exhibits a large infrared excess radiation which could be attributed to either graphite or iron grains with a temperature of 1,100 °K or 900 °K, respectively.

International Cooperation

In 1978 several astronomers agreed to join efforts to study HR 5999 simultaneously with various techniques. In April simultaneous infrared and optical photometry of the star was carried out by Smyth (Edinburgh) in cooperation with Andrews of SAAO. A shallow minimum ($\Delta V = 0\overset{m}{.}25$) was observed. During this period a few coudé spectra were obtained by de Loore and Marijke van Dessel (Brussels) with the 1.5 m telescope at ESO (La Silla). A second period of simultaneous observations was carried out during the last 12 nights of May. The first 5 nights were devoted to infrared photometry between 1.25 and 4.8 μm by Thé and Wamsteker (ESO) with the 1 m photometric telescope. Hereafter Thé took coudé spectra of the blue and red spectral regions with the 1.5 m telescope. During the whole period of observations the star was followed photometrically at La Silla with the 50 cm Danish and the 60 cm Bochum telescopes by Bakker (Amsterdam) and Zeuge (Hamburg), respectively. These data show again a shallow minimum with $\Delta V = 0\overset{m}{.}2$. Polarization was observed during April and May by Bastiaansen (Leiden) with a polarimeter attached to the light collector of the LSSH. Meanwhile at four nights in May the star was observed spectroscopically with the IUE satellite (cf. *Messenger* No. 15, p. 27) in the far ultraviolet by Viotti and Cassatella (Frascati, ESTEC), and by Gahm and Fredga (Stockholm). Besides these data at shallow minimum, a few spectra were taken at ESO at the times of deep photometric minima ($\Delta V = 1^m$), in April 1976 by Andersen (Copenhagen) and in July 1978 by de Loore and van Dessel (Brussels). Another deep minimum was measured by Thé during August 1978 with the Walraven photometer at LSSH. All these data are now being reduced and analysed.

The infrared, ultraviolet and polarization data are expected to give limitations as to the possible *composition* and *temperature* of the grains, and hopefully to impose some constraints on the parameters of the dust shell. The spectra in the visible and the ultraviolet contain information on the emission and absorption regions of the gas shell. The time variations of the gas and dust components of the shell seem somehow to be correlated and a detailed study of this phenomenon should throw some light on the question of the origin of the dust variations, and on the more general problem of the evolution of the circumstellar dust shell.

The ESA Astrometry Satellite

E. Høg

Recent advances in methods and instruments for astrometry (i.e. the accurate determination of positions in the sky of astronomical objects) have resulted in a proposal for an astrometrical satellite by a group of European astronomers. Dr. Erik Høg of the Brorfelde Observatory (Copenhagen University, Denmark) outlines the project and explains how it would make possible an incredible number of accurate, positional observations of the brighter stars.

A technological study has demonstrated the feasibility of an Astrometry Satellite which will be able to obtain an accuracy of $\pm 0\overset{''}{.}002$ for parallaxes, yearly proper motions and positions of 100,000 stars, mostly brighter than $m_B = 11$.

It is emphasized that the scientific impact of these orders of magnitude improvements over present data will be multiplied if astrophysical data are also obtained for the selected stars by ground-based techniques.

Why Do Astrometry From Space?

Astrometric observations obtained from an instrument outside the earth's atmosphere should be more accurate than ground-based observations for a number of reasons. There is no refraction and no instrumental flexure due to gravity: The optical resolution of the telescope is not deteriorated and variable due to atmospheric turbulence. In return for these advantages, a number of technological problems must, however, be solved in connection with the optical system, the thermal control and the attitude stabilization of an Astrometry Satellite (AS or HIPPARCOS).

The European Space Agency (ESA) has carried out a feasibility study of such a satellite in a collaboration between a team of scientists and a number of industrial firms from ESA countries. The study has demonstrated that an AS is feasible. It employs the optical principle of a two-axis telescope for scanning of great circles as proposed by P. Lacroute many years ago. It has now been imbedded in the framework of a professional spacecraft design, as required for the judgement of feasibility, and incorporates new ideas for optical system, scheme of scanning the sky, orbit, photoelectric detection, data analysis, etc. The AS will be launched into a geosynchronous orbit.

What will be Observed?

About 100,000 preselected stars, most of them brighter than $m_B = 11$, will be observed. The predicted accuracy of the observed parallaxes, proper motions per year, and positions is $\varepsilon = 0\overset{''}{.}002$ for stars of $m_B < 11$, degrading to $\varepsilon = 0\overset{''}{.}010$ at $m = 14$. This includes all sources of error: photon statistics, attitude instability, optical aberrations, thermal disturbances, etc.

The 100,000 stars will be selected in advance by astronomers according to the astrometric and astrophysical criteria they may wish. A rather uniform distribution of the stars on the sky is required for technical reasons. All 60,000

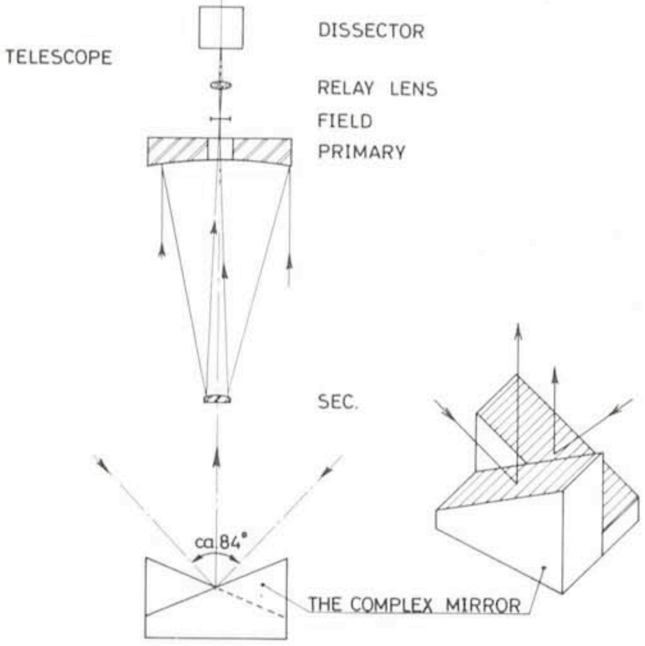

Fig. 1: *Optical system of the AS. It sweeps the sky while it spins around an axis perpendicular to the two optical axes.*

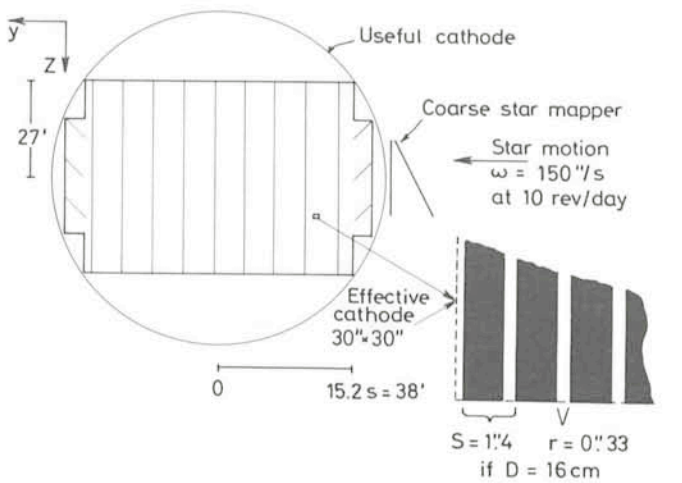

Fig. 2: *The light from a star is modulated by the grid system. The cathode spot is switched back and forth between two stars for a few seconds while the intensity is recorded. Then the next pair of stars will have its turn.*

stars with $m_B < 9$ may be included. In response to an inquiry on scientific projects with the data, many proposals were received. Altogether 90 projects or investigations were defined by about 60 astronomers at 17 institutions. More proposals are of course very welcome and are being collected by the present author. A colloquium was held in Padova on 5–7 June 1978 with the participation of European and American astronomers to discuss the scientific impact of the AS.

Since the scientific importance of these new astrometric data will be greatly increased if other astrophysical data are obtained for the same stars at the same time, a joint meeting of IAU commissions is being planned for Montreal in 1979. Radial velocities, photometry and spectroscopy are desirable for these fairly bright stars and the joint meeting may thus be called: "New basic astronomical data of bright stars".

The estimated time schedule for the AS, if it is finally approved by ESA, contains a launch in 1984 followed by 2.5 years of operation. A number of preparations before the launch are 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 the astronomical institutes.

It is hoped that the European Southern Observatory will play an active role in obtaining the ground-based astrophysical observations.

List of Preprints Published at ESO Scientific Group

December 1978–February 1979

38. J. BREYSACHER and M. AZZOPARDI: A Search for New Wolf-Rayet Stars in the Small Magellanic Cloud. Submitted to *Astronomy and Astrophysics.*
39. N. VOGT and *M. FAUNDEZ:* Photoelectric Observations of Peculiar A and Related Stars. I. Strömgren Photometry of 341 Ap Stars. Submitted to *Astronomy and Astrophysics,* Supplement Series.
40. H. STEPPE, P. VÉRON and M.P. VÉRON: The Surface Density of QSOs. Submitted to *Astronomy and Astrophysics.*
41. R.M. WEST and R.A. BARTAYA: A Preliminary Investigation of a Distant Globular Cluster in Eridanus (GCL 0422-213). Submitted to *Astronomy and Astrophysics,* Supplement Series.
42. R.C. KRAAN-KORTEWEG and G.A. TAMMANN: A Catalogue of Galaxies Within 10 MPC. Submitted to *Astronomische Nachrichten.*
43. M. AZZOPARDI and J. BREYSACHER: New Wolf-Rayet Stars in the Large Magellanic Cloud. Submitted to *Astronomy and Astrophysics.*
44. H. QUINTANA and R.J. HAVLEN: A Detailed Photometric and Structural Study of the Southern Cluster of Galaxies CA 0340-538. Submitted to *Astronomy and Astrophysics.*
45. P. VÉRON: Un Essai de Classification des Galaxies à Noyau Actif. Submitted to *Annals de Physique.*
46. E.G. TANZI, A. TREVES, P. SALINARI and M. TARENGHI: On the System V961 SCO ≡ OAO 1653-40. Submitted to *Astronomy and Astrophysics.*
47. D. ALLOIN, S. COLLIN-SOUFFRIN and M. JOLY: Line Intensity Data Compilation for a Sample of H II Regions. Submitted to *Astronomy and Astrophysics, Supplement Series.*
48. D. ALLOIN, S. COLLIN-SOUFFRIN, M. JOLY and L. VIGROUX: Nitrogen and Oxygen Abundances in Galaxies. Submitted to *Astronomy and Astrophysics.*
49. A. SANDAGE, G.A. TAMMANN and A. JAHIL: The Velocity Field of Bright Nearby Galaxies. Submitted to *Astrophysical Journal.*
50. A.C. DANKS, S. LAUSTSEN and H. VAN WOERDEN: Dust and Young Stars in the Lenticular Galaxy NGC 5102. Submitted to *Astronomy and Astrophysics.*