Meteoroid streams identification amongst 231 Southern Hemisphere video meteors

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Abstract

231 video meteoroid orbits observed at the Southern Hemisphere were searched for streams. Several searches has been made by three D-criteria: D_{SH} by [5], D_N by [6] and D_V proposed lastly by [7] The mutual D-distances we processed with a cluster analysis computer program implementing an algorithm based on the single neighbor linking technique. The values of the meteor association thresholds for groups of 2, 3, 4, ... members were estimated by the statistical approach. In all basic searches about 29-33% of the meteoroid's sample turned out to belongs to the stream component. Following streams have been detected: Piscis Austrinids, γ Piscids, Librids, Ophiuchids, χ Capricornids and Microscopids.

The Piscis Austrinids consists of two exactly the same orbits. In this case we do not claim about a real stream, and we do not discuss this result. Twelve members of γ Piscids were detected using all three D-functions, and we didn't find this stream among the members of the working list of the IAU MDC. Therefore we have some basis to claim that our γ Piscids are a new meteoroid stream.

In our search, already known Librids and Ophiuchids formed two separate groups. They were identified in the basic search using D_{SH} function with 36 and 25 members respectively. Using D_V and D_N both streams were detected as a single very complex structure.

Ten members of chi Capricornids and six members of Microscopids were found using the D_N function only. Also for those streams we did not find any counterparts among the stream given on the working list of the IAU MDC.

Observations: place, campain and equipement

The double station video observation of meteors was carried out in New Zealand, between May 18 and May 30, 2002. One of the video cameras was located at West Melton, second camera was placved at Birdling Flat (base lenght was 45.3 km). Observations were carried out only when the sky on both stations was clear.

Each observational site was equipped with S-VHS commercial Panasonic camcorders connected to second generation Dedal-41 image intensifiers and Arsat 1.450 mm lenses. Such configuration provides the field of view about 25 deg. The limiting sensitivity of this system is about +5.5 mag. All records were stored on S-VHS tapes. The time resolution is 0.04 second, spatial resolution 768 x 576 pixels. After inspecting by the recognition software MetRec [?] all found meteors were digitalized with a PC framegrabber. Subsequently, each meteor was measured by the original software MetPho [3]. The trajectory computations were done by means of our standard procedures.

Stream searching method

As a quantitative measure of the difference between two meteor orbits we have used three distance functions: the D_{SH} by [5], the D_N proposed in [6] and the D_V introduced in [7].

All the mutual distances we processed them with a cluster analysis computer program implementing an algorithm based on the single neighbour linking technique; the values of the meteor association thresholds $D_{c,M}$ were estimated with the method described in [1, 2].

General results

The main results are presented in the second and third column of Table 1. The last four columns list the results obtained with the similarity thresholds $D_{c,M} \pm \sigma_{D_{c,M}}$ — the upper and lower boundary of the thresholds intervals. In all basic searches (columns 2-3 of Table 3) about 29-33% of the sample turned out to belongs to the stream component. Three searches with D_V function gave exactly the same result. For D_{SH} function two streams, Librids and Ophiuchids, identified as separate groups with $D_{c,M}$, have connected in a single complex group when the thresholds $D_c + \sigma_{D_{c,M}}$ were applied. Using D_N function and $D_c + \sigma_{D_{c,M}}$ thresholds, two more groups has been found. When the lower thresholds were applied, the Microscopiids stream has not been deteted.

Table 1: General results of nine meteor stream searches; S and P_S are the number of streams and the fraction of stream component detected in this study. The results were obtained using thresholds equal to $D_{c,M}$, $D_{c,M} - \sigma_{D_{c,M}}$ and to $D_{c,M} + \sigma_{D_{c,M}}$; columns 2-3, columns 4-5, and columns 6-7 respectively.

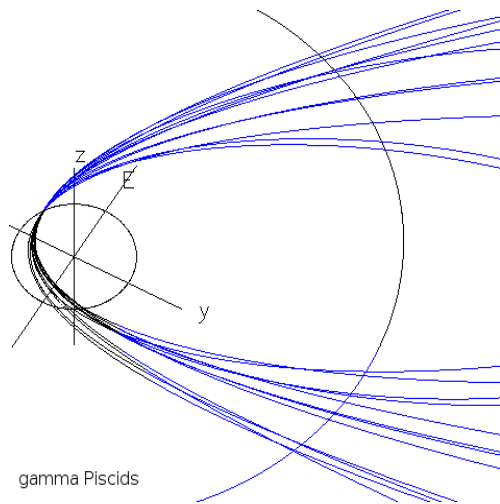| D-function	S	P_S	S	P_S	S	P_S
D_{SH}	4	32.5%	4	32.5%	3	32.9%
D_N	5	32.9%	4	30.3%	6	38.5%
D_V	3	29.4%	3	29.4%	3	29.4%

Figure 1: Twelve members of γ Piscids stream.

Identified meteoroid streams

Twelve members of γ Piscids (see TAble 2) were dedected using all three D-functions. The Piscis Austrinids consists of two exactly the same orbits. In this case we do not claim about a real stream, so we do not discuss this result, we give it just for the completnees of our search. The Librids and Ophiuchids streams (36 and 25 members respectively) have formed two complex separate groups identified in the basic search using D_{SH} function. Using D_V and D_N both streams were detected as a single very complex structure. Ten members of χ Capricornids and six members of Microscopiids were found using the D_N function only. Table 4 lists three groups of the 6 streams that were identified jointly in all searches. The names of the streams were assigned by us, using the Nomenclature Rules for Meteor Showers, see the web site [8].

Table 2: Meteor streams detected in three searches. The first column gives the stream name, the second its code, the third, fourth and fifth ones the number of members M_{SH}, M_N and M_V identified by, respectively, D_{SH}, D_N and D_V. The flags S and N sometimes added to the stream code denote that the latter refers to the search made with D_{SH} and D_N, respectively. The absence of the flag means that the code is the same for all distance functions.

Name	Code	M_{SH}	N_V	N_N
γ Piscids	65	12	12	12
Piscis Austrinids	78	2	2	2
Librids (N)	3	13	24	17
Librids (S)	3	23	30	29
Ophiuchids (N)	6S	13	-	-
Ophiuchids (S)	6S	12	-	-
χ Capricorniids	5N	-	-	10
Microscopiids	12N	-	-	6

Acknowledgements

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