nights at the ESO 50-cm during the new moon. The reduction of the photometric data was completed in April and a statistical analysis showed the presence of a regular variation with a period of $1^d.408 \pm 0^d.002$ and an amplitude of 0.15 magnitude. The light curve is double-humped with one maximum being variable in intensity (Fig. 1). Twenty-one electronographic spectra of this star were reduced using the PDS computer-controlled microphotometer of Nice Observatory (CDCA). The spectrum shows H, He I and He II in absorption; the spectral type is about O8 and the mean radial velocity confirms LMC membership. The λ 4686 He II line is also present in emission and it exhibits periodic radial-velocity variations in phase with the light curve. A preliminary value for the semi-amplitude is 450 ±50 km/s. Maximum recession velocity occurs at the time of the variable maximum in the light curve. The underlying λ 4686 absorption line shows approximately constant radial velocity to within ±50 km/s. The optical light curve of this star resembles strikingly those of Vela X-1, SMC X-1, Cen X-3, and Cyg X-1, all positively identified binary X-ray sources with OB-type supergiant companions. However, the orbital period of the LMC X-4 candidate is shorter and the radial velocity of the λ 4686 emission line is larger than in these other systems. In this sense the object is remarkable. Except in Cyg X-1, X-ray eclipses have been found in all the above systems and we hope that future X-ray observations will reveal whether they exist in LMC X-4. If so, the identification will have been confirmed beyond doubt.

A Search for Anomalous Tails of Short-period Comets

Should any future comet display a spectacular sunward spike like the one Comet Arend-Roland exhibited in late April 1957, it would not surprise observers any more. Recent dynamical studies of cometary dust by Z. Sekanina at the Centre for Astrophysics of the Harvard College and Smithsonian Astrophysical Observatories led to the understanding of the behaviour of the sunward, "anomalous" tails or "antitails", to the recognition of the rules that determine the conditions of visibility of these phenomena, and thus to the possibility of their routine predictions.

The astrophysical significance of the anomalous tails is determined by the fact that they are composed of relatively heavy dust particles, whose sizes vary typically from about 100 microns to a few millimetres. The millimetre-sized grains correspond to meteoroids that give rise to the meteor phenomenon, primarily to the one detectable by radar techniques. The submillimetre-sized particles are believed to contribute most significantly to the mass of the interplanetary dust cloud (zodiacal cloud). It thus becomes obvious that studies of anomalous tails are relevant to many aspects of the comet-meteor relationships and to the evolutionary problems of the zodiacal cloud.

Successful Prediction of Antitails

Since Sekanina's formulation of the criteria of visibility in 1973, predictions of anomalous tails have been published by him for two nearly-parabolic comets: Kohoutek 1973 XII and Bradfield 1975 XI. Both predictions were confirmed by observations. The application of the criteria to the past instances led to successful identifications of antitail observations for a number of nearly-parabolic comets, but no positive reports seem to exist for the short-period comets in spite of plentiful opportunities. The apparent absence of anomalous tails among the short-period comets is difficult to reconcile with the well-established associations of meteor streams with a number of these comets, and particularly with the occasional occurrences of the remarkable "meteor storms".

The zodiacal cloud is self-destructive. As shown by F. L. Whipple, it requires a continuous input rate of 10^7 grammes/sec to replenish the mass lost by dissipation. The source that provides the mass input is unknown. However, the mass cannot be supplied by asteroidal collisions as recent investigations of the dust population in the asteroid belt have shown. Likewise, the mass cannot be provided by nearly-parabolic comets, since virtually all dust they release escapes from the solar system to interstellar space. The short-period comets are regarded as another inadequate source, but the present estimates are hardly meaningful. They are based on highly doubtful premises, such as a linear relation between the intrinsic brightness of the comet and its large-particle emission rate. It appears that the detection and photometric investigation of anomalous tails is the only ground-based technique that can resolve the problem of the short-period comets as a potential supplier of the required mass.

The ESO Schmidt Telescope Observes Comet d'Arrest

The absence of reports on anomalous tails of the short-period comets in the past suggests that such formations must be very faint and that only fast cameras might have a chance to detect them. This kind of reasoning led to a collaboration—a very fruitful one, as it turned out later—between Dr. Sekanina and Dr. H.-E. Schuster, who is in charge of the ESO 1-metre Schmidt telescope. Dr. Sekanina's list of the short-period comets with favourable conditions for observing anomalous tails shows almost two dozen cases between the years 1976 and 2000. Periodic Comet d'Arrest, the first comet on the list, was south of the Sun when it developed favourable conditions in October 1976; they persisted as long as the comet could be followed, well into 1977. The anomalous tail was to point to the west of the nucleus. Dr. Schuster took the first plate in mid-November, a 45-minute exposure on a panchromatic emulsion combined with a GG 385 filter. The image of the comet was large and circular. Direct inspection showed no trace of the anomalous tail, but a densitometer scan revealed a definite extension in the anticipated direction at angular distances from the nucleus exceeding 10 arcminutes. Most of the visible coma was apparently due to C_2 which was not filtered out and which entirely obliterated the minor contribution from dust near the nucleus. It became obvious that in order to obtain a more convincing evidence, it was necessary to use a more restrictive filter (a red one) which in turn required a

The tail that extends to the north from Comet d'Arrest on this ESO Schmidt photograph is not anomalous; it is a typical, straight gas-tail, pointing away from the Sun. The line to the left of the comet head is a meteor trail.

The circumstances of this photo are peculiar and illustrate the work with a large Schmidt telescope in a good climate. On the night between October 19 and 20, 1976, ESO night assistant Guido Pizarro obtained several plates for the ESO (B) Survey of the Southern Sky. Each plate was exposed for one hour on blue-sensitive IIa-O emulsion with an ultraviolet-cutting filter GG 385. Immediately after the plate of field No. 352 (R.A. = 01^h13^m; Decl. = –35°00') came out of the water-rinse in the darkroom, Guido was seen running downstairs in great excitement. He had noticed the beautiful image of a bright comet and having no prior knowledge of the position of the known comets, he could not know that it was actually Comet d'Arrest that had accidentally been caught on the plate. It was no fun for the ESO astronomer on duty to tell Guido that "his" comet war already known, but he took it as a man and is still perfectly confident that the day will come when the first real "Comet Pizarro" is found.

considerably longer exposure. On January 22, 1977 Dr. Schuster took the second, 90-minute exposure, using a panchromatic emulsion in combination with a RG 630 filter. Although by then the comet's image became much smaller in size and fainter in brightness, its densitometer tracing showed a well-pronounced extension in the expected direction—the existence of the anomalous tail was confirmed. The scan is now being calibrated and it will shortly be used to calculate the production rate of large dust particles from Comet d'Arrest—the first positive step in the search for a source of the interplanetary dust cloud.

Drs. Schuster and Sekanina both look forward to their continuing collaboration. Their next target is Periodic Comet Encke, for which a successful search for an anomalous tail at the forthcoming apparition must be conducted within a few days in mid-October 1977—the only period when the comet is sufficiently far away from the Sun in the sky to allow long exposures and, simultaneously, the anti-tail projection conditions are favourable.

Optical Identification of a Strong Southern Radio Source

There is good reason to believe that one of the strongest, so far unidentified southern radio sources has finally been photographed with the ESO Schmidt and 3.6-m telescopes.

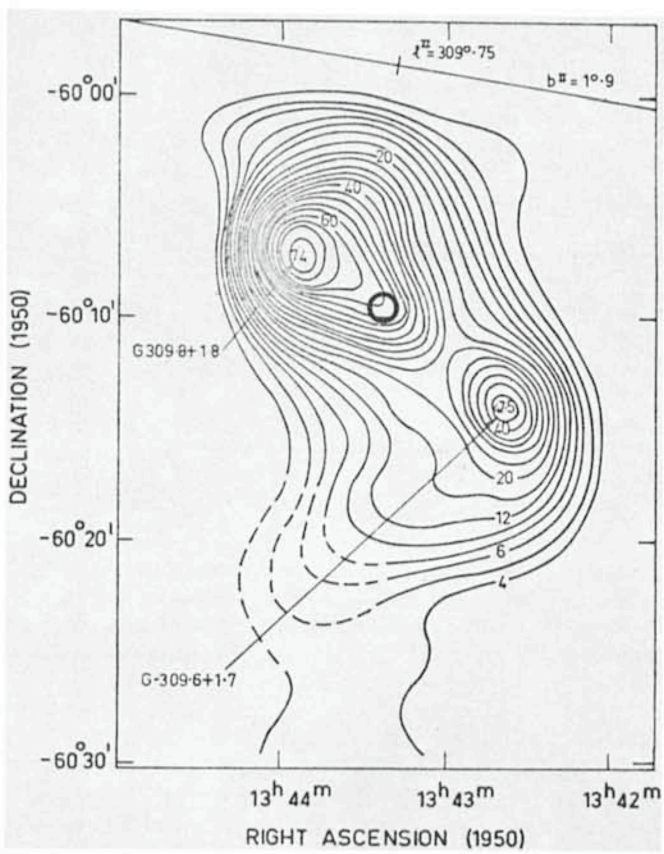

Fig. 1.—*Reproduction of the radio map of G 309.8 + 1.8/G 309.6 + 1.7 at 408 MHz by Shaver and Goss* (Austr. J. Phys. Astrophys. Suppl., **14,** *104, 1970) with the position of the ESO object indicated as an open circle.*