and $0.005/\text{yr}$ respectively. (Yasuda).

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Solar System Obs. 1974-1977: Tokyo Astr. Bull. 252.
Error of Relative Positions, Tokyo MC: Publ. Astr. Soc. Japan, 29, 631-637, 1977.
Magnitude equation in Tokyo Catalogue: Publ. Astr. Soc. Japan, 30, 173-190, 1978.
Mizusawa - FK4 corrections: Publ. Int. Lat. Obs. Mizusawa, 10, 2, 1976.
Star-place corrections theory: Publ. Int. Lat. Obs. Mizusawa, 11, 2, 1977.

H. ROMANIA

At Bucharest, the results of the SRS observations were sent to USNO, Washington, and the BS results to Kiev. Publication of the corresponding catalogues has been delayed by organizational difficulties at the publishing establishment. The catalogues include notes on the FK4 reference star positions and comparisons with AGK3R and Perth 70. The NPZT observations are partly reduced. The observing list has been extended by including the Cagliari PZT stars. The RA and declination micrometer screws have been replaced by new screws, and the study of the screw errors is continuing. Considerable delays in all work continue as a consequence of the earthquake in 1977. (Marcus, Rusu).

I. SPAIN

At San Fernando, analysis of the astrolabe catalogues CASF1 and CASF2 has given the systematic departures of these catalogues from FK4 and FK4 Supp. A third catalogue has been published, and a fourth catalogue observation campaign is in progress. Planetary observations have continued, as reported above (section E).

The Meridian Circle has completed 82% of the NPZT observations. Results for two zones have been sent to Tokyo. Planet observations continue. New differential drives have been installed in the astrolabe micrometer and in the Meridian Circle RA micrometer.

The "Carte du Ciel" Astrograph is observing the 20 selected minor planets of the ITA Program. (Quijano, Sánchez).

References

Astrolabe catalogues CASF1 and CASF2: A & A Suppl. 25, 9, 1976.
Analysis of differences: A & A 60, 61, 1977.
Third catalogue: A & A 29, 245, 1977.

J. U.S.A.

At Washington the 7-inch TC is undergoing a rather thorough renovation. An image dissector photon-counting "micrometer" has been giving promising results on bench tests. The Automatic TC is having various parts re-worked at the factory. The 6-inch TC continues its current zodiacal observing program. A new electronics system for the Inductosyn circle-reading device is being evaluated. At Bloomington, Atkinson continues consideration of yielding and non-yielding Earth models in the study of nutation. A re-analysis of the Cookson Zenith Telescope results shows that the plates would be capable of giving better results if measured on a modern machine, but this is impossible because the plates have been destroyed. (Hughes, Klock, Atkinson).

References

Short program for aberration: MNRAS, 172, 469, 1975.
Use of C & D for reduction of radial velocities, MNRAS, 172, 465, 1975.

K. U.S.S.R.

At Pulkovo, the Zverev Photographic Vertical Circle is in operation. The original photographic circle reading system gives an accuracy of 0".05 for a single reading. Differential determinations of declinations of Pulkovo Zenith telescope stars have begun. Reconstruction of the horizontal meridian circle and the Toepfer meridian circle continues. A highly sensitive eyepiece micrometer is being constructed. 4000 stars of the latitude and zenith-tube programme have been observed by the Ertel Vertical Circle. Absolute RA catalogues have been published for FK4 and FKSZ stars in northern and southern zones, using the Large Transit Instrument at Pulkovo and at Santiago de Chile. An absolute RA catalogue has been prepared for the Backlund-Hough stars observed at the Melbourne Observatory 1928-1940. An astrolabe catalogue of RA and Decl has been published. The Santiago declination observations are being reduced.

At Golosseyevo, the eyepiece micrometer of the Wanschaff Vertical Circle has been automated. A compilation catalogue using 15 RA and 14 Declination catalogues, 1939-1973, has been completed jointly with Pulkovo. A nine-year series of observations of Sun and planets shows considerable deviations of Mars from the ephemeris position. A new compilation of Washington, Greenwich and Nikolayev observatories has the aim of improving the FK4 equinox and equator corrections.

At Kazan (Engelhardt) the new refraction tables are completed. Latitude star observations are being reduced. Declination observations of PZT programme stars with the Meridian Circle have been completed.

At Kharkov, progress continues in automation of meridian observations and reductions. A digital signal storage device has been constructed. Minor planets (ITA programme) are regularly observed. Three differential RA catalogues have been published, together with corrections to RA of 372 FK4 stars.

At Kiev, two positional catalogues have been published, and a compilation catalogue of bright stars is in preparation.

At Leningrad, observations of 10 selected minor planets (1950-1974) are being reduced. Regular observations of 20 selected minor planets are being organized

for 21 observatories, of which 10 are in USSR.

At Moscow, a device for studying personal pointing errors on disc-like objects has been built. A text book on General Astrometry by V.V. Podobed and V.V. Nesterov has been published. Observations with the Sanders-Raimond method have been completed. An absolute RA catalogue, a Differential Catalogue of ZT and PZT stars, and a Compilation Catalogue of radio source positions have been published. Corrections to the FK4 equator and equinox have been found from Venus observations (1969-1972) amounting to $\Delta A = -0^s.003 \pm 0^s.001$ and $\Delta \delta = +0''.16 \pm 0''.03$. Corrections $\Delta k = -0''.08 \pm 0''.16$ and $\Delta n = +0''.37 \pm 0''.14$ have been found from star proper motions relative to galaxies in 30 areas.

At Nikolayev, it is now possible to graduate metal circles with diameters up to 1200 mm. The Spitzbergen observations of absolute RA of stars are completed, and being reduced. Objects of the solar system continue to be observed with meridian and photographic instruments. One Declination catalogue and 2 RA catalogues have been published.

At Odessa, the Meridian Circle has been fitted with a recording measuring device. RA observations of major planets have been made. One RA catalogue and 2 positional catalogues have been published.

At Tashkent, regular solar observations and RA observations of inferior planets are made with the Meridian Circle. 2 Absolute RA catalogues, corrections to 36 FK4 stars, and RA of Sun, Venus and Mercury (1974-1975) have been published. Observations and reductions of RA observations of FK4 stars in various declinations are nearing completion. (Tavastsherna).

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- Catalogue FK4, FKSZ, RA: Trudy Gl. Astr. Obs. ANSSR. 82, 1977.
Automation, eyepiece of Wanschaff VC: A.C. No. 940, 1977.
New reduction, equinox to equator: A & A 31, 1977.
Differential RA Catalogue, FK4,: Vestnik Kharkov State Univ., 137, 1976.
FK4 (-20° to $+35^\circ$) Vestnik Kharkov State Univ. 160, 1974.
FKSZ (-20° to $+90^\circ$): Vestnik Kiev Univ. Astron. No. 20, 1978.
"General Astrometry" (text book): Podobed and Nesterov.
Absolute RA Catalogues, Tashkent: Circ.Astr. Inst. Uzbek. Acad. Sci. 65, 1976,
and 67 (414), 1976.
Corrections to 76 FK4 stars: Circ. Astr. Inst. Uzbek Acad. Sci. 79, (426), 1977.
Correction of Fundl. RA.: Circ. Astr. Inst. Uzbek Acad. Sci. 44, 1973.

L. YUGOSLAVIA

At Belgrade, the Meridian Circle continues with observations of the NPZT stars. A preliminary catalogue of these observations shows mean errors of $\epsilon \alpha = \pm 0^s.017 \text{ sec}$ and $\epsilon \delta = \pm 0''.13$. Daytime observations of Sun, Mercury, Venus and stars are also made. Declination catalogues have been compiled for ILS stars and Latitude stars (GCLS, IKSZ). Systematic errors $\Delta \delta \alpha$ in the latitude observations are being studied.

The Transit Instrument and Vertical Circle are both engaged in observing BS stars of the north polar zone. The TI collimation and azimuth variations are controlled by vacuum meridian marks. The positional stability of the plane glass plate closing the vacuum tube has been demonstrated by a novel collimation method. A new method of calibrating and observing a bubble-level, using a collimator at 6 m distance, has been developed. The Vertical Circle has restarted observations after a successful reconstruction. A bibliography of star catalogues and a review paper on Fundamental Astrometry has been published. (Sadzakov, Teleki).

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Decl and pm ILS stars: 1929-1972, Publ. Astr. Obs. Beograd, No. 21, 1975.
 General Catalogue Latitude stars: Publ. Astr. Obs. Beograd, No. 24, 1978.
 Reconstruction of Askania VC: Report of Commission 8 to XVI IAU.
 Refraction table progress: Bull. Obs. Astr. Belgrade, 128, 7-10, 1977.
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 Askania VC after reconstruction: Publ. Dept. Astr. Belgrade, 6, 123-124, 1976.
 Astron Refraction: Proc. Int. Symp. Stockholm, Aug 1974, 5, No. 1, 1977.
 Earth Rotation and Refraction: Bull. Obs. Astron. Belgrade, 128, 19-22, 1977.
 Present and Future of Fund. Astrometry: Publ. Dept. Astr. Belgrade, 7, 31-67, 1978.
 Bibliography of Catalogues: Publ. Dept. Astr. Belgrade, 7, 69-212, 1978.
 Atmospheric Influences: Bull. Obs. Astron. Belgrade, 129, 1978.

3. Other Reports

A. WORKING GROUP ON ASTRONOMICAL REFRACTION (Chairman: G. Teleki)

The Group concentrated on two main tasks, the elaboration of the new international refraction tables, and the organization of the IAU Symposium No. 89 (co-sponsored by IAG of IGGU). Some progress has been made in the elaboration of the tables. A report of the Symposium follows.

B. IAU SYMPOSIUM NO. 89

"Refractional Influences in Astrometry and Geodesy", Uppsala, Sweden, 1-5 August 1978.

The Symposium was co-sponsored by the IAG of IUGG, with the aim of summarising results achieved in different fields, and of exchanging views and experiences of refraction.

The session topics were: astronomical refraction, general; astronomical refraction in astrometry; astronomical refraction, regional and local experiences; refraction effects in deep-space-network, VLBI and satellite geodesy, including the Moon; refraction effects in 3D-geodesy through meteorological and adjustment approaches; statistical and direct methods of determining refraction effects in 3D-geodesy; 3D geodetic network and stellar triangulation; instruments constructed for taking care of refraction effects; levelling and photogrammetric refraction; the use of dispersion methods for determining refraction effects in astronomy and geodesy; wave propagation; local dynamics from refraction-corrected measurements.

The Symposium approved the following Resolutions, incorporating 9 recommendations.

The Symposium on Refractional Influences in Astrometry and Geodesy considering the fact that astronomical and terrestrial refraction are still severe limitations on the attainable accuracy of measurements in Astrometry and Geodesy recommends:

1. that the existing astronomical refraction tables or computation methods should be improved so as to bring them nearer to reality,
2. that for higher accuracy demands the real state of the atmosphere should be taken into account. Especially, means should be found to determine the influence of the deviations of the atmospheric layers from the hypothetical shape,
3. that all possible preventive measures be taken by astrometric observers to minimize the effects of refraction. Careful site selection using the appropriate scientific criteria is of utmost importance. Attention must also be given to, e.g. the design of buildings and the organization of the observing programme,

4. that established observing sites be investigated by all means possible in order to determine the local refraction effects not corrected by the application of the general theories in use,

5. that since investigations to determine the influence of refraction on directions and distances using two or more wavelengths showed encouraging results, all efforts should be made to test these methods in the field and to bring them to a state where they can be applied in astrometric and geodetic practice,

6. that since after extensive researches into refraction effects in geometric and trigonometric levelling there are still problems with refraction in relation to the current demands for higher accuracy, more investigations of the refraction be encouraged using either classical means or new methods and techniques,

7. that since the meteorological approach to refraction problems has led to encouraging results, further investigations should be undertaken along these lines including the testing, development, and application of improved atmospheric models, and improved methods for probing and remote sensing of atmospheric parameters,

8. since both astronomers and geodesists are concerned with refraction problems, that the existing cooperation of the IAU and the IAG in this field be intensified, and that a special joint commission of the IAU and the IAG should be established with the participation of interested meteorologists and physicists and that this recommendation be transmitted to the Executive Committees of the IAU and the IAG,

9. that in view of the possibilities of using Space Lab facilities to investigate refractive effects in the atmosphere, that steps be taken by the IAU and the IAG to request the European Space Agency to consider such research.

The Symposium expresses its most cordial thanks to the IAU and the IAG for the sponsorship of the meeting, to the Geodetic Institute at Hällby, the Organizing Committees, and Uppsala University for the kind hospitality and for the most excellent arrangements made for a successful joint meeting.

C. IAU COLLOQUIUM NO. 48

"Modern Astrometry", Vienna, Austria, 12-14 September 1978.

The Scientific Organizing Committee included C.A. Murray (Chairman), W.F. van Altena, H.K. Eichhorn, B. Elsmore, L.W. Fredrick, W. Gliese, R.S. Harrington, E. Høg, D.D. Polozhentsev, G. Teleki, R.H. Tucker, Chr de Vegt. The Chairman of the Local Organizing Committee was Professor J. Meurers. The Proceedings are being published by the University of Vienna with F.V. Prochazka and R.H. Tucker as Editors.

The Colloquium was attended by 132 participants from 15 countries. Topics covered included Astrophysical Astrometry, Astrometry of Radio Sources, New Developments in Ground-based Astrometry, Positional Astrometry and Impact of New Techniques in Astrometry. The Concluding Summary was given by Professor A. Blaauw, President of the Union.

The following Resolutions were passed:

1. Recognizing the need for an improvement in the Stellar Reference Frame over the whole sky, we urge the completion of current and proposed projects, including those in the southern hemisphere, for the determination of positions of stars, and we recommend that Commissions 8 and 24 set up a Joint Working Group to coordinate efforts in this field.

2. The participants at this Colloquium strongly support the independent and

complementary astrometric programmes proposed for the ESA Astrometry Satellite and the NASA Space Telescope.

D. ASTROLABE REPORTS.

These have been given above under the appropriate national headings of Chile (2B) and France (2E).

E. ASTROMETRY SATELLITE REPORT

The ESA study of an astrometry satellite has now demonstrated that it is feasible, and that the technological problems can be solved. The satellite containing a two-axis telescope as proposed by P. Lacroute will scan the stars from a geo-synchronous orbit. A number of about 100,000 preselected stars, most of them brighter than $m_B = 11$, will be observed. The observing program will need to be defined beforehand by astronomers according to the selected astrometric and astrophysical criteria. A rather uniform distribution of the stars on the sky is however required for technical reasons. All 60,000 stars of $m_B < 9$ may be included.

The predicted accuracy of the observed parallaxes, proper motions per year and positions is $\epsilon = 0''.002$ for stars of $m_B < 11$, degrading to $\epsilon = 0''.010$ at $m = 14$. This includes all sources of error: photon statistics, attitude instability, optical aberrations, thermal disturbances, etc.

It would be useful if astronomers express their views (as many have already done) on desirable projects based on data from such a satellite. The projects should assume an accidental accuracy of $\pm 0''.002$ per star and systematic errors less than $0''.001$.

The estimated time schedule for the satellite if it is finally approved by ESA comprises a launch in 1984 followed by 2.5 years of operation. A number of preparations before launch is expected from the scientific community: definition of investigations, selection of stars, ground-based observations of radial velocities and photometric data, development of reduction procedures. ESA's responsibility will be the development and launching of the spacecraft as well as data acquisition, transmission to the ground and a first evaluation of the data. Final evaluation and application of the astrometric data will be the responsibility of astronomical institutes.

The report on the feasibility study is available from ESA as DP/PS(78)13 Paris 26 April 1978. A colloquium on European Satellite Astrometry took place in Padova 5-7 June 1978 with the participation of European and American astronomers.

4. Late Reports

M. GERMAN DEMOCRATIC REPUBLIC

At Dresden the pilot program for the "Lohrmann Program" is still under way. 90 plates 30.1×30.1 overlapped by 0.6 in zone $\delta = 52.5$ were taken with the Tautenburg 2-m Schmidt. The latitude observations (Horrebow method) continue. A new astrograph 300/1500 cm was installed in Gönnsdorf. A program on minor planets (ITA Leningrad) was started. Photoelectric observations of occultations were continued.

At Potsdam, the PZT catalogue was published in 1976. A photo-electric device was tested on the Potsdam 100/1000 cm transit. Tests confirm the Dresden results. (Sandig).

References

Pilot Lohrmann Program: Wiss. Z. TU. Dresden, 28, No. 3.

Latitude observations: Circ. Lohrmann Obs., Nos. 77-93.

Minor planet program: Wiss. Z. TU. Dresden, 28.

Use of occultations in astronomy, geodesy & selenodesy: Mitt Lohrmann Obs. Nos. 38 & 39.

Potsdam PZT catalogue: Veröff. Zentralinst. f. Phys. Erde, No. 37.

Photoelectric device tests: Wiss. Z. TU. Dresden, 28, No. 3. (Potsdam)

Wiss. Z. TU. Dresden, 25, No. 4. (Dresden)

Dr. Syuzo Isobe has announced his retirement from the Commission.

N. ASTRONOMICAL RECHEN-INSTITUT, HEIDELBERG

The work on the FK5 has been continued on the lines described in the report of Commission 8 (Trans. IAU Vol. 16 A - Part 2, 9). Numerous catalogues of observation have been studied with the aim to find out whether they may serve for one of the following purposes: improvement of the FK4 system, correction of individual data of FK4 and FK4 Sup stars, extension of the FK4 to fainter stars (Fricke, Gliese). Suitable catalogues have been taken on magnetic tape (Lederle, Walter); the U.S. Naval Observatory, Washington, D.C., and the Centre de Données Stellaires at Strasbourg have contributed to this task.

Completed are studies and tests of various computerized methods for the determination of systematic differences between catalogues of observation and the FK4 (Bien, Fricke, Lederle, Schwan). In the work on the FK5 two of them will be applied simultaneously: a computerized version of the conventional numerical method and an analytical method. The analytical method uses products of Fourier series, Legendre polynomials and Hermite polynomials for describing systematic differences; it has evolved from a method developed by Brosche and Schwan (19.041.041) in which products of spherical harmonics and Hermite polynomials were used instead.

Some progress has been made in the work on the determination of the equinox and equator of the FK5 (Fricke, Scholl). Observations of the Sun and planets and lunar occultations confirm the existence of a non-precessional motion of the FK4 equinox, which has to be eliminated in the FK5. Furthermore, attention is drawn to published work related to the FK5; Lieske et al. (19.043.006) have developed the expressions for the precession quantities based upon the IAU (1976) System of Astronomical Constants, and Fricke (19.043.007) has presented the basic material on which the new value of the lunisolar precession is based, and has outlined the arguments in favour of the change in precession (19.043.002). Lederle (Bull. CDS, No. 14) has computed tables giving information on the accuracy of FK4 data at different epochs. Walter (20.041.026) has compiled a list of positions of radio stars which may serve for tying the extragalactic reference frame to the fundamental reference coordinate system. (W. Fricke, W. Gliese, T. Lederle and H.G. Walter).

R. H. TUCKER

President of the Commission