

G.V.Danilenko-Roshina, V.I.Musij and others.

Result of research works was published by E.N.Kramer co-author with collaborations. In common with A.K.Markina was published data of meteor orbit elements, which was photographed in 1950- 1972. With Markina there was carried out the meteor flash statistics. With V.A.Vorobjova was made a research of meteor breaking in atmosphere. Most fruitful was cooperation between E.N.Kramer and I.S.Shestaka. They made the research of photographic meteors height statistic, bolid after-shining, and have print co-author monographs.

Because of system errors, which author mentioned in 60-s, meteor method of nondirect atmosphere parameters measuring have not give the expected results. That is why the research become to classical celestial-mechanic problem. Doctor degree thesis, which was defended in 1993 by I.S.Shestaka named "Origin, evolution and genetic ties of small bodies of Solar system and their combinations". In systematic sense, very useful was E.N.Kramer and I.S.Shestaka book "Photographic methods of meteor astronomy", published in 1989.

Follow the traditions of new obturator inventor, E.N.Kramer offered V.P.Orlov to realize small cut obturator construction for obtain meteor "instant exposure". This idea was shared with meteor photography observation manager P.B.Babadzhanov, who come to Odessa many times. In general, in result of photogra-

phic observations in Odessa and Dushanbe there was published some monographs and defended nearly 10 candidate and two doctor degree thesis. However, collaborator I.N.Kovshun, who was the first who defended the candidate degree thesis, get one vote less than it need to defense doctor degree thesis. There are exist references to the I.N.Kovshun works in scientific literature.

Unfortunately, in spite of spend means, bolid observation station network, that was create in 70's, didn't give the scientific results and was write off.

Note, that in 1960/61 study year in Odessa university, meteor astronomy lecture course was delivered by I.S.Astapovich. Specially for this course V.P.Tsessevich translates in Russian the E.Öpic's book "Physics of meteor flight in atmosphere".

Author of this essay, worked in 60-s in observatory, got near 20 meteor spectrums and worked up it with special laboratory created equipment. The works were made under I.S.Astapovich and V.P.Tsessevich head and was generalized in monography "Spectrums of short atmospheric light phenomena: meteors" (Fizmat literature, Moscow, 1994).

Going to the USA city of Portland, professor E.N.Kramer continues now to consult meteor department collaborations.

So, in spite of viewpoint collisions, the meteor science gets it progress in Odessa.

## ECLIPSING STARS IN OPHIUCHUS

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**ABSTRACT.** In a previous contribution some amateur organizations have been described. Here is presented one example of the work performed. Possibilities of cooperation are discussed.

**Key words:** eclipsing variables, period of V 448 Oph cooperation of observers

In this poster is presented a work on stars in CMi, started 8 years ago. By now all eclipsing and most RR Lyr-type stars in that constellation have been observed, for many of them reliable forecasts can be calculated. Canis Minor is a winter constellation, a similar project for the summer was be started too. Ophiuchus

is an area with many neglected stars. But it is too large for a single observer. A few years ago I selected only 12 obviously neglected eclipsing stars and started to observe.

One of them was V 441 Oph, discovered here in Odessa 50 years ago. Relatively bright, very large amplitude, easy to observe and - completely ignored. By now two CCD minima have been published in the BB-SAG bulletin and a forecast is again possible. The work is done, for the moment at least.

Most of the selected stars have no known period and will take more time. Two of them have been recently solved by other observers, my contribution was little or nothing:

AL Oph by V.Marsakova (Odessa)/ M.Wolf (Prague)  
 V 974 Cyg by L.Chinarova (Odessa)/ M.Wolf (Prague)  
 V 415 Oph by I.Kondratenko / S.Shugarov (Moscow)

The star I was interested most is V 448 Oph, we worked on it together with Jan Manek, Stefanik observatory, Prague, Czech Republic. I shall describe it here in more detail and neglect the others.

A peculiar fact about southern part of Ophiuchus, where most of the selected stars are, is the lack of photographic plates. For example Sonneberg Sky survey: they exist old plates of the declination -20 zone, but the field was abandoned because of light pollution from the city. V 448 Oph is too faint to be studied on Sonneberg Sky Survey. On the Klet observatory in southern Bohemia are stored about 10'000 plates taken by Prof.Mrkos and his assistants in search of small planets. Only 2 (in words: two) cover V 448 Oph. As far as I presently know the only large plate collection is the one at Mt.Palomar, already carefully examined by Plaut. He has discovered many new variables, but V 448 Oph he mentioned explicitly as not found. (The star was published and cataloged with erroneous coordinates). One of the goals of my journey to Odessa was to find out, if somebody somewhere in eastern Europe has a collection of good photographic plates covering this part of the sky?

The other possibility of course is to find the star (I succeeded with V 448 Oph some years ago) and to observe it as frequently as possible. This is quite time consuming for a set of isolated stars somewhere in the sky, the original idea of the CMi project was exactly that all the studied stars should be close to each other and easy to find. Anyhow, during several years I collected a set of CCD images and found 3 weakenings: 49098.609, 49888.387, 50281.404. There is only one reasonable solution: 3.743 days period.

Shajn, who discovered V 448 Oph, published 4 weakenings: 23586.467, 26130.432, 26514.398 and 26867.378. They do not fit the period I would prefer.

The GCVS gives an uncertain period (6.086 days) also not fitting the times given by Shajn. Maybe other minima, unknown to me, have been used. Indeed, future observation will clear the questions in one or two years. But a discussion with people knowing the background may do it immediately. Verifying the period will be much faster if done from several distant stations in different weather conditions.

### Stars synchronous to Earth rotation

Eclipsing binaries with periods or ratios of periods very close to one day (Earth rotation) are difficult to study. Specially if they are placed near the equator. The most extreme case known to me is CX Ser, discovered here in Odessa by Prof. Tsesevitch. Nobody has published a minimum since.

The difference to the sidereal day should be only a few seconds. In other words - the shadow is sitting somewhere on Earth and moving only a few kilometers each day. As eclipsing stars use to change their periods we even do not have certainty, if the shadow moves east- or westward.

Jindra Silhan from Brno, Czech Republic, has drawn attention to this star several years ago, but the minimum was not yet found. We have done some sporadic observations each year since, but how many years will it take until the minimum reaches central Europe?

This year, in the spring 1996 I have observed an increase of brightness. The minimum of CX Ser must have been observable from eastern Europe, most probable from the longitude of the Ural. It is not sure, if it is the primary or the secondary minimum. But is somebody here in the audience living near the Ural and willing to spend a night on CX Ser? And how are the chances to establish a similar cooperation for future targets? Stars with periods more or less synchronous are many and a cooperation between observers will be less costly than an expedition to the north or south pole, from where of course one could do the work alone.

### Summary

Observing occultations of stars by small planets or meteors are teamwork. Variable stars are the field of patient individuals. But cooperation may speed the work, specially in cases as named above. We can join and build a chain or net of small telescopes placed in different time zones, mutually disposable for each of us. With CCD cameras and the Internet we have the technical means. The obstacles are "only" administrative, financial and psychological.