Optical Bursts from MXB 1636-53

H. Pedersen

Dr. Holger Pedersen of ESO/Chile recently was privileged to witness optical "bursts" from an X-ray source. With only a very limited number of such observations ever made, he conveys in this note a very important aspect of observational astronomy: the immense joy of making discoveries!

Until recently, only two of the five known optical counterparts of the X-ray bursters were known also to emit optical bursts. In both cases, the association between the X-ray data and the optical bursts were based on only one event.

The optical counterparts are very faint, around 30,000 times fainter than visible to the naked eye. This is probably one of the reasons why so few events have been observed so far. Moreover, the bursts are quite unpredictable and come with intervals of hours or days.

Therefore, the astronomer who wishes to do this kind of observation needs three things: a large telescope with a highly effective photometer, a dark, moonless sky and then either good luck or a lot of observing time. All these conditions were fulfilled when I had the opportunity to use the newly finished Danish 1.5 m telescope at La Silla in June and July this year. The work was only a small part of an international "Burst Watch" campaign coordinated by Professor W. Lewin and co-workers at the Massachusetts Institute of Technology. Several other optical observatories did similar observations and the X-ray data were taken by no less than two recently launched satellites: the Japanese HAKUCHO (the Swan) and the British UK-6.

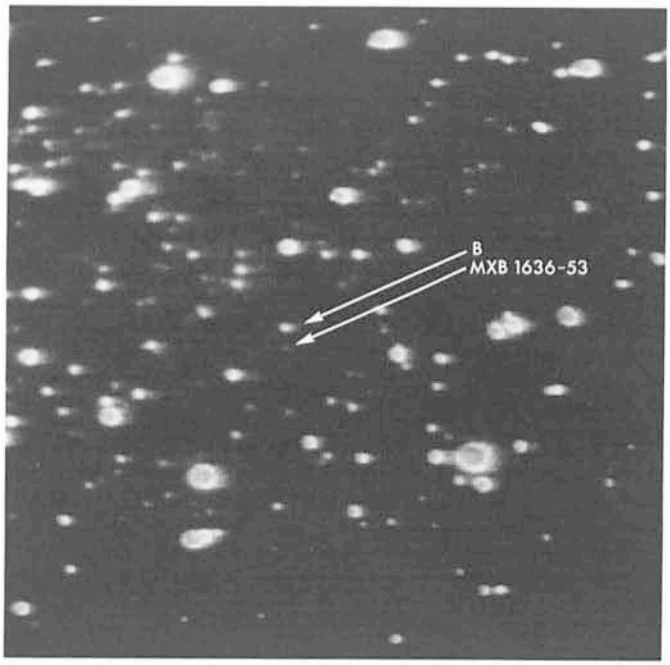

Fig. 1: *The field around the X-ray burster MXB 1636-53 as observed on the Quantex TV system at the Danish 1.5 m telescope. The first optical burst observed from this object was actually seen on the TV monitor. During its outburst, the object was brighter than a nearby star marked "B".*

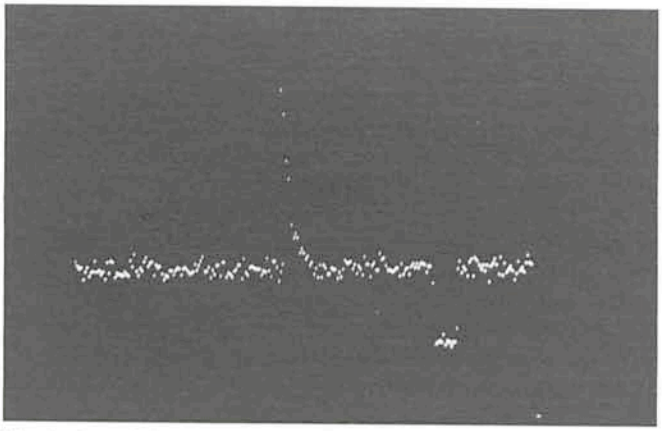

Fig. 2: *One of the strongest optical bursts from MXB 1636-53. The photograph was taken from an oscilloscope display showing the last 12 minutes of observations. The stellar intensity increased nearly by a factor of four in less than 2 seconds. The level of the sky brightness is also indicated.*

The first two nights on La Silla were used mostly to solve various technical problems and rehearsing the observing routine. Finally I got started on the night June 20/21. Seventeen minutes after the beginning, the star (called MXB 1636-53) had to be recentred in the diaphragm. An extra mirror was inserted into the beam in order to image the star and its surroundings on the TV camera. Suddenly the field on the TV monitor looked strange and unrecognizable. It took some moments to realize that the object was in outburst, now being much brighter than normal! A few more seconds were lost when doing the final position correction and taking the TV mirror out of the beam. Therefore, the measurements showed only the tail of the burst. Bad luck. No doubt the burst had been very bright compared to the two previous optical bursts observed last year from Cerro Tololo and Wyoming. However, later the same night two more bursts were recorded and, this time, also "secured" on magnetic tape. That was nearly too good. Could they perhaps be due to some instability in the electronics? In any case, a telex was sent to MIT stating that "optical events" had been seen. A couple of days later came the confirmation. The Hakucho team, headed by Professor Minoru Oda, hat found X-ray bursts at all three moments (the British satellite was observing another object, MXB 1735-44).

During the rest of the observing period eleven more bursts were recorded. All were noticed as the data slowly crossed an on-line oscilloscope display. Figure 2 shows one of the strongest bursts: the intensity increased by a factor of 3.7 in less than 2 seconds. Seeing such a phenomenon while it was going on was a great experience. Now remains a joint effort with the Hakucho team and MIT in order to correlate and interpret the data. Hopefully these observations will help to give an answer to some of the still open questions regarding the physics of these strange objects.