Comparison of the surface errors of telescope 3 of the WSRT before (left) and after re-attaching the reflector panels to the supporting structure. The measurements were made with a holographic technique described in this issue.

WSRT

Holographic observations with the WSRT

Hans van Someren Grève

Holographic observations of a strong calibrator source can be used to map the surface errors on the reflectors of the WSRT telescopes. The method has been used previously for the 5 km array of telescopes at Cambridge, and is described by P.F. Scott and M. Ryle in Mon. Not. R. Astr. Soc. (1977) 178,539-545.

Method

The observations are done with at least one telescope in the array pointing at a strong point source, while the other telescopes measure a square grid of points around it. The method is illustrated in Figure 1. Each interferometer consisting of a reference telescope and a "stepping" telescope measures the complex far field pattern in this way. The surface profile of the stepping telescope is constructed by using the Fourier transform relation between the measured far field pattern and a function.
related to the induced surface current. The phase derived from this complex function is a measure of the surface errors, and the amplitude is a measure of the feed illumination function and the reflection capability. As only the surface of the stepping telescopes can be mapped, we need at least two observations for mapping the surface of all 14 telescopes of the WSRT. Since the accuracy with which the surface errors can be determined is a fixed fraction of the wavelength, the best results are achieved at 6 cm, the shortest observing wavelength for the WSRT. The size of the observed grid is a trade-off between the length of the observation and the required resolution on the surface of the reflector. As we need an integration time of at least 30 sec per gridpoint, including telescope move time, the length of the observation will have to be at least N x N x 30 sec to measure a square grid of N by N points.

**Observations and Reduction**

The only sources used until now for the holographic measurements are 3C84 (40 Jy) and 3C454.3 (10 Jy). An initial set of observations of 4-hour duration, with the telescopes at different attitudes, showed that the telescope structures are relatively insensitive to gravity deformations. It turns out that those deformations are negligible compared to the local permanent distortions of the actual surfaces with respect to the ideal parabolic shape. This result allowed us to extend further observations over a full 12-hour period. In 12 hours we can measure a grid of 37 x 37 points, corresponding to one point per 0.73 meter on the reflector surface.

The program HOLOG performs all necessary steps to transform the measured data into the reflector function: a two-dimensional FFT of 128 x 128 points, removal of the phase-zero and the phase-slope, conversion of the phase of the reflector function into surface errors in millimeters measured in the direction normal to the surface, etc. As an option, an estimate of the forward gain reduction is made by scaling the surface errors to another observing frequency, then transforming back to the observation domain, and comparing the intensity at the centre.

In order to calibrate the program, two conducting plates were attached to the surface of one of the telescopes. This was very helpful, particularly in sorting out the signs of the surface distortions and the orientations of the telescope surface map.

**Results**

With the present receivers we can obtain a signal-to-noise ratio of 1100 for 3C84 per grid integration time, yielding a theoretical error of 0.12 mm of the determined surface. Hence it is no surprise that the surface distortions found repeat extremely well (on mm level) between subsequent observations.

Figure 2 shows contour diagrams of the surface distortions, normal to the ideal surface, for each of the 14 WSRT telescopes. Typical distortions are of the order of 2 mm, increasing to 1 cm at many places near the edge of the dish, but also at some spots near the centre. The average rms surface distortion is 2.7 mm. In the area shadowed by the four frontend support legs and by the frontend itself, the distortions cannot be determined with sufficient accuracy. The surface of telescope 3 turned out to be particularly bad over large areas near the centre of the dish. Most of these bad spots were located where the reflecting mesh had become detached from the backing frame. After these areas had been repaired new holographic observations showed spectacular improvement, with deviations of less than 2 mm from the ideal parabolic shape (see panels 3a and 3b in Figure 2).

The feed illumination functions of many telescopes also show distortions at the locations of the severest surface errors, indicating that the radiation is not properly reflected to the feed at these spots. The reduction in forward gain due to reflector errors was on the average 0.88 at 6 cm, and would be 0.6 at 3 cm if the panels were not adjusted. As an illustration: the efficiency of telescope 3 improved by about 10 percent as a result of the repair of the bad spots in the central area.

![Complex Far Field Pattern](image)

![Complex Reflector Function](image)

Figure 1. Outline of the holographic surface measurements. The complex far field function has been measured on a square grid of points of an interferometer formed between a reference and a stepping telescope. The Fourier transform gives a complex reflector function, the phase of which is a measure of the surface distortions while the amplitude is a measure of the feed illumination function and the reflective capability of the telescope dish.

**Observation Frequency:** 4874 MHz
**Source:** 3C84 40 Jy
Figure 2. The surface distortions of all fourteen WSRT telescopes. The solid contours are at positive intervals of 2 mm, dotted contours are at negative intervals of 2 mm, the zero contour line has been omitted. The bottom right panel shows a typical reception pattern (amplitude), the contour lines give equal steps in voltage, the scale is arbitrary. The general pattern shows the illumination function of the feed. Note that the outermost parts of the reflector with their rather large surface imperfections get a relatively low weight. The surface of telescope 3 is shown before (3a) as well as after (3b) the repair of its central part (out to a radius of 7.5 meters).

Concluding remarks

Holographic observations with the WSRT provide us with a very valuable tool for inspecting the telescope surfaces. The imposition on telescope time is not more than 2 times 12 hours, and even observations of 2 times 4 hours yield very useful results. These observations have already led to a dramatic improvement of the surface of telescope 3, and show many spots in other telescopes which must be improved as well. Especially at higher observing frequencies, (i.e. 3 cm) simulations with the HOLOG program predict a significant amount of signal reduction, which can be more than 50% with the present reflector distortions. A programme to fix the inner areas of all fourteen Westerbork dishes was started this summer and will be completed next year. The outer rings will be dealt with later. The effect of the distortions of the outer areas on the performance of the dish is diminished considerably by the fact that the outer rings are illuminated far less by the feed than the centre. This effect counterbalances the relatively large dish-surface present in the outer ring.
The status of the telescopes

Hans Kahlmann

The WSRT is a composition of steel, electronic hardware and software. A report on the status of an instrument like the WSRT must deal with all these aspects. Usually it is the electronic hardware, frontends and backends and the software that get all the attention. The mere telescopes are taken for granted. The "steel" however, needs attention as well.

The mounting and drive systems

These heavy constructions require a good deal of mechanical attention to keep them running smoothly. No details on oil and greasing will be given here, but it is certainly not to be forgotten. The maintenance performed on the drive systems in the past years -like replacing bearings, modification of the gear boxes to prevent corrosion- has resulted in a reasonably good condition of these systems. In a campaign to diminish the backlash on the telescopes the hourangle axes have been replaced by a modified system that allows us to press the axis in one direction against the drive wheels. This system applies a hydraulic pressure only when the telescopes are in tracking mode. It switches off during positioning, when the telescopes are stationary and when the wind becomes too strong. The backlash will theoretically add up to approximately 5 mdegree (20") with the pressure applied. Pointing observations in the future will have to be done to confirm those numbers. Without the pressure the backlash is approximately 15 mdegree.

Corrosion protection

The telescopes need protection against corrosion. It is about 9 years ago that the telescopes were painted with a protective paint. There are several possibilities of which the possibility of neglecting this aspect is not a realistic one any more, due to the increasing aggressiveness of the atmosphere (acid rain). In practice, every inspection of the protective coating indicates a degradation that is more than the prediction based on the previous inspection. The WSRT needs a new protective coating system applied in the next few years. How this will be done is under investigation. The ideal method, involving taking the telescopes apart, cleaning the individual pieces, applying the coating on a really clean surface and erecting them again with new bolts, will probably be very expensive.

The dishes

The surface of the dishes of the telescopes consists of a 8x8 mm mesh which was originally glued to the back structure. In 1975 a panic arose when it was discovered that the mesh came loose and in the summer of 1976 the entire Dutch astronomical community was busy in Westerbork to fasten the surface. This was done by drilling little screws into the broad members of the backstructure framework. This action saved the telescopes and no negative effect has ever been noticed from this bolting. Recently, however, it became clear that the mesh attachment to the small ribs of the backstructure is becoming unreliable. This influences the surface accuracy. There is no panic now, because the mesh is properly bolted to the backstructure, but it is degrading the surface accuracy. Peak values of more than 2 cm are measured. This means that the quality of 6 cm observations is affected. After extensive trial and error the question of how to fix this was answered by: drilling small holes and applying rivets. This has to be done very carefully because the small ribs are easily damaged by applying too much pressure during the drilling of a small hole.

There is no reason to have a 1976 equivalent campaign but many holes have to be drilled and many blind rivets must be put into these holes. The results of these activities are nicely demonstrated in the holographic measurement article by Hans van Someren Grêve in this newsletter. At the time of writing, 6 telescopes have had the treatment for the inner part of the dishes. The outer part will be taken care of in the summer of 1991.

New multi frequency front ends for the WSRT

Gie Han Tan

Introduction

The design and construction of the Multi Frequency Front End (MFFE) receiver is one of the major projects currently in progress at the NFRA laboratory at Dwingeloo. This work is one part of the major upgrade that will take place on the Westerbork Synthesis Radio Telescope (WSRT) in the 1990's. This article will focus on the specifications that are important to the future users of these new front ends. Next to this item, the last paragraph is spent on the current status of the MFFE project and the planning schedule for the next year. Users who are more interested in the technical details of the new MFFE's are advised to read NFRA-note 555 "Report Feasibility Study Multi Frequency Front End", published in March of 1990.

Extended frequency coverage

Probably the most interesting specifications from a user's point of view are the frequency coverage of the MFFE and the ability to change rapidly between frequency bands. The frequency bands covered by the new front ends are extended compared to the presently used front ends and, more importantly, four frequency bands are added which are new for the WSRT. The construction of the MFFE will make it possible to do simultaneous observations in two frequency bands. The electrical construction of the MFFE differs very much from the presently used front ends. Especially the set-up for the local oscillator signal is different. The present system uses one main tunable synthesizer driving all 14 front ends, so all front ends are tuned to the same frequency. The MFFE, however, has it's own tunable synthesizer driven by a central fixed reference frequency.
Improved sensitivity

The application of new developments in solid state technology like High Electron Mobility Transistors (HEMT’s) and the use of cryogenically cooled systems in the MFFE design provide an interesting improvement of the sensitivity of the WSRT. Table 2 compares the current interferometer system temperatures with those achieved by the use of the MFFE’s. The figures include the contribution from spill-over, mesh transmission and sky. The maximum front end bandwidth of 160 MHz is not usable until the new WSRT back end receiver is available.

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>present $T_{sys}$</th>
<th>future $T_{sys}$</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>92 cm</td>
<td>130 K</td>
<td>120 K</td>
<td>0.2 mJy</td>
</tr>
<tr>
<td>49 cm</td>
<td>110 K</td>
<td>100 K</td>
<td>0.2 mJy</td>
</tr>
<tr>
<td>21 cm</td>
<td>55 K</td>
<td>27 K</td>
<td>0.01 mJy</td>
</tr>
<tr>
<td>18 cm</td>
<td>60 K*</td>
<td>26 K</td>
<td>0.01 mJy</td>
</tr>
<tr>
<td>13 cm</td>
<td>n.a.</td>
<td>52 K</td>
<td>0.02 mJy</td>
</tr>
<tr>
<td>6 cm</td>
<td>91 K</td>
<td>53 K</td>
<td>0.03 mJy</td>
</tr>
<tr>
<td>3.6 cm</td>
<td>n.a.</td>
<td>84 K</td>
<td>0.05 mJy</td>
</tr>
<tr>
<td>UHF low</td>
<td>n.a.</td>
<td>300 K</td>
<td>0.5 mJy</td>
</tr>
<tr>
<td>UHF high</td>
<td>n.a.</td>
<td>180 K</td>
<td>0.3 mJy</td>
</tr>
</tbody>
</table>

Table 2: Present / future WSRT interferometer system temperatures and future sensitivities. The theoretical r.m.s. continuum sensitivity for 12 hrs observation is based on the future system temperatures and the maximum MFFE bandwidth for the various wavelengths (10 MHz for 92 and 49 cm and UHF, and 160 MHz for the others).

MFFE prototype

The actual start of the MFFE project was in 1987 with the beginning of a feasibility study on the design of the new front end type. This study was completed in 1989 and the results have been published in the NFRA-note 555 “Report Feasibility Study Multi Frequency Front End”. The next phase of the project was the construction of a single prototype MFFE and this started already last year. At present we are still in this prototype phase and it is planned to finish it next year, 1991, when this first MFFE will be ready for testing at the WSRT. More information on the progress of the project and interesting test results will be published in future issues of the ASTRON/NFRA-newsletter.

Staff news

Stefi Baum and Chris O’Dea, both postdoctoral fellows at Dwingeloo, left NFRA on October 1st, 1990. Both moved to Baltimore where Stefi accepted a Hubble fellowship and decided to spend this fellowship at the John Hopkins University, and Chris got a position at the Space Telescope Science Institute. They spent three years at Dwingeloo to carry out astronomy using the observational facilities of NFRA (WSRT and ING on La Palma).
When $1 \times 12^h$ is almost as good as $2 \times 12^h$: a sampling theorem lesson

Richard Strom

In normal aperture synthesis with the WSRT, a field is observed for one or more twelve-hour periods to obtain enough $u,v$-plane coverage for reliable imaging (and sufficient integration time for the sensitivity required). Each $12^h$ measurement is normally made with a different setting of the movable telescopes and has the ultimate goal of producing a set of equally spaced visibility ellipses (Hogbom and Brouw, A&A 33, 289, 1974). The required spacing between ellipses is determined by the maximum extent of structure in the field; for a source size $\theta$, it is desirable to have an ellipse spacing (or baseline increment) well under $\lambda/\theta$. This will ensure that any extended source lies within the first grating ring (i.e., that it does not suffer self-confusion). The baseline increment in a single $12^h$ measurement is $72$ m, so the maximum source extent which can be imaged in a single observation at $92$ cm (our longest wavelength) is less than $\lambda/72 = 44$ arcmin (although as the declination decreases and the baselines become foreshortened, the maximum source extent in the NS direction increases accordingly).

Figure 2. Antenna pattern for the observations shown in Fig.1. Note that the source is larger than the radius of the first grating ring.

low brightness emission from the remnant itself.) Subsequently, it became apparent that the observation with $9A = 72$ m suffers from a severe defect, probably caused by low level interference, which greatly distorts the weak, extended emission (including that from the SNR). Somewhat dismayed, I pressed on with the reduction of the other measurement, in the hope that I could somehow produce a reliable image.

Having finally iterated my way to a model for all sources stronger than $5 \mu Jy$ (both point and extended, but excluding the remnant itself), I decided that self-calibration had reached the point of diminishing returns. The maps I was producing of the SNR looked like Figure 1 (which has been heavily smoothed to bring up the extended emission, and from which the background sources have been removed): it was our remnant alright, but what were those 'ears' to the north and south? Knowing that this map did not obey the sampling theorem (the source is self-confused, as shown by the antenna pattern in Figure 2), one would certainly be loath to believe that all the emission was real. With visions of a new proposal to request additional observing time ("...damaged by interference...", "...essential SNR research...", "...act of God??") fluttering through my mind, I wondered what more could be done with the good observation. CLEANing seemed a hopeless possibility under the circumstances (see, e.g., Hughes et al., ApJ. 283, 147, 1984; and 246, L127, 1981 for, unfortunately, a classical example of what can go wrong) and I did not even attempt it. More by way of rounding off a lost cause than in any genuine belief that it would significantly improve things, I decided to make a 'final' map including all baselines (standard and nonstandard).

Those who have used the WSRT in recent years will be aware that in addition to the standard baselines (formed by combining the 4 movable and 10 fixed telescopes), we also measure nonstandard (fixed-fixed and movable-movable)
Figure 3. Smoothed map of the observation with both standard and non-standard spacings.

Their main value lies in providing redundant spacings to correct telescope errors, but they can also be used to improve the signal to noise. In our case, the standard baselines were at increments of 36 + n72 m, where n = 0,1,...,37. The nonstandard spacings were the fixed-fixed combinations, \( n144 (n = 1,2,...,9) \), and the movable-movable ones of 72, 1224, 1296 and 1368 m, many spacings occurring more than once. The reason that I expected no substantial improvement was that although the nonstandard baselines would increase the \( u,v \)-plane coverage, the major addition was the 144,288,... m group, which would have the disadvantage of introducing an extra set of grating rings at half intervals (of 22 arcmin). I had forgotten that 72 m would also be included, and actually expected the map to be worse.

How mistaken my pessimism was! Far from decreasing the image quality, the map was vastly improved (see Figure 3, in which precisely the same contour and grey-scale values have been used as in Figure 1). What went right? The key to the answer lies in the fact that the SNR has very little fine scale emission. While it is true that spacings of 216,360,504,... m are absent from the map, the visibility of the remnant at these baselines is essentially zero, so it doesn't matter. At the all-critical shorter spacings, we have 36,72,108,144 and 180 m, and they provide practically all of the required information, with a grating ring spacing of 88 arcmin. The lesson to be learned from this is that in a redundancy observation with \( 9A = 36 \) m, use of the nonstandard baselines may enable one to properly image objects twice as large as might be expected with a spacing increment of 72 m, or in other words, \( 1 \times 12^a \) as good as \( 2 \times 12^b \). Although it might seem that our object constitutes a rather special case, many well-extended sources contain only small patches of fine scale structure (which, like the extended background sources removed from Figures 1 and 3, may well be CLEANable). Other users may wish to consider whether their extended sources could also be mapped in this way.

Excerpts from the WSRT Program Committee meeting


Dwingeloo operations

The HI survey of Hartman and Burton is progressing reasonably well.

Reduction status

The current backlog of uncalibrated WSRT data is 2 to 2.5 months. An effort will be made to decrease the backlog to the 1.5 month level now that reduction is proceeding smoothly with the new computer hardware. Archiving of new (since 1-1-90) data on optical disk is complete through the end of August. The entire WSRT archive with only a 2 week backlog is now accessible with the La Palma archive access system as described in the ASTRON newsletter (June '90). Archiving of pre-1990 data from tape to optical disk has not yet begun at a significant rate. Extra manpower will likely be required for this work to proceed at a rate exceeding about 1 year of re-archiving per year.

WSRT operations

During the 92 cm period, ending on 23 April 1990, it was possible to complete all outstanding allocations of first and second priority as well as a large fraction of the filler allocations. Data quality was generally good. The sun, although bright, was relatively stable. Even so, daytime observations will require significant effort to extract useful information on baselines shorter than about 200 m. It was possible to carry out the planned mosaic test on the Coma cluster field during the last weeks of the period.

A 6 cm period extending from late April through mid-June 1990 was interrupted with a special session at 49 cm to accommodate monitoring of the low frequency light curve of SN1986j (proposal W936.4), and by a week of VLBI participation. A good working system allowed efficient completion of all previously allocated observations and a series of pointing and holographic tests. All antennas should be completed during the summer of 1991. The efficient completion of the allocated program made it possible to accomodate a number of 6 cm interim proposals which are listed in the table of allocations.

21 cm observations were carried out between mid-April and mid-September. From the beginning of the period it was clear that the line backend (DLB/DXB) was operating with a higher error rate than ever previously experienced. The errors are characterized by groups of (typically eight) interferometers which contain spurious correlation products (typically an elevated amplitude), either
intermittently or in some cases continuously. Extensive test
time was used in an attempt to track down the cause of
these errors. Their intermittent and often subtle nature
makes them difficult to localize effectively. Eventually, the
most serious of these errors were traced to component
failure in the 15 year old backend and repaired. It is not yet
clear whether the experience of this period represents an
isolated incident, or signals a more general increase in the
component failure rate. It is definitely a cause for some
concern. External problems, in the form of a military
communications exercise at 1470.5 MHz, led to the loss of
about one week of observations before negotiations for
operation at a different frequency were successful. With a
considerable effort it was just possible to provide useful
data for the first priority allocations. Most of the second
priority allocations for this period could not be observed.

Miscellaneous Items

A concept for a combined cover and request sheet for
WSRT proposals will soon be ready for review by the PC
members. The aim is to distribute the new sheets in time
for the next proposal deadline. The mechanism is in place
to support archiving on optical disk of well documented
FITS format images.

Schedule

The adopted schedule of the WSRT for 1990/1991 is as follows:

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Leader</th>
<th>Subject of study</th>
<th>λ-cm</th>
<th>Allocation</th>
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<tbody>
<tr>
<td>W1024.3</td>
<td>G. de Bruyn</td>
<td>NGC1569</td>
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<td>X-ray Binary Mon.</td>
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New proposals: 6/21/49/92 cm

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Such puzzling changes may be indicative of outburst phenomenon and their origin is the subject of further investigation.

**Future Work on Radio OH Lines in Comets**

Within the usual constraints of cometary orbits and scheduling restrictions, it will continue to be possible to observe bright comets in the 18-cm lines with the Dwingeloo 25-m telescope. Scaling from the present comet Austin observations, this means that a comet must be brighter than about 7.5 magnitudes (corrected to Earth-comet and heliocentric distances of 1 A.U.) to obtain a signal-to-noise ratio of 5 in 12 hours of observation with a nominal velocity resolution of 0.44 km/s. In addition, the distribution of OH emission within cometary comae has been observed to contain relatively small-scale clumps (Palmer, de Pater, and Snyder 1989, in A.J., 97, 1791, and references therein). Therefore, with the increase in sensitivity of the WSRT at 18-cm due to the coming Multi-Frequency Front Ends (Tan, this issue), it may be possible to use that instrument to study the detailed spatial distribution of OH in bright comets.

![Figure 1. OH spectra of Comet Austin.](image)

![Figure 2. Flux density of the OH line, mean relative velocity (v) and line-width (FWHM).](image)

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**La Palma**

**Analyzing light curves by maximizing entropy**

*René G. M. Rutten*

**Introduction**

Data obtained from some measurement is in many cases merely a distorted reflection of the information we want to obtain. There are several methods available to unscramble information from distorted-, corrupted- or just noisy data (e.g. "cleaning" and Fourier filtering). A particularly useful method is provided by the so-called Maximum Entropy algorithm, which has gained fame as an image restoration tool but which can also be applied as a general-purpose tool for data analysis. I will describe here how the Maximum Entropy algorithm is being used to analyze eclipse light curves of cataclysmic variable stars (CVs) to produce an image of accretion disks in these close binary systems. But first a few words on accretion disks in CVs.

**Accretion disks in close binaries**

A CV typically consists of a cool star orbiting a white dwarf primary with an orbital period of the order of a few hours. The cool star fills its Roche lobe and material from its outer layers flows towards the white dwarf. Due to the appreciable angular momentum, the infalling gas is forced into an orbit around the white dwarf where it is stored in a thin accretion disk. Viscosity causes the material to spiral in gradually, whereby it becomes progressively hotter as it travels towards the centre of the disk. In the optical the accretion disk generally dominates the spectrum. A small fraction of CVs is seen at high inclination. In these systems the secondary star periodically eclipses (part of) the accretion disk which results in a deep dip in the light curve, typically lasting for 30 minutes. The shape of the eclipse light curve reflects the spatial intensity structure of the accretion disk, while the temperature structure of the disk is reflected in the color changes through eclipse.
Hence, by analyzing eclipse light curves at different wavelengths, it is possible to reconstruct the intensity and temperature structure of the accretion disk.

Recovering the accretion disk

Our aim is to derive the spatial intensity structure of the accretion disk from the light curve. The light curve, however, does not uniquely determine the disk intensity structure and hence we have to make a choice from the set of possible disk structures which all reproduce the observed light curve equally well. The classical way to pick one solution is to take a physical model of the accretion disk which is constrained by a (small) number of adjustable parameters, and try to fit the light curve optimally by varying the model parameters. The disadvantage of this method is that different models may come up with different, but equally valid solutions. An alternative method is to select the smoothest possible intensity structure which reproduces the observed light curve within the observational errors. This solution is the most simple structure which contains the least information and it may therefore be considered as the most likely solution to the problem. This solution is usually referred to as the maximum-entropy solution. Clearly this method is not biased towards some physical model.

In practice, to obtain the maximum-entropy solution a grid of points in the plane of the accretion disk is defined, and each point is assigned an intensity value. The intensity on each grid point is an independently adjustable parameter. Finding the maximum-entropy solution involves searching parameter space (which has a typical dimension of a few thousand) for that one, unique vector which specifies the smoothest possible intensity structure that reproduces the observed light curve.

An example

SW Sex is an eclipsing nova-like cataclysmic variable star. The cartoon in Figure 1 gives an impression of the Roche lobe filling star and the accretion disk of SW Sex. Several eclipses have been observed with the Multi-Purpose Fotometer (MFF) at the 1m Jacobus Kapteyn Telescope (JKT) on La Palma. The light curve at 4300 Å (see Figure 2) is taken as an example to reconstruct the disk intensity structure employing the maximum entropy criterion.

Figure 1: Cartoon of the binary system SW Sex showing the Roche lobe of the secondary star partly eclipsing the accretion disk.

Figure 3 shows the reconstructed disk. The white dwarf is located at the centre of the picture and the inner Lagrange point, from where matter leaves the secondary star to join the disk, is at the centre of the lower border. The reconstruction shows that the bulk of the radiation is coming from an extended, more or less symmetric structure centred on the white dwarf. But there is also a less pronounced structure off centre towards the lower right-hand corner which causes the light curve to be asymmetric. This structure is the so-called bright spot where the gas stream from the cool star hits the accretion disk. The light curve which corresponds to this disk structure is compared with the observed light curve in Figure 2. Currently we are undertaking a long-term project on the JKT, observing eclipses in 4 wavelength bands of many CVs with the Multi-Purpose Fotometer. These observations, analyzed with the maximum-entropy method, will enable us to study the disk temperature structure as a function of a number of binary star parameters which will improve our understanding of accretion disks in binary systems.

Figure 2: Observed (thin, full curve) and computed (bold full curve) eclipse light curve of SW Sex at 4300 Å. The computed light curve corresponds to the disk image in Figure 3.

Figure 3: Maximum-entropy grey-scale image of the accretion disk as reconstructed from the light curve at 4300 Å.
UK/NL Collaboration

Wilfried Boland

ING, JCMT and UKIRT

News regarding the Isaac Newton Group (ING) of optical telescopes on La Palma, the James Clerk Maxwell Telescope (JCMT) and the United Kingdom Infrared Telescope (UKIRT) on Hawaii is regularly reported in the RGO newsletter GEMINI, the JCMT newsletter PROTOSTAR and the UKIRT newsletter, respectively. Although the astronomical community in the Netherlands is involved in the operations and receiver construction programme of ING and JCMT, and has access to ING, JCMT and UKIRT, we will not report on these telescopes in this newsletter on a regular basis. Readers interested in these facilities are referred to above mentioned newsletters to be kept informed. However, for special occasions we will accept news on these telescopes, especially when this contribution contains highlights of astronomical research.

Jan Lub appointed to Head Operations ING

The SERC-NWO Joint Steering Committee has appointed Jan Lub of Leiden University to Head Operations of the ING on La Palma starting September 1st, 1990. He will succeed Jasper Wall who will return to the UK. Lubs appointment is for a period of three years.

Flexible Scheduling JCMT

The PATT Time Allocation Group for the JCMT approved a proposal by Richard Wade (Astronomer in Charge at the JCMT) for an experiment in flexible scheduling. Briefly, the system is as follows. An allocation of n nights for observations requiring exceptionally dry weather is scheduled in a slot of 3n nights. Within this period, the observer has the right to select his/her own n nights. The remaining 2n nights will be used by other scheduled observations, not requiring dry weather. The advantage of the system is that the dry weather observer has a greater chance of obtaining his/her data, the disadvantage is that everybody stays longer in Hawaii, hence higher residence cost. The system is on a voluntary basis, at least for the moment.

Calendar

Deadlines for submitting observing proposals.

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