A Very Near Miss: 1976 UA

Science-fiction authors use the effect ever so often, but in real life it seldom happens. We know, however, that the Earth is being struck by meteorites every day, and that statistically the number of small bodies in the solar system is more than enough for a larger-size celestial boulder—a small asteroid—to hit the Earth at regular intervals. And if it happens in the near future it could be a more or less catastrophic disaster, depending on the size of the asteroid and the location of the impact site.

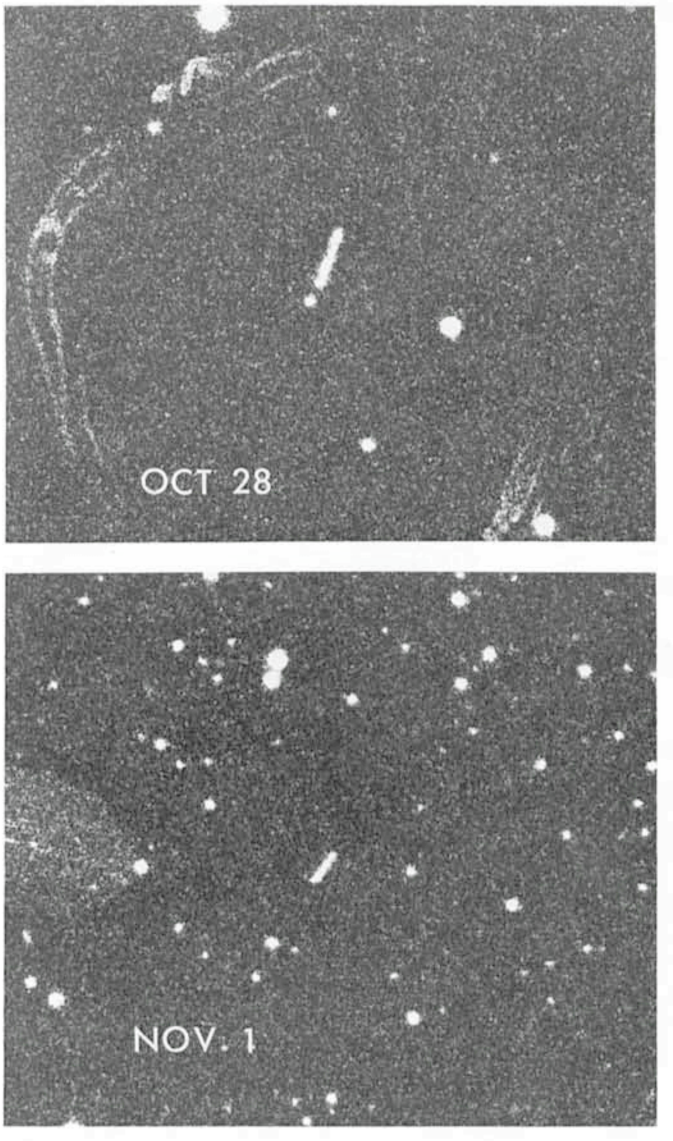
On October 20, 1976, a small asteroid passed within 1.5 million kilometres from the Earth, four times further away than the Moon. Its diameter, probably around 100 metres, would have made a very neat hole, had it actually hit the Earth's surface. Luckily, it went past and it was by pure chance that it was at all detected by astronomers.

It was first seen at the Hale Observatories' Palomar station where by extraordinary coincidence it was recorded on photographic plates taken almost simultaneously with two Schmidt telescopes. W. Sebok was working at the 48-inch Schmidt and E. Helin, T. Lauer and D. Zelinsky at the 46-cm Schmidt on the night of October 24–25, when they independently noticed a long asteroid trail on their plates (cf. *Messenger* No. 6, p. 11). It was soon realised that C. Kowal had seen the same object on an October 21–22 plate taken with the 46-cm Schmidt telescope, but not less than 17° north of the Oct. 24–25 position! That gives an impression of the speed with which it was moving. Further observations on October 26 confirmed the object. The name 1976 UA was given to the asteroid, since it was the first one discovered in the period October 16–31, 1976. (Jan. 1–15 = A, Jan. 16–31 = B, ..., Oct. 16–31 = U).

Dr. B. Marsden at the Central Bureau for Astronomical Telegrams in Cambridge, Massachusetts, was informed and on October 27 a general alert went out by telegram to all observatories with telescopes large enough to observe the asteroid, at that time of magnitude about 16 . This telegram was received on La Silla at about 18.00 local time in the evening. It included a rough ephemeris (table of expected positions) for the next-coming days. Unfortunately, the weather that evening was not very promising; there were clouds and cirrus, and the Moon was up during the beginning of the night.

It was therefore with a limited optimism that Guido Pizarro, night-assistant at the ESO Schmidt telescope, and Richard West, ESO staff astronomer (temporarily replacing Hans Schuster), went to the Schmidt dome, put a plate in the telescope and settled down to wait for a hole between the clouds. But nature was kind, and at 23.30 the shutter was opened for 10 minutes. After some anxious moments in the dark-room, followed by a careful search under a microscope, the short trail of 1976 UA was found. The magnitude of the asteroid was difficult to estimate due to the clouds, but it appeared that it was somewhat fainter than expected.

The position was measured and a telegram was sent to Dr. Marsden in the morning of the 28th. On the basis of the Palomar positions and the ESO position, Dr. Marsden computed the orbit. It showed first of all that a very close encounter took place on October 20, but also that 1976 UA is the asteroid with the shortest period known, only 283 days! In its rather elliptic orbit, it comes as close as 70 million kilometres from the Sun and as far as 183 million kilometres. It was during its outward passage across the Earth's orbit that it came so close this time.



The motion of 1976 UA, just after the close encounter with the Earth, is well illustrated by these two photos, obtained with the ESO Schmidt telescope on October 28 and November 1, 1976. Both exposures were 10 minutes on blue-sensitive IIa-O emulsion. The image (trail) of 1976 UA is clearly longer and stronger on the October 28 plate than on the November 1, showing how the small planet quickly recedes from the Earth and becomes fainter with increased distance.

The observations were continued at ESO every night until November 1, when the Moon moved too near to the position of 1976 UA. It appears that these observations will be very important for the computation of the definitive orbit. Since 1976 UA moves so fast, relative to the Earth, its magnitude will rapidly diminish through November and it will be an unobservable object of magnitude 21 in the beginning of December 1976. Therefore, if we shall have any hopes of ever finding 1976 UA again, we must try to get as many and as accurate positions as possible during this short time interval. Presently (November 11), the ESO Schmidt telescope is about to start a new series of observations after the passage of the Moon. From Dr. Marsden's first orbit, it appears that we may see 1976 UA in October 1983 as a faint object of magnitude 18 when it passes within 15 million kilometres from Earth. There is no doubt, however, that the small planet leads a dangerous life in the space between the inner planets, and its orbit is frequently modified when it passes relatively close to the Earth, as it certainly did this time.

This experience is most interesting because it demonstrates that there are many planets yet to be discovered in the inner part of the solar system. Doing some simple statistics about the chance of discovery of a minor planet like 1976 UA, one may well wonder how many have passed unnoticed through the Earth's neighbourhood in recent years? Or what about those that are now on their way?

Some French Stellar Programmes in the Magellanic Clouds

Eric Maurice

Since the very early years of the existence of ESO, French astronomers and technicians have been closely involved in its activity. It is not possible, here, to mention all those who, starting in 1961—and even before for site-testing—have spent a period of their lives in South Africa or in Chile to install and test the instruments and then to observe. Nearly all French observatories are or were involved in these activities but it is appropriate to mention especially the Haute-Provence and Marseille observatories, and the prominent influence of Ch. Fehrenbach.

Eric Maurice, *now at the Marseille Observatory, was ESO staff astronomer in Chile from 1968 to 1973. His review is based on information from many French astronomers and gives a comprehensive, up-to-date summary of observations and results obtained with the ESO telescopes during recent years.*

Fifteen years have passed since the first plates were taken with the objective prism-astrograph (the GPO) at Zeekoegat in South Africa; now applications for observing time regularly exceed the possibilities by a factor of three to one for the 1.5 m and the 1 m telescopes at La Silla. Many French astronomers are regularly travelling to observe in Chile. My present purpose is to present a survey of French stellar programmes in the Magellanic Clouds.

The Large Magellanic Cloud

A large number of objective-prism plates have been taken in this direction; the Fehrenbach "prisme-objectif à champ normal" is essentially devoted to radial-velocity determination. Its diameter is 40 cm, the photographic limiting magnitude is $12^{m}.5$ over a square field of $2^\circ \times 2^\circ$. The plates are measured at the Marseille Observatory under the supervision of Ch. Fehrenbach and Marcelle Duflot.

On each plate, generally more than 500 measurable spectra are present. The radial velocity (approximately 250 km s^{-1} for the LMC, and 0 km s^{-1} for the galactic stars) is used as membership criterion. The plates now cover nearly the whole LMC. In Fig. 1, the area delimited by thick lines corresponds to the radial-velocity results already published (398 LMC supergiants and 1434 galactic stars). The area delimited by thin lines corresponds to the results to be published soon.

Among the high radial-velocity stars found in the direction of the LMC, two groups must be mentioned.

In the first group (approximately 30 stars of spectral types ranging from A0 to F0), the spectra present very strong hydrogen lines and a large Balmer discontinuity. These stars have been thoroughly studied and their membership in the LMC now seems certain. No equivalent class of stars is, at present, known in our Galaxy. The second group contains at present 34 high-velocity galactic stars; their radial velocity is larger than 100 km s^{-1}. The study of these stars is in progress.

Ch. Fehrenbach and M. Duflot are also listing the objects presenting emission spectra observed from objective-prism plates. They have recently published a list of 80 Wolf-Rayet stars for which they give precise classifications. For 30 of them, the C or N character was not previously known. They are now preparing a list of planetary nebulae, emission-line stars (H, Fe II, forbidden [Fe II], etc.). Most of these objects have already been mentioned but a more accurate description of their spectra will be given.

Among the stars selected by the Fehrenbach-Duflot group are some that were studied at 74 Å mm^{-1} with the Marseille Cassegrain spectrograph (RV Cass) and photometrically by A. Ardeberg (Lund Observatory), J.P. Brunet, E. Maurice, G. Muratorio and L. Prévot. The method of selection of these LMC stars did not permit obtaining a complete list of O-type stars: their spectra do not present a sufficient number (if any) of absorption lines to permit radial-velocity determination. A systematic search of the O-type stars has consequently been undertaken by the "PLM group"; (L. Divan and M.L. Burnichon-Prévot from Paris; J. Rousseau and A. Mianes from Lyon; N. Martin, L. Prévot and E. Rebeirot from Marseille) for two reasons; firstly, to make possible a statistical study of this type of star; and secondly, because of the intrinsic interest of these very young stars which are still very near their place of formation.

For this purpose the objective-prism astrograph has been equipped with an interference filter; consequently the exposure time may be considerably longer (fainter objects are reached) and spectral overlapping on objective-prism plates are not so frequent. A list of 272 new OB2 stars, detected by this method, has been published.

Using all the known members of the LMC, the same group undertook a study of the structure of the Large Cloud, particularly to compare the spatial distribution of supergiants and of ionized and neutral gas.

Three-colour (blue, visible and red) photographic photometry has also been undertaken; for this the prism was