

Presidential address

## The Rings of Uranus – the South African Story

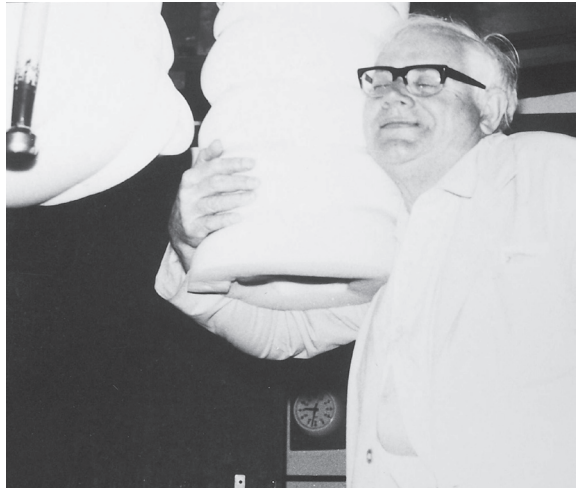
Pat Booth

This is the story of what happened on Thursday the 10th March 1977 here at the SAAO when Uranus occulted the star SAO 158687 in which I was a participant.

It was one of the last major planetary discoveries made from the ground when any such discoveries were expected to come from space probes. The honours belong entirely to Joe Churms who at the time was Deputy Director at the SAAO. He laboured in the unglamorous field of astrometry where great discoveries were just not made. While he was alive it was for him to tell the tale but he was not one who spoke of his work and he left no popular account of what happened in the dome that night. I have always felt that Southern Africa is owed such an account. Over the years errors have crept into the tales from a mythical 13-inch McClean telescope to the SAAO's confusion over which of its telescopes fits

where in the story. If that was not bad enough, a few days ago when I sought

access to the trace in order photograph it for tonight, they were not sure if it still existed – it might have been destroyed. I knew that Joe would never have done so – he was incapable of throwing anything away – and if it had ever been in danger of destruction, he would most probably have rescued it and kept it with his personal records where, after his death, I would have found it. Yesterday



**Figure 1.** An early photo of Joe Churms. (SAAO)

[2005 August 16] while preparing this, I spoke with three people before Ian Glass remembered seeing it in a cupboard in

the first room under the MRM (Multiple Refractor Mounting) building. Isobel Basset then found it, in a punch card box of occultation traces from that era. It is not dated but the paper enclosing it is marked “Uranus Obs” in Joe’s handwriting (Figure 2). It is back there now, in the gray steel cabinet standing against the inside wall as you enter the room, where Isobel and I returned it.

The occultation would be the first of its kind for Uranus and attracted much attention overseas. South Africa had a ringside seat as it would have darkness for the event. Originally the event was predicted to be visible everywhere from the Earth’s night side. True to form for that era, when new photographic plates were taken and the star’s position recalculated in preparation for the event, it was found that the path of the occultation had shifted southward cutting out the night side of the northern hemisphere.

The main observing effort in South Africa was to be at Sutherland but Joe, knowing the value of occultations in probing the upper atmosphere of a planet, decided he could do something here with the available equipment – the 18-inch reflector in the dome behind the Main Building and its photometer, used for much of Dr Cousins’ work, an RCA



photomultiplier with a gallium arsenide photocathode and a 3-mm thick Schott RGN9 filter.

The story takes place in the two hours before midnight. That night Uranus rose here at about 09:30 and by midnight was at about 30°.

I must confess that for me that night is memorable not only for its end result but for the two things that knocked me sideways right at the beginning. The first was the sight that greeted us on walking into the 18-inch dome. Uranus being low on the horizon, the telescope with its finder would have to be reached by climbing onto a trolley which circled the pier on rails, then onto a stool and up a small step ladder perched on it. My experience of the world of professional astronomy was then not very extensive but I had watched Joe taking photographic plates in the McClean and been duly impressed by the level of high-tech of the rising floor. I had also seen the transit circle at

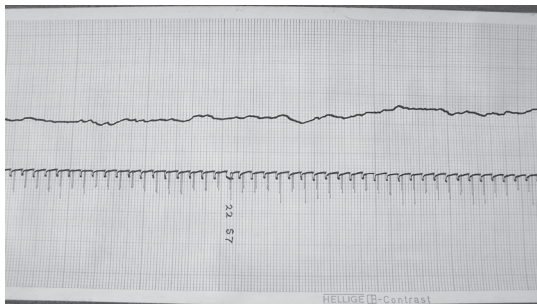
Greenwich where the observer had to lie down but this really took the cake. This rickety Heath-Robinson arrangement was the reason for my presence – I was there to raise the alarm for the accident clearly waiting to happen. Obviously astronomy was a dangerous profession.

While I was still absorbing this, Joe proceeded to disillusion me for ever about professional astronomers. He checked the telescope's tracking by setting on Sirius and while I could recognise the relevant parts of Canis Major through the slit in the dome, he had to go outside to be sure it was Sirius. In my innocence I thought studying the stars meant you knew the sky backwards. In later years, during his retirement in the age of PC's, I prepared many a chart of the night sky for him – later I must have

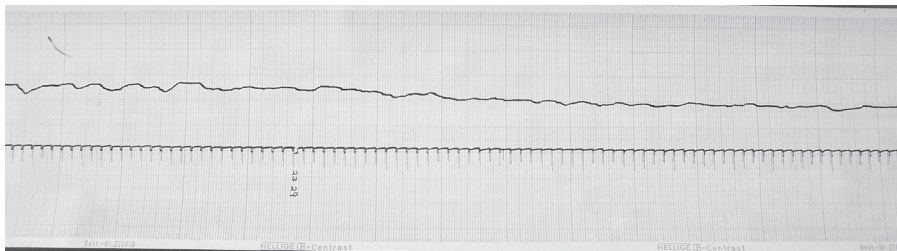
found every one of them – and he enjoyed learning the sky at last.

Some minutes before the star was due to go behind Uranus but not in time to get the rings in the pre-immersion phase, the observation started. The photometer was linked to a chart recorder which recorded the level of light on a paper trace together with a radio time signal (Figure 3). I was stationed at the recorder in the window alcove with instructions to tell Joe, if the line, traced by the pen recording the light, moved extensively, so that he could check that the planet was still centred on the cross wire of the finder.

All went according to plan but after the trace indicated the star had re-appeared, Joe being careful, wanted to be certain before he stopped recording. The finder being too small to show the star in



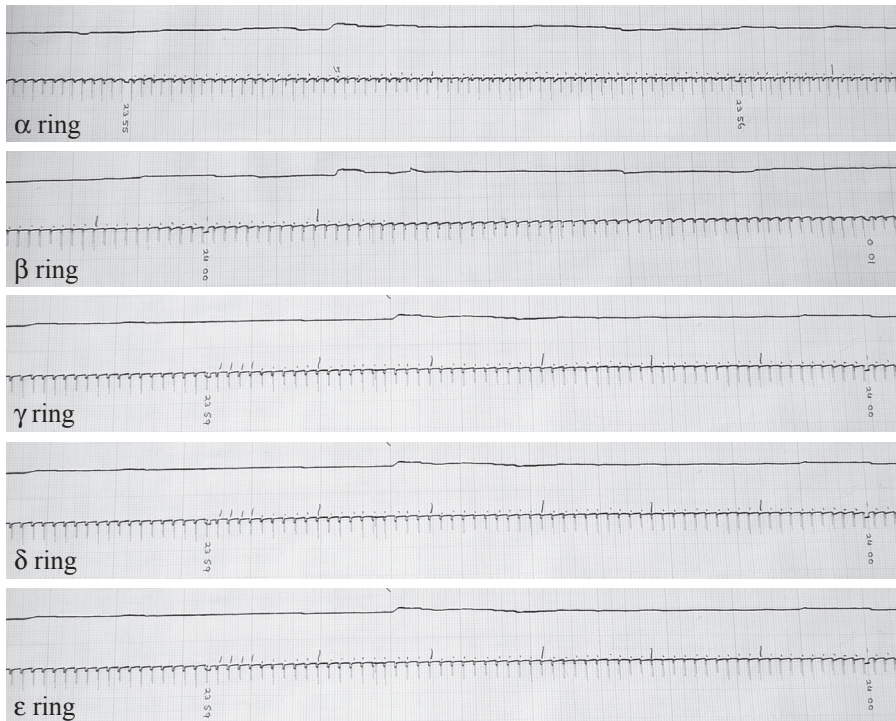
**Figure 3.** (left) The start of the planetary occultation. The combined light of Uranus and the star on the left. The star fades behind the planet's atmosphere in the middle until to the right only the light of Uranus remains. The lower line of the radio time signal is marked in SAST. (below) The end of the planetary occultation. The process is reversed as the star emerges from behind the planet.



Uranus' glare, he left the dome shortly before midnight to open up the McClean where he would be able to see it in the 18-inch refractor there. He used the 24-inch refractor there to take his plates.

While he was away the trace did a V-shaped movement for a few seconds and now mindful of my instructions, it was my turn to risk life and limb for astronomy. Today I am sure I would not do it. It was hairy enough climbing the steep and narrow steps to the dome in the poring rain this morning. Just as I

was returning to the chart recorder, Joe came back and I said, "Look what its done". This was  $\epsilon$  ring which is the only obvious one on the trace (Figure 4). Joe thought it could be one of the moons, he would check on his return from Sutherland where he was going later that morning. It certainly did not occur to us that it might be a new one. The delay, caused by Joe wanting to be certain the star was out, resulted in him getting the rings, although he was not in the dome when they were recorded.



**Figure 4.** The strip charts recording the discovery of the five rings of Uranus. Just before midnight, unnoticed by me, the  $\alpha$  ring is recorded. All the rings are now marked by a faint pencil cross on the original. The lower image is of the  $\epsilon$  ring, the one I watched being recorded and will never forget. (Photo: Pat Booth)

Meanwhile the major participants in the discovery were flying out over the southern Indian Ocean in the Kuiper Airborne Observatory (KAO) from Perth, Australia. Their equipment was much more high-tech. The main recording went onto magnetic tape and their more sensitive chart recorder was the backup recording as well as the monitor for the observation. They got the rings before the planetary occultation and realised immediately that something was up. Their main speculation was of a ring of small moons around the planet. The problem now was to get the news to South Africa so that observation could continue for as long as possible. The alert went more than halfway round the world but did not reach down here. The co-pilot radioed Perth Observatory who phoned Brian Marsden in America. He phoned Jan Hers in Johannesburg who told him it was raining. Even if Hers had known about Joe, there was no way to contact him (those being the days when cellphones were science fiction) because the telephone was in the deserted Main Building.

The KAO having landed but still with their heads in the clouds, at this stage, claimed only five rings. Marsden started looking for other confirming observations and contacted Dr Michael Feast for news of the South African activities. Sutherland had also been under cloud so Joe was the only one with an observation. Marsden then used the Kuiper event times to work out the corresponding times for Cape Town and phoned Dr Feast who descended on Joe's trace to find the rings recorded. Joe was phoned in Sutherland and on the weekend he phoned me with the news.

Later on the Kuiper Airborne Observatory and Perth Observatory data, which had the pre-immersion ring occultations but no planetary event, would yield four more rings. September of that year saw *Voyager 2* start its long journey to the gas giants and we had to wait nine years before we saw the pictures of the rings. Twenty eight years later I would see the trace again and, for the first time, find the other four rings. It is fitting that they should at last be published in the journal edited by Joe for so many years. Sadly the telescope is not used now – there is no power in the dome – and the 18-inch is perpetually enshrouded in the murky gloom of the dome. The chart recorder is there too, as part of the observer's console which now occupies the trolley.

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