

# **Slovak video meteor network – status and results**

## **Lyrids 2009, Geminids 2010, Quadrantids 2011**

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# Motivation for video meteor network

- To have relatively precise orbits  
-> theoretical invest. of meteoroids origin
- To have statistically sufficient meteors to distinguished weak showers  
-> possible asteroidal origin  
(*Tóth, Vereš and Kornoš, 2011, MNRAS, 415, 1527-1533*)

# Astronomical Observatory at Modra



# Slovak Video Meteor Network

- Start: 1998-1999 first Leonids obs.
- Systematic observations from April 1, 2007 as a single station, more than 20 000 met.
- Second station 2009, several 1000 p.m.
- Cooperation with amateur stations CEMeNt by 2009





ch Republic

Krása Slaska

Rybnik  
Tychy  
Wodzislaw Slaski

Ostrava  
Bielsko-biala

Olomouc

Brno

Slovakia

AGO Modra

Arboretum

Niederösterreich  
Wien

Bratislava





- Canon 2.4/15mm fish-eye lens

- Mullard X1332 image intensifier, Ø 50mm

- Meopta 1.9/16mm lens

- digital DMK 4AUB2 CCD camera

+

PC

+

UFOCapture software

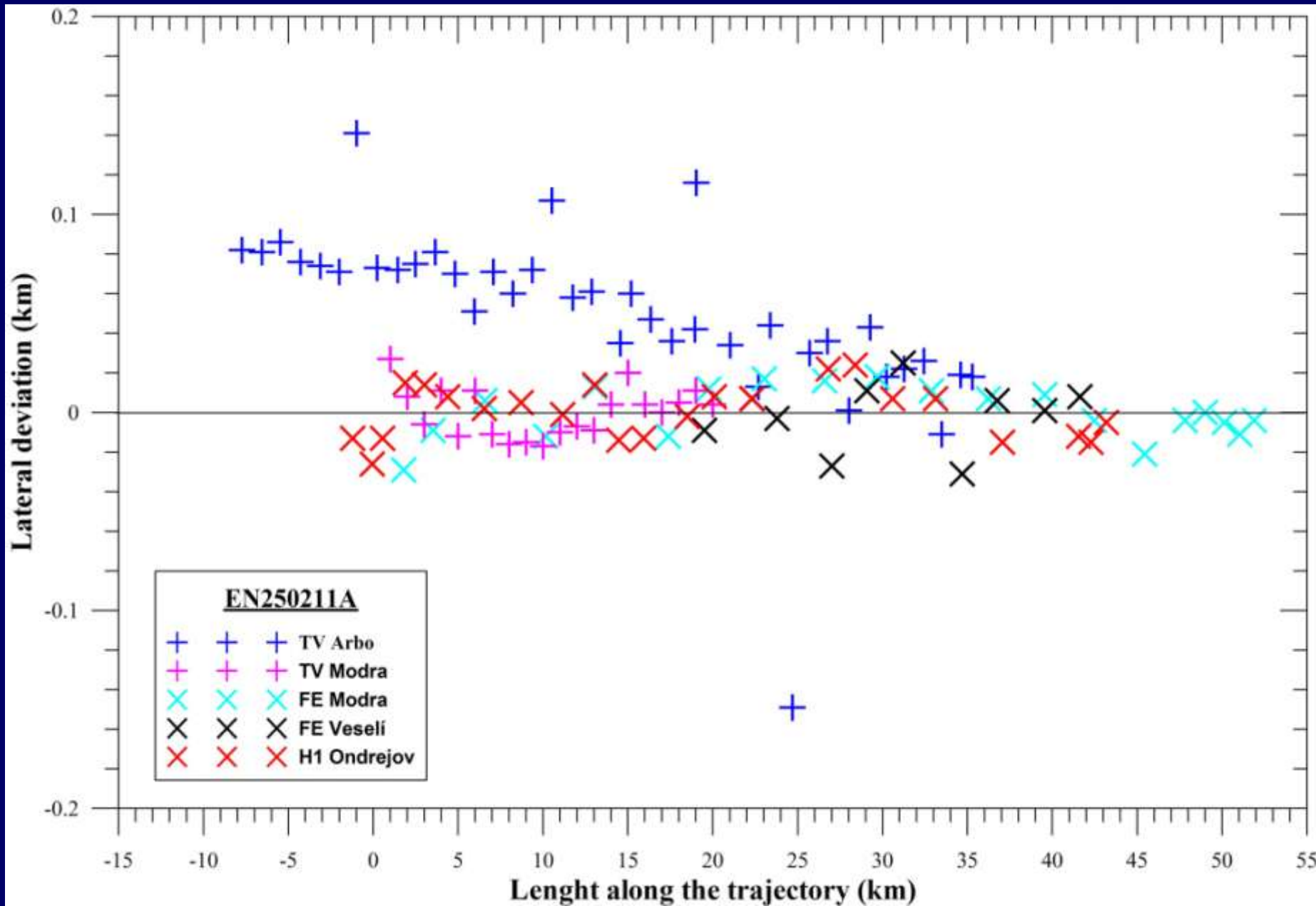
# All-sky digital video setup of fish-eye lens ...



- noncompressed .avi files with moving objects are stored
- 15 frames/s
- 1280 x 960 pixels
- resolution ~ 8 arcmin/pixel
- field of view 180° x 140°
- limiting stellar magnitude ~ +5.5
- faintest meteors ~ +4.0 mag.

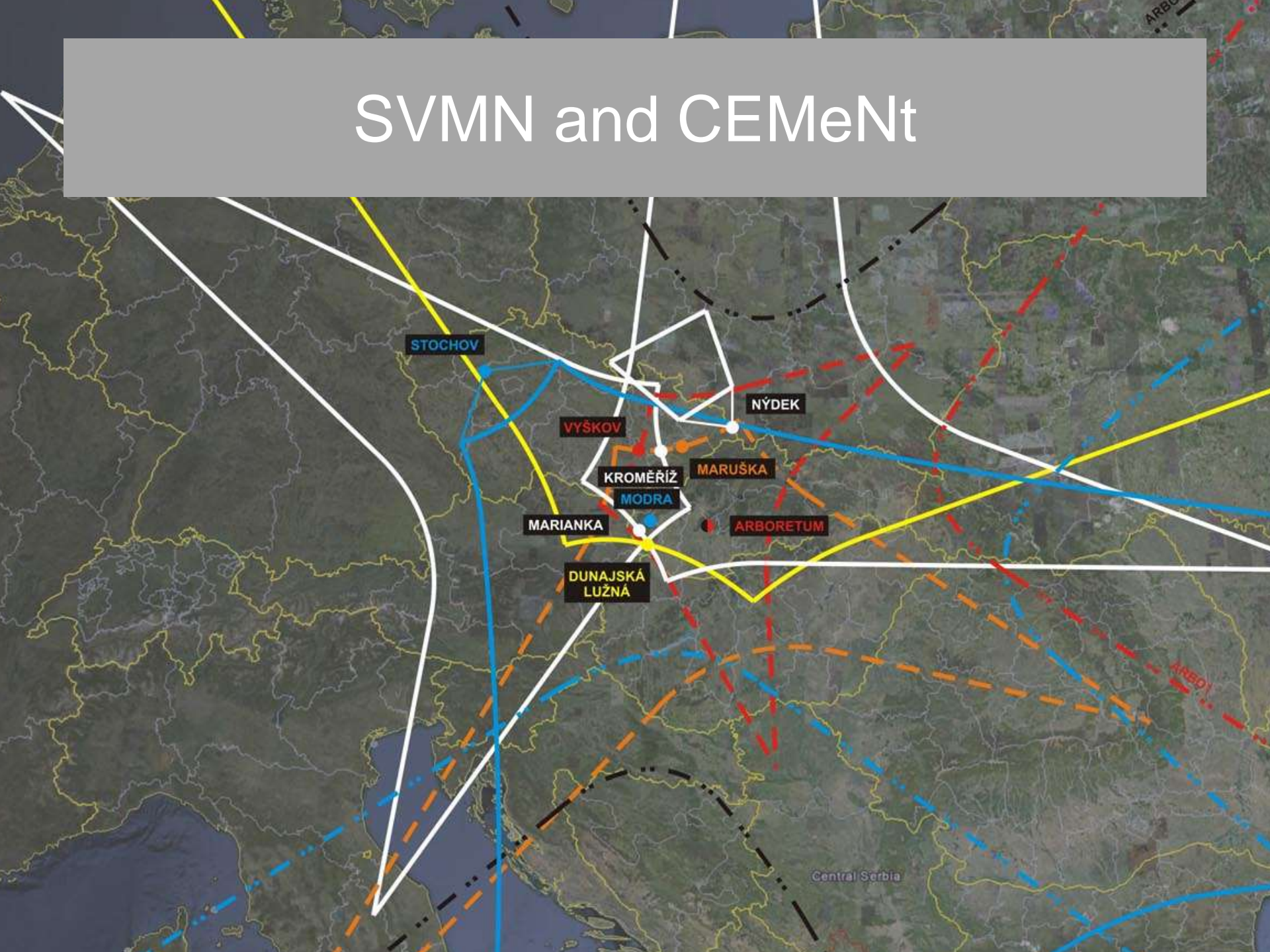






*Calc. and graph by P.Spurný*

# SVMN and CEMeNt



# Lyrids 2009



2010/04/22 01:32:53.984(UT)

0021

W00002+030 A60 II



# Lyrids 2009



2010/04/22 01:32:54.682(UT)

0062V00003+081 ARBO-01



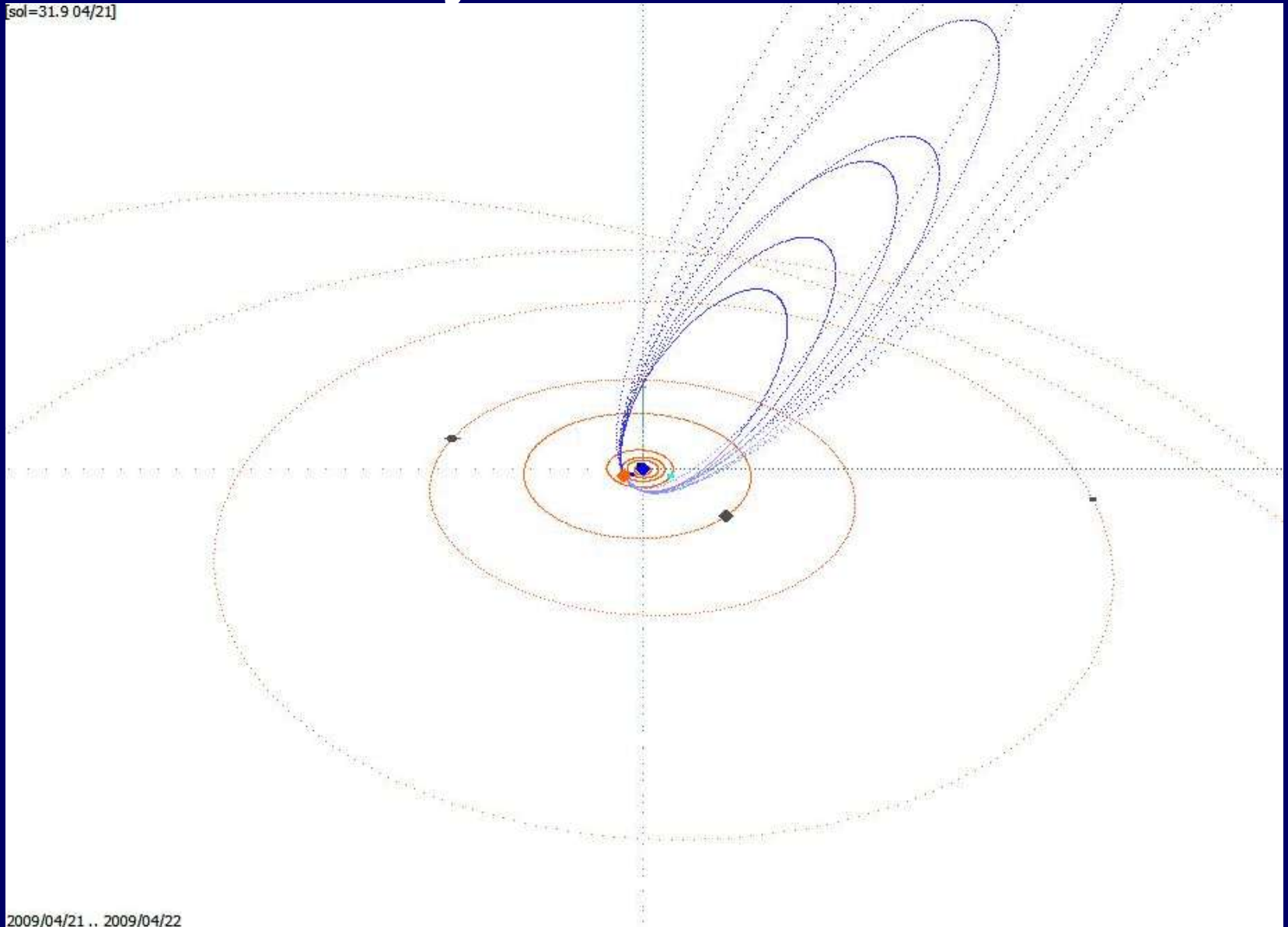
# Lyrids 2009

- April 21/22 from 19:15 to 2:20 UT
- There were 78 and 52 meteors detected from the first and the second station, respectively.
- 32 meteors were simultaneously observed from both stations
- 17 of them were Lyrids.
- Analog cameras Watec, first double station test

[Tóth, Juraj](#); [Kornoš, Leonard](#); [Vereš, Peter](#); [Šilha, Jirí](#);  
[Kalmančok, Dušan](#); [Zigo, Pavol](#); [Világi, Jozef](#), 2011, Publications of  
the Astronomical Society of Japan, Vol.63, No.2, pp.331-334

# Lyrids 2009

[sol=31.9 04/21]

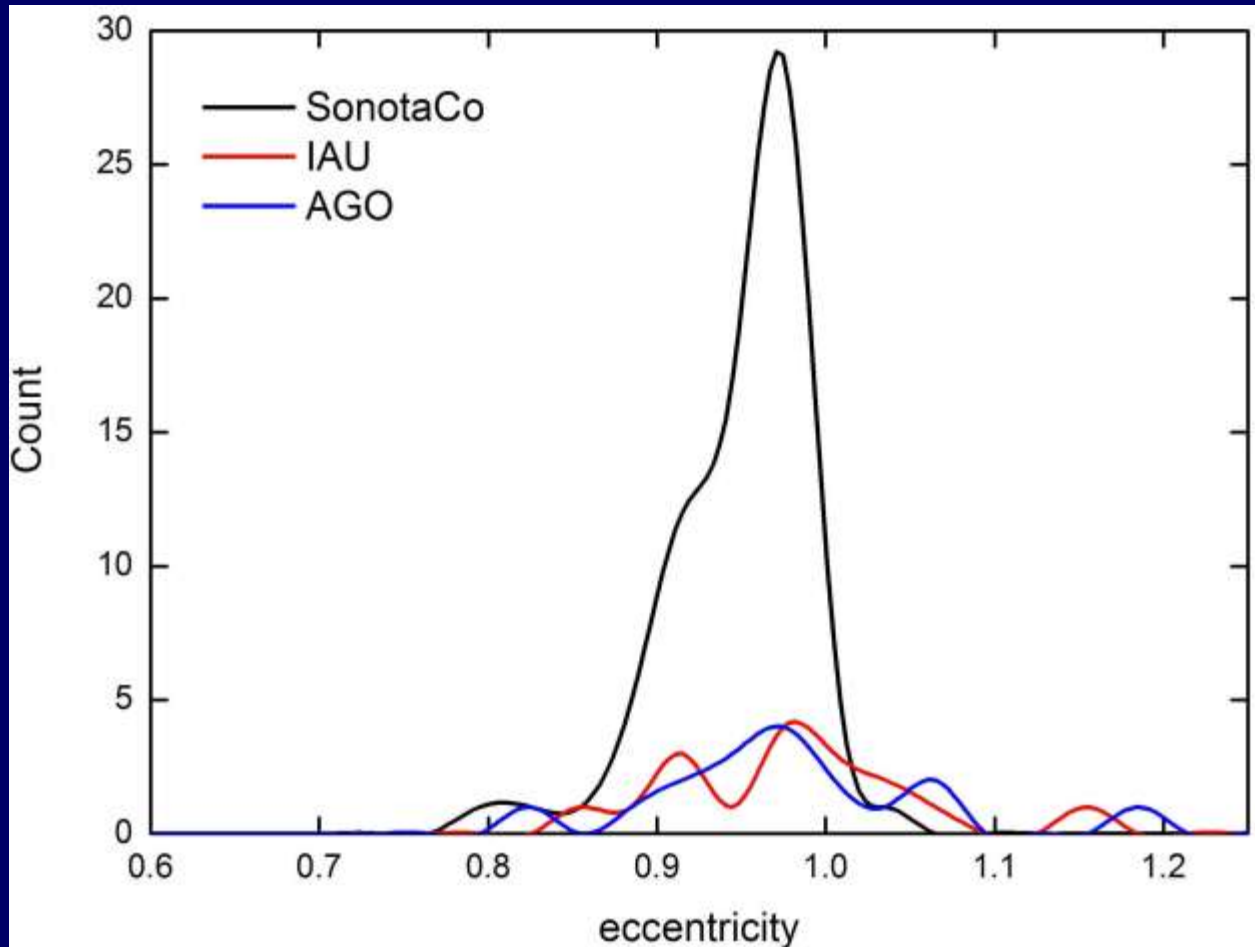


2009/04/21 .. 2009/04/22

# Lyrids 2009

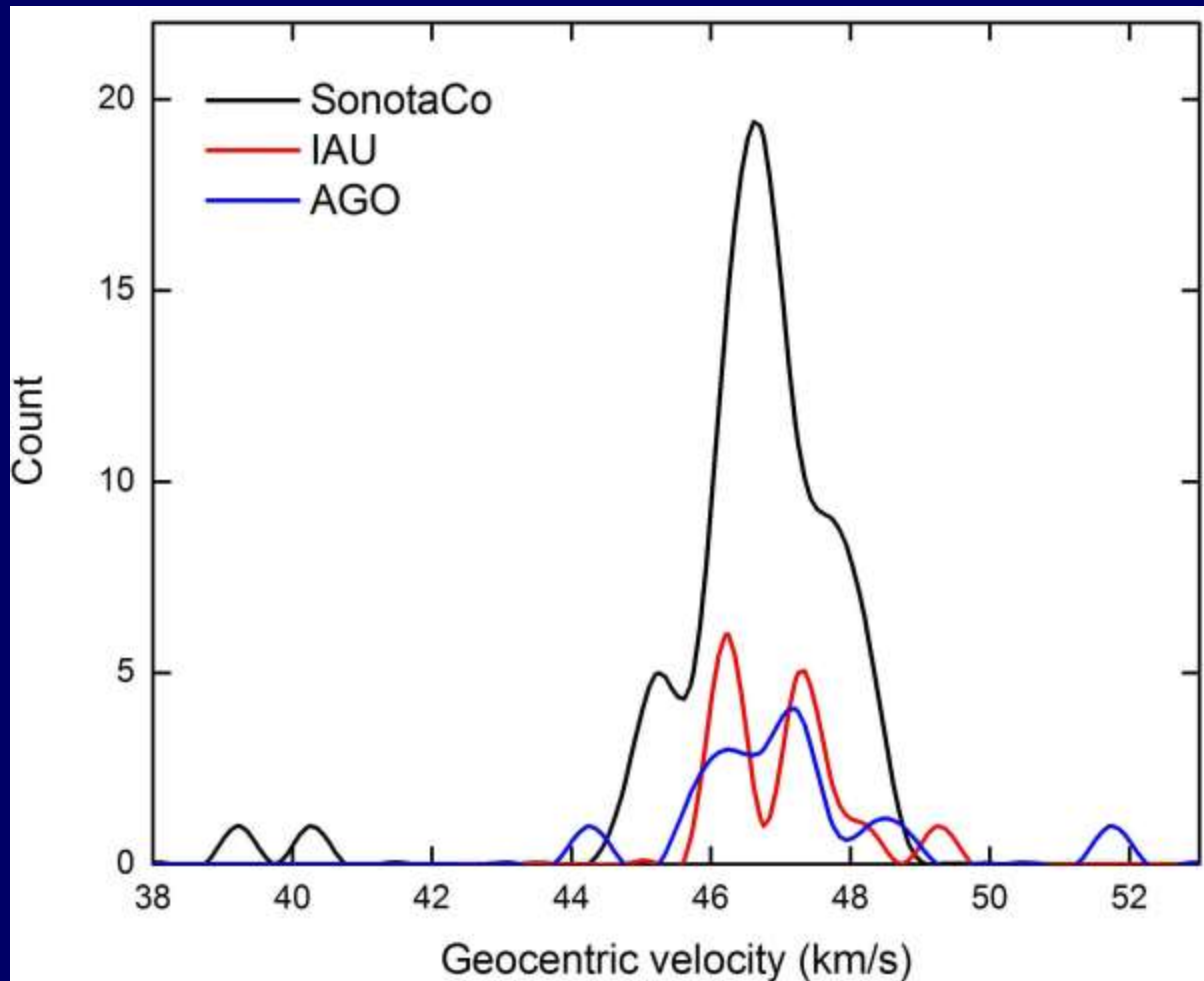
- results compared with two databases:
- precise photographic orbits IAU MDC (17)
- video orbits by SonotaCo (75)  
*(Vereš and Tóth, 2010, WGN, vol. 38, no. 2, p. 54-57)*
- All three datasets contains hyperbolic Lyrids:  
IAU MDC 35%,  
SonotaCo 8%  
SVMN data 35% Lyrids

# Lyrids 2009

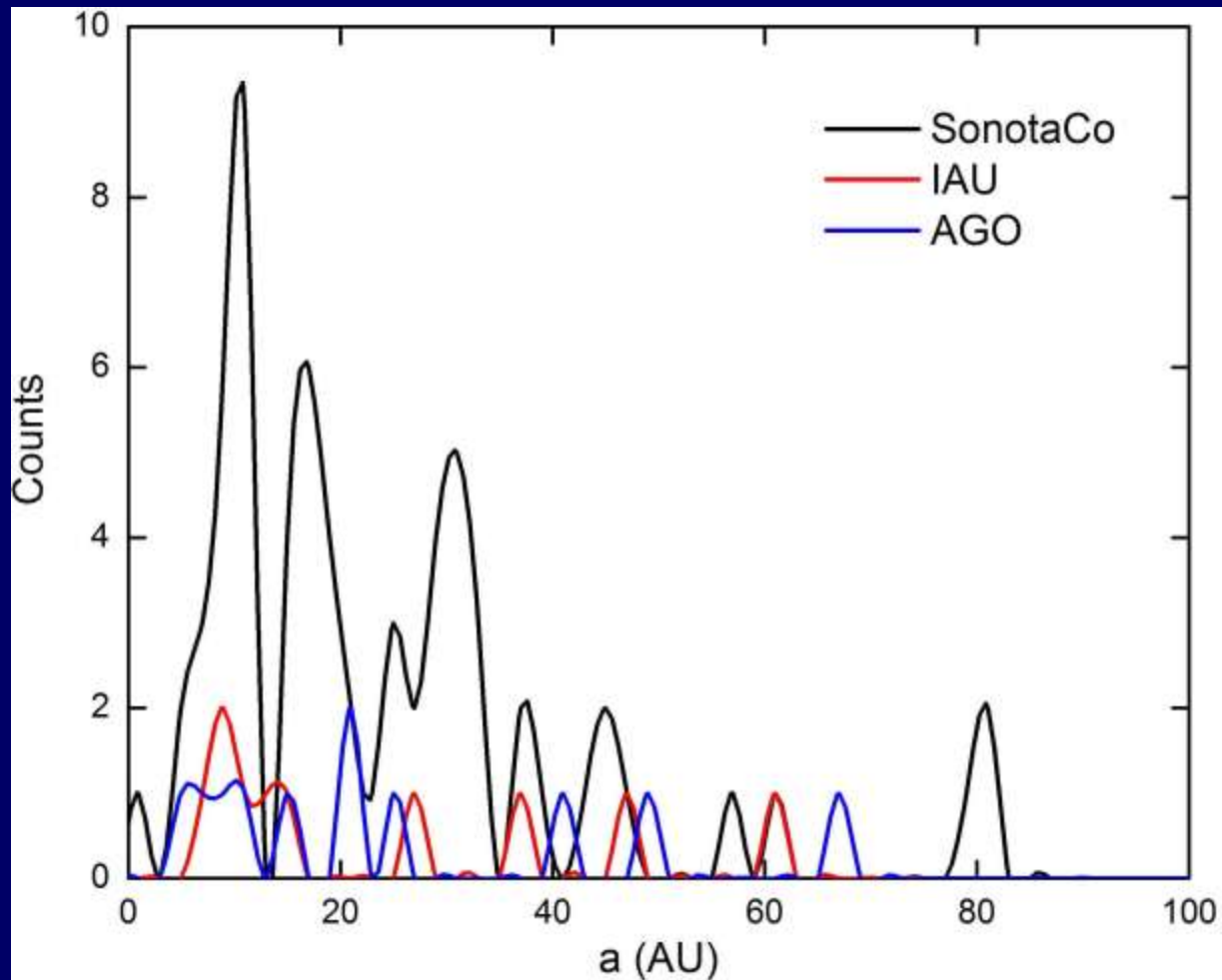




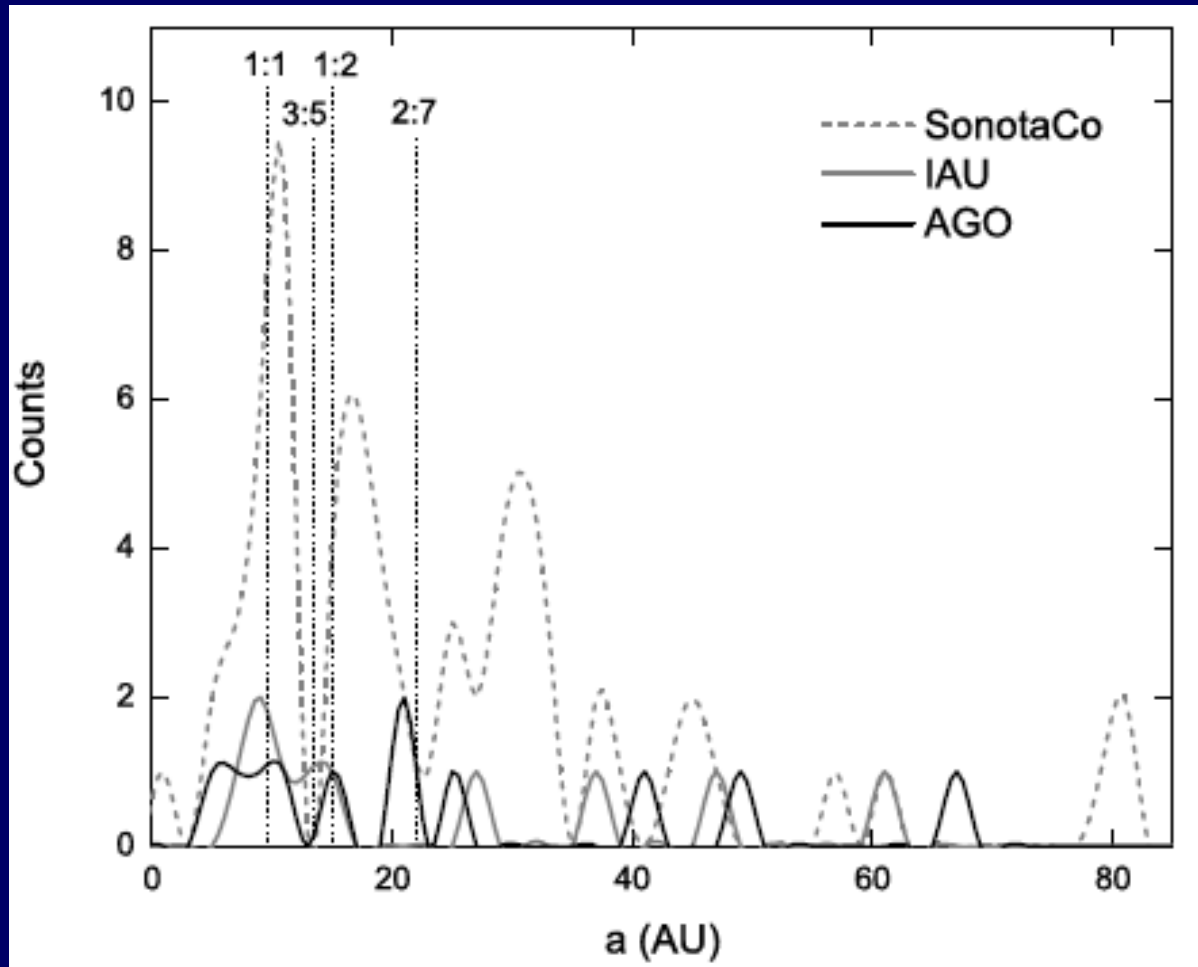
# Lyrids 2009



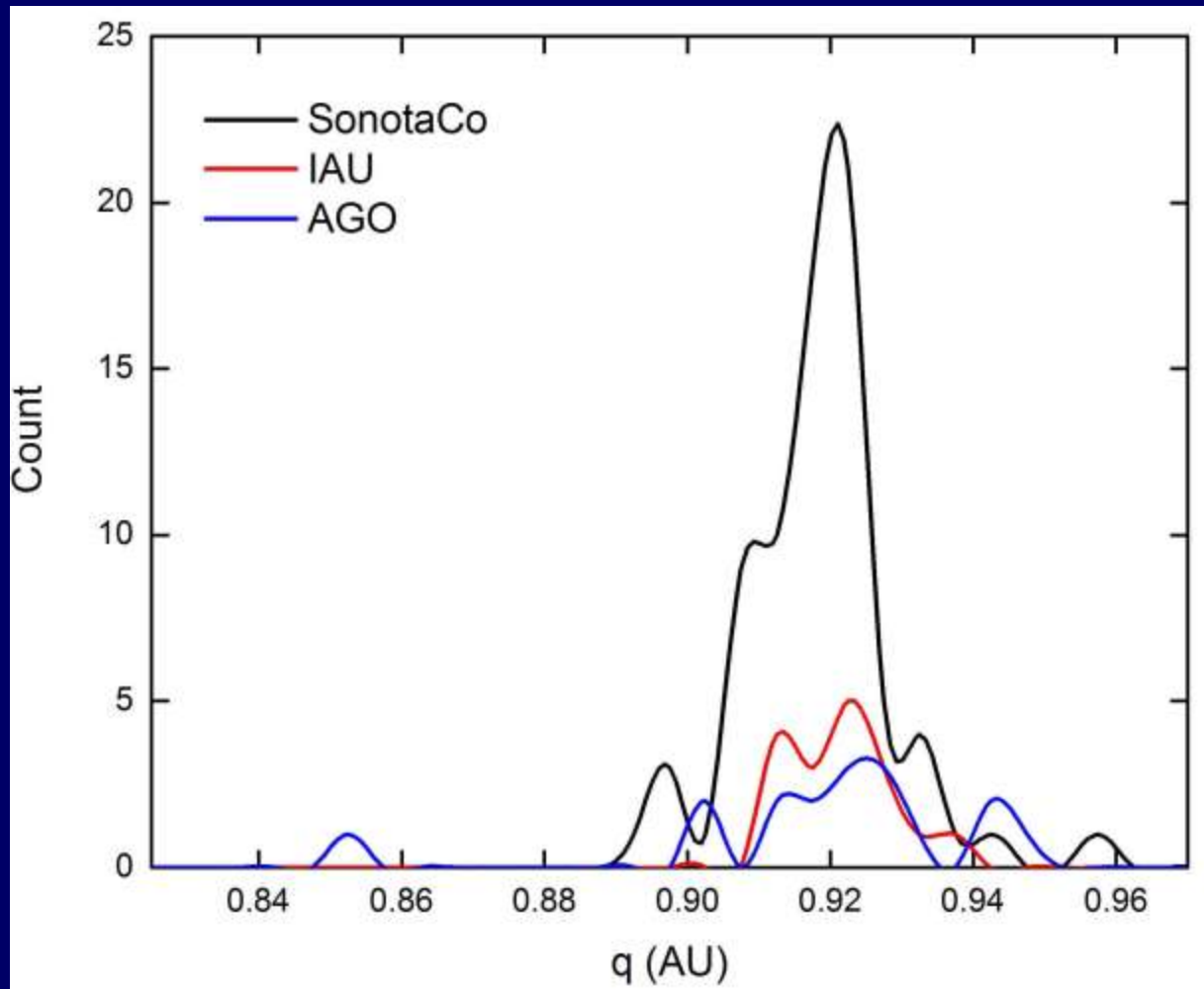
# Lyrids 2009



# Lyrids 2009

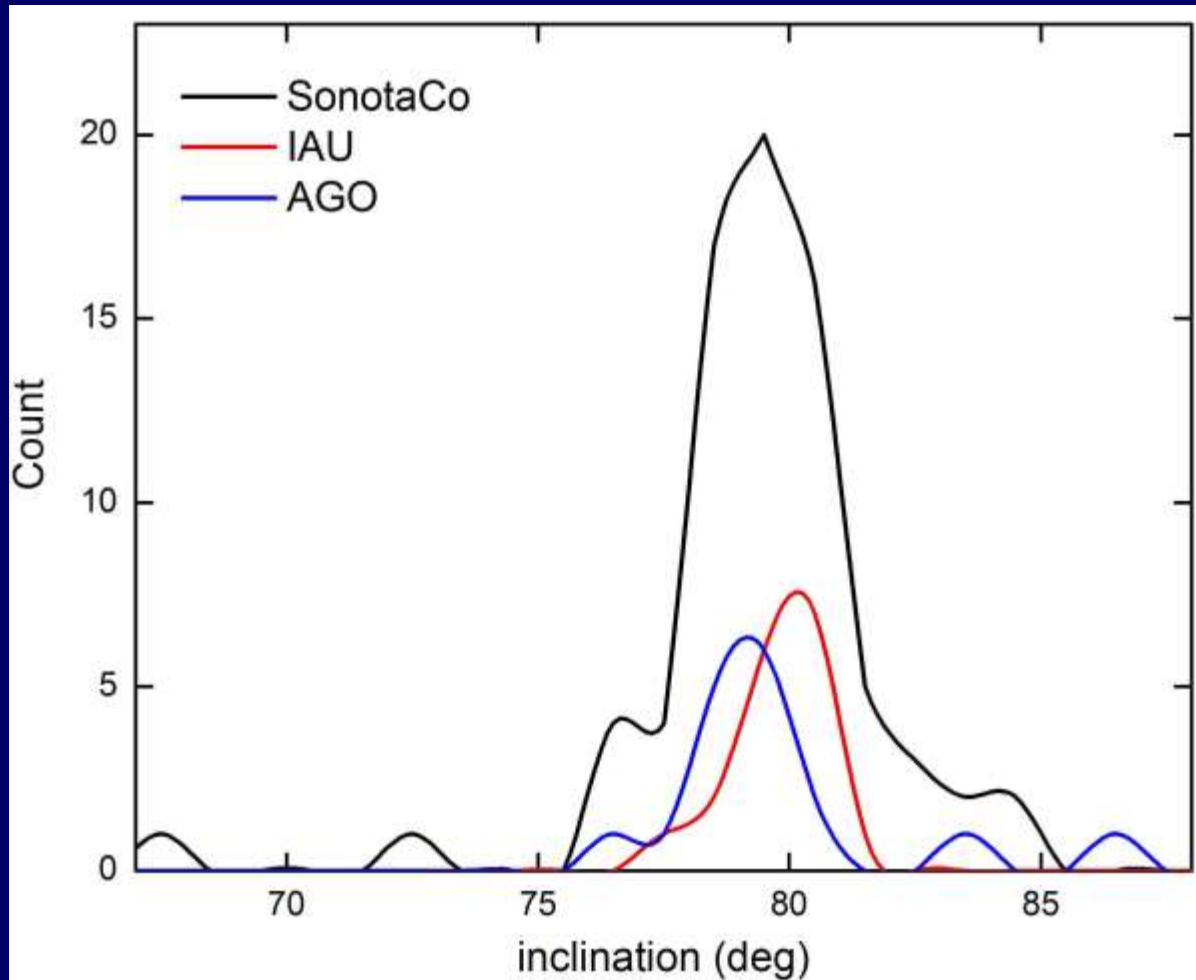


# Lyrids 2009





# Lyrids 2009



# Lyrids 2009

**Table 1.** Mean values and standard deviations of the orbital elements, geocentric radiant (eq. 2000.0) and velocities for the short (<200 years), long (>200 years) periodic and hyperbolic subset of observed Lyrid meteors on the base of Modra - Aboretum, April 21/22, 2009. The same parameters of the parent comet C/1861 G1 (Thatcher) are displayed for the comparison (Marsden 1989).

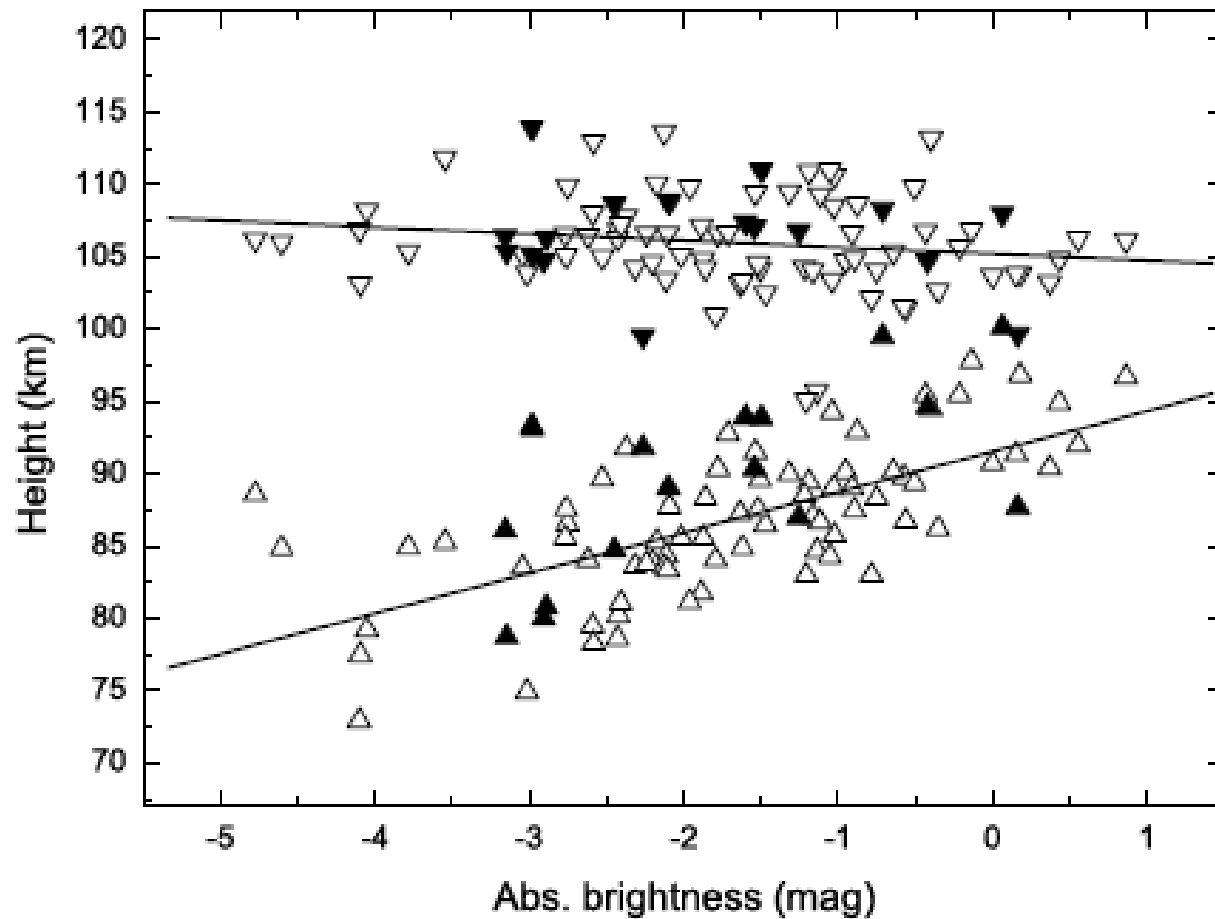
	a (AU)	q (AU)	e	i (°)	$\omega$ (°)	$\Omega$ (°)	$\alpha$ (°)	$\delta$ (°)	$V_g$ (km/s)	n
short-periodic	14.46	0.912	0.919	78.7	216.0	31.9	271.3	33.2	46.07	8
	$\pm 7.16$	$\pm 0.026$	$\pm 0.044$	$\pm 0.9$	$\pm 4.7$	$\pm 0.1$	$\pm 1.9$	$\pm 1.5$	$\pm 0.76$	
long-periodic	52.90	0.919	0.982	79.0	214.1	31.9	271.3	33.7	46.77	3
	$\pm 13.50$	$\pm 0.006$	$\pm 0.004$	$\pm 1.1$	$\pm 1.1$	$\pm 0.1$	$\pm 1.0$	$\pm 0.3$	$\pm 0.48$	
hyperbolic	–	0.930	1.065	81.1	211.2	31.8	272.6	33.5	48.39	6
		$\pm 0.018$	$\pm 0.062$	$\pm 3.1$	$\pm 3.7$	$\pm 0.1$	$\pm 2.4$	$\pm 1.6$	$\pm 1.75$	
comet Thatcher	55.62	0.921	0.984	79.8	213.5	31.9	272.0	33.5	47.08	

**Table 2.** Mean values of the orbital elements, geocentric radiant (eq. 2000.0) and velocities and the absolute magnitudes of the five most precise orbits of observed Lyrids on the base Modra - Arboretum, April 21/22, 2009.

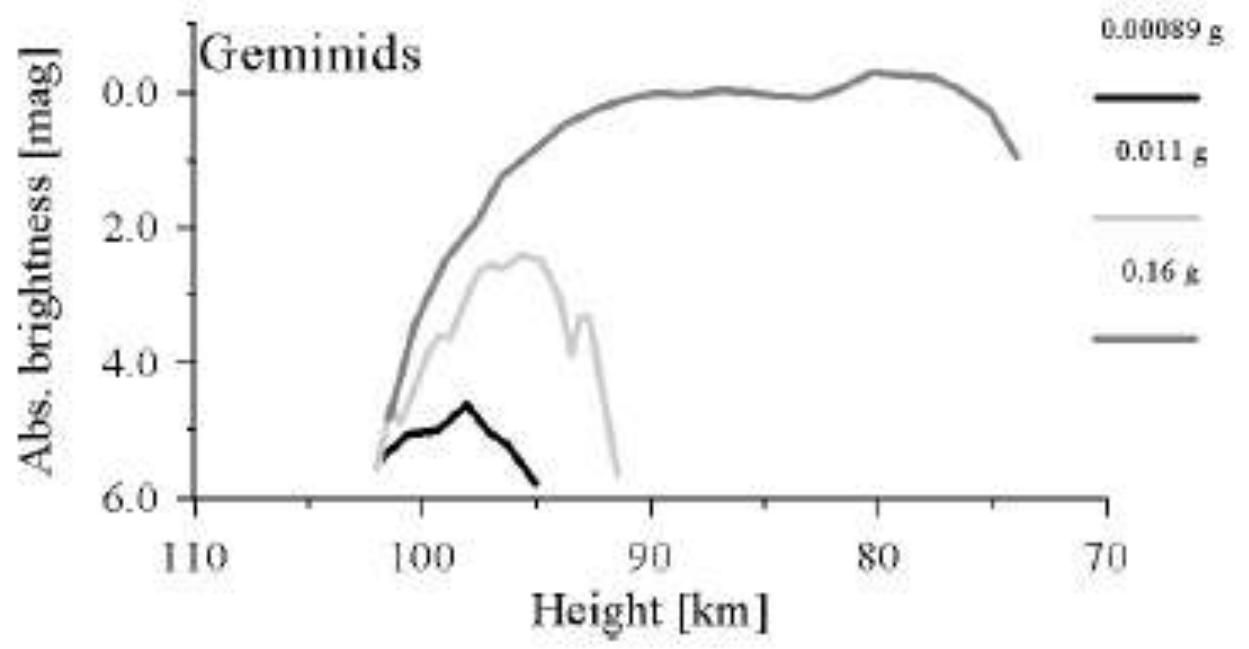
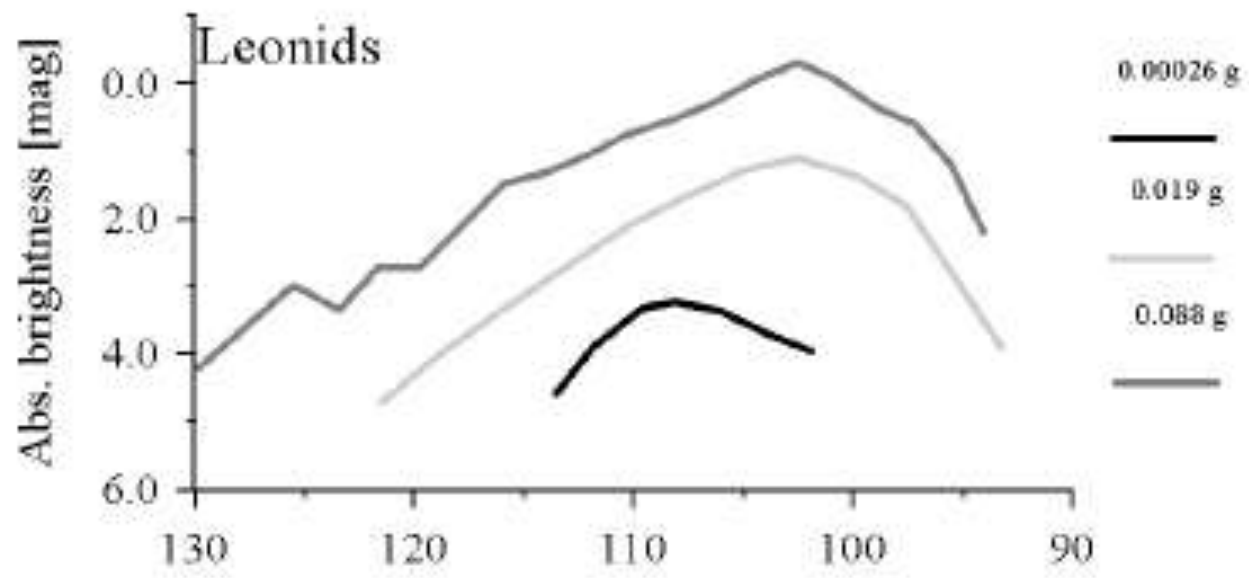
Date-Time	a (AU)	q (AU)	e	i (°)	$\omega$ (°)	$\Omega$ (°)	$\alpha$ (°)	$\delta$ (°)	$V_g$ (km/s)	$M_{abs}$
20090421 221532	7.44	0.922	0.876	79.4	214.6	31.80488	272.8	33.1	45.96	+0.0
20090422 005955	9.98	0.922	0.908	78.5	214.3	31.91625	272.1	33.7	45.84	-1.5
20090422 010531	49.83	0.914	0.982	77.7	215.2	31.92006	270.2	34.1	46.21	-2.9
20090422 013515	67.66	0.918	0.986	79.5	214.3	31.94020	271.5	33.4	47.02	-2.5
20090422 015213	20.40	0.930	0.954	78.0	212.2	31.95169	272.1	34.6	46.05	-3.1



# Lyrids 2009



The beginning heights of Lyrids do not depend strongly on the absolute brightness. This behavior is similar to Geminids.





# Geminids 2010, Quadrantids 2011



- CEMENT
- SVMN

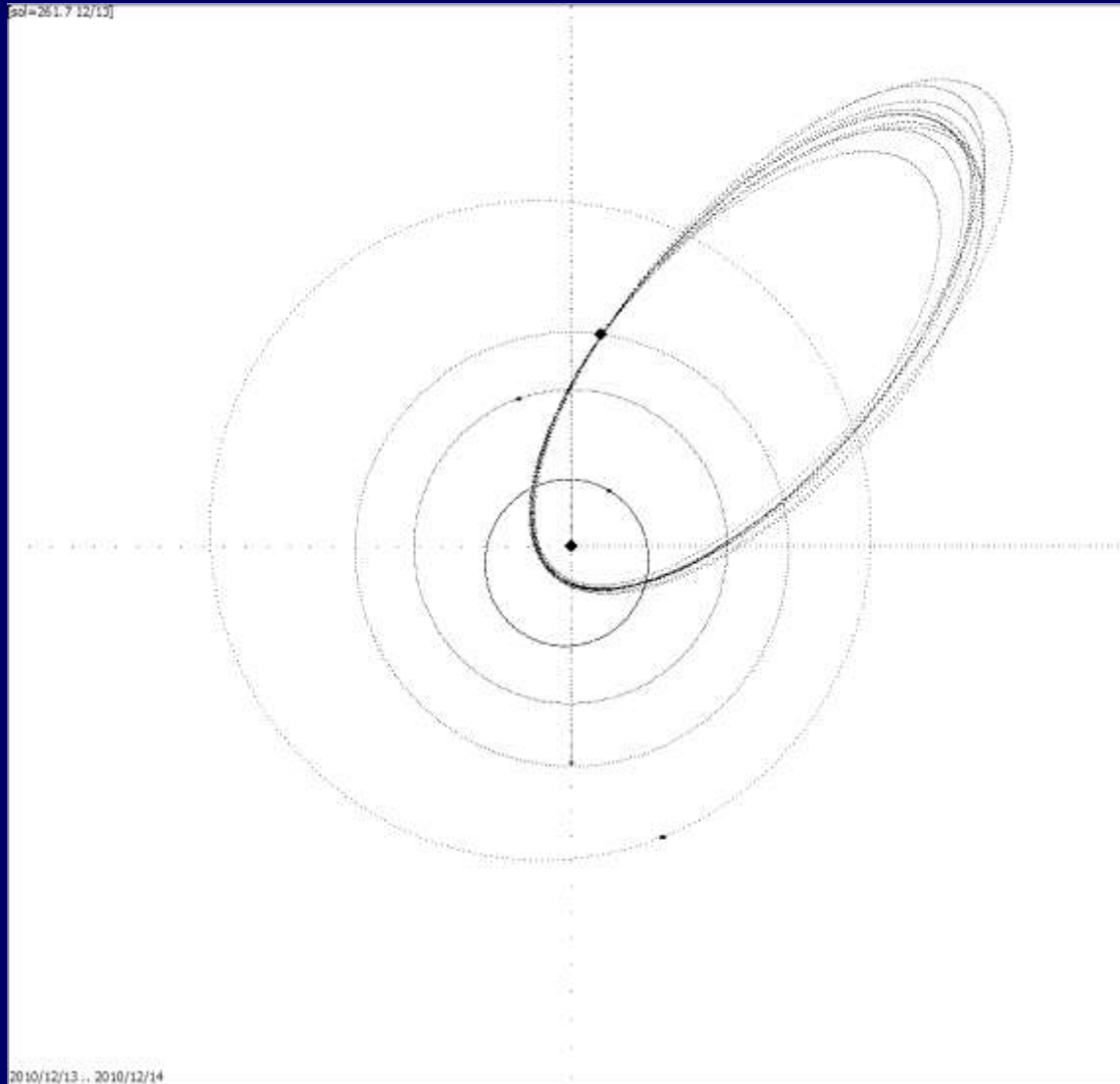
# Geminids 2010

Toth, J.; Veres, P.; Kornos, L.; Piffli, R.; Koukal, J.; Gajdos, S.; Majchrovic, I.; Zigo, P.; Zima, M.; Vilagi, J.; Kalmancok, D., 2011, WGN, vol. 39, no. 2, p. 34-38

Table 1: Multi-station Geminids detected on December 13–14, 2010 by SVMN and CEMENT video networks. Orbital elements, geocentric velocity and observing stations are presented. Stations: Dunajská Lužná (Luz), Vyškov (Vys), Astronomical and Geophysical Observatory Modra (AGO). SonotaCo mean orbit from solar longitude interval ( $261.49^\circ - 261.79^\circ$ ) is also presented.

No	a (AU)	q (AU)	e	i ( $^\circ$ )	$\omega$ ( $^\circ$ )	$\Omega$ ( $^\circ$ )	$\alpha$ ( $^\circ$ )	$\delta$ ( $^\circ$ )	$V_g$ (km/s)	Station
1	1.172	0.152	0.870	20.86	324.78	261.49	113.51	32.09	32.20	AGO-Vys
2	1.259	0.159	0.873	21.42	322.86	261.52	112.35	32.62	32.71	AGO-Vys
3	1.268	0.146	0.885	23.29	324.53	261.57	113.48	32.59	33.55	AGO-Vys
4	1.352	0.145	0.893	23.16	323.89	261.58	112.75	32.43	34.18	AGO-Vys-Luz
5	1.292	0.144	0.888	22.62	324.51	261.58	113.16	32.23	33.73	AGO-Vys
6	1.260	0.147	0.883	22.77	324.43	261.59	113.39	32.49	33.37	AGO-Luz
7	1.231	0.150	0.878	21.13	324.36	261.61	113.13	32.01	32.85	AGO-Vys
8	1.313	0.135	0.897	22.85	325.55	261.62	113.53	31.79	34.30	AGO-Luz
9	1.271	0.155	0.878	19.42	323.34	261.71	112.16	31.50	32.82	Luz-Mar
10	1.263	0.145	0.885	20.86	324.72	261.79	113.20	31.57	33.33	Sto-Luz
mean	1.268	0.148	0.883	21.84	324.30	261.61	113.07	32.13	33.30	
st. dev	0.048	0.007	0.008	1.28	0.76	0.09	0.49	0.41	0.67	
SonotaCo	1.279	0.149	0.884	22.69	324.03	261.69	113.24	32.45	33.47	121 orbits
st. dev	0.075	0.014	0.017	2.49	1.45	0.08	0.76	0.78	1.16	

# Geminids 2010

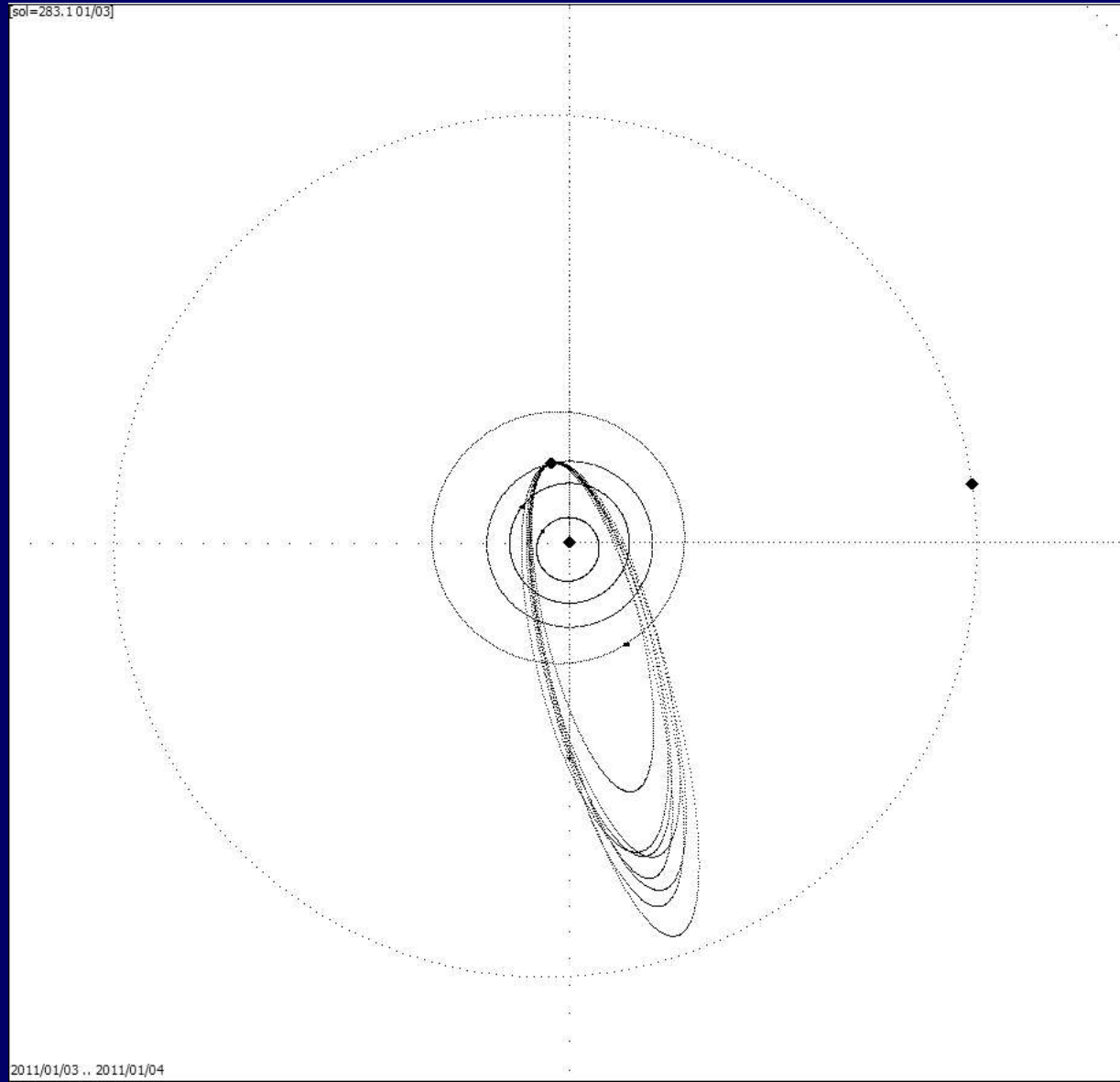


# Quadrantids 2011

Table 2: Multi-station Quadrantids detected on January 3–4, 2011 by SVMN and CEMENT video networks. Orbital elements, geocentric velocity and observing stations are presented. Stations: Mariánka (Mar), Dunajská Lužná (Luz), Stochov (Sto), Kroměříž (Kro), Astronomical and Geophysical Observatory Modra (AGO). SonotaCo mean orbit from solar longitude interval ( $282.88^\circ - 283.32^\circ$ ) is also presented.

No	a (AU)	q (AU)	e	i ( $^\circ$ )	$\omega$ ( $^\circ$ )	$\Omega$ ( $^\circ$ )	$\alpha$ ( $^\circ$ )	$\delta$ ( $^\circ$ )	$V_g$ (km/s)	Station
1	2.040	0.982	0.518	70.86	175.56	282.99	226.65	49.72	39.40	Mar-Sto-Kro
2	2.608	0.980	0.624	72.10	172.51	283.14	228.67	49.22	40.87	Kro-Sto
3	2.433	0.983	0.596	69.34	179.15	283.19	227.39	51.93	39.32	Kro-Sto
4	2.779	0.981	0.647	70.94	173.73	283.20	229.36	50.23	40.51	Kro-Sto
5	2.477	0.975	0.607	68.25	167.54	283.22	233.18	49.58	38.90	AGO-Kro
6	2.645	0.983	0.628	70.31	177.64	283.24	227.85	51.35	40.06	Ago-Sto-Luz
7	2.471	0.980	0.604	69.60	171.83	283.25	230.46	50.07	39.52	AGO-Sto
8	2.921	0.983	0.663	71.07	178.44	283.31	227.45	51.44	40.71	Ago-Luz
mean	2.547	0.981	0.611	70.31	174.55	283.19	228.88	50.44	39.91	
st. dev	0.264	0.003	0.044	1.20	3.93	0.10	2.12	1.00	0.73	
SonotaCo	2.467	0.978	0.606	70.162	169.89	283.30	230.39	49.20	39.82	39 orbits
st. dev	0.487	0.003	0.082	2.59	2.98	0.16	2.36	0.93	1.79	

# Quadrantids 2011







Thank you for your attention!

*(Leonids 1998, AGO MODRA)*