Viceo Meteor Network Impact on working lists Jürgen Rendtel

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Outline

- Introduction
- Outer regions of showers: ORI & QUA
- Comae Berenicids or/and December Leonis Minorids
- Meteoroid velocity variations
- New recent detections
- Annual updates of the IMO working list?

Search for showers – early target

W.F. Denning

1890ies

Memoirs of the Royal Astron. Soc. 53, 1899, 203-292

General Catalogue of the Radiant Points of Meteoric Showers and of Fireballs and Shooting Stars observed at more than one Station. By W. F. Denning.

[Received 1899 February 23.]

410 Mr. Denning, Catalogue of Radiant

L. 7,

MNRAS 50, 1890, 410-466

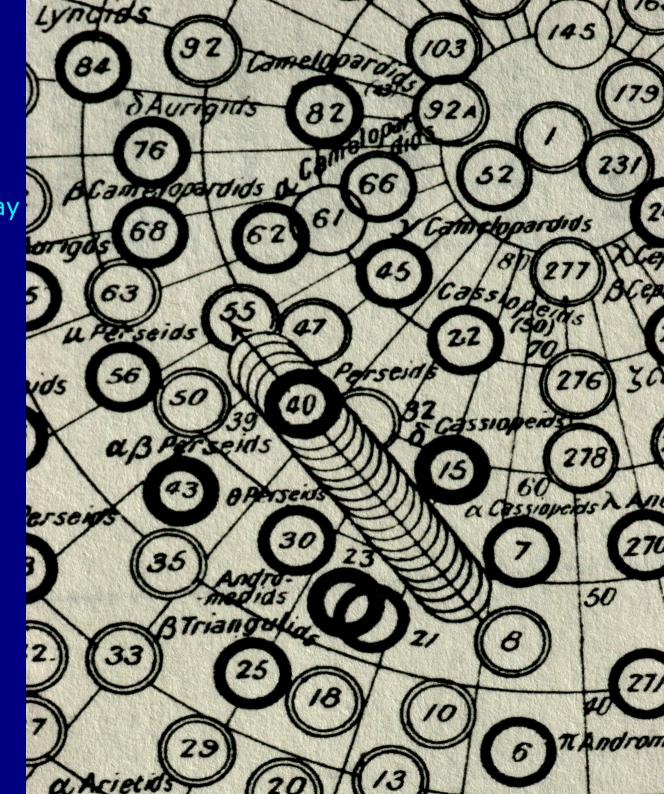
Catalogue of 918 Radiant Points of Shooting Stars observed at Bristol. By William F. Denning.

My observations of shooting stars date from the great display of Leonids in November 1866, though for several years they were merely pursued in a desultory way. In 1870 and at subsequent periods I furnished notes to the British Association Committee on Luminous Meteors, and thereafter adopted a more systematic plan of recording the paths of shooting stars. It was not, however, before the spring of 1876 that I entered upon any lengthy and regular observations with the design of ascertaining the radiant points of the minor showers generally.

Catalogue 1899

"... there are considerably more than 50 showers in play on any and every night of the year"

- based on single station
 visual meteors
- poor criteria



Current shower compilations

34 delta Serpentids

38 xi Ursae Majorids North. alpha Leonids

zeta Cygnids

zeta Serpentids

phi Draconids

46 beta Craterids

47 mu Virginids

IAU Meteor Data Center

IAU Comission 1

Currently

360 showers

64 "established"

296 "working" stat

Lis	t of	all	meteor	showers

	List of all meteor	show	Vers Sorting order:	IAI	J No Sol. Lon. R.A.
No	Name	No	Name	No	Name
1	alpha Capricornids	162	alpha Circinids	286	omega Taurids
2	South. Taurids	164	North. June Aquilids	287	Nov. egsilon Eridanids
3	South. iota Aquariids	165	South. June Aquilids	288	South. Dec. delta Arietids
4	Geminids	166	June Lyrids	289	North. Dec. delta Arietics
5	South. delta Aquariids	167	Nothern sigma Sagittariids	300	zeta Puppids
6	April Lyrids	168	South. sigma Sagittariids	301	gamma Puppids
7	Perseics	169	Scutids	302	b Puppids
8	Orionids	170	June Bootids	303	lambda Velids
9	October Draconids	171	Dayt. Arietids	304	c Velids
10	Quadrantids	172	Dayt. zeta Perseids	305	sigma Puppids
11	eta Virginids	173	Dayt. beta Taurids	306	Columbids
12	kappa Cygnids	174	Dayt. theta Aurigids	307	tau Puppids
13	Leonids	175	July Pegasids	308	January pi Puppids
15	Ursids	176	July Phoenicids	309	gamma Velids
16	sigma Hydrids	177	beta Cassiopeiids	310	January alpha Pixidids
17	North. Taurids	178	July Centaurids	311	delta Velids
18	Andromedids	179	sigma Capricornids	312	epsilon Carinids
19	Dec. Monocerotids	180	mu Serpentids	313	eta Carinids
20	Dec. Comae Berenicids	181	kappa Pavonids	314	alpha Crucids
21	alpha Virginids	182	omicron Cygnids	315	omega Centaurids
22	Leonis Minorids	183	Piscis Austrinids	316	beta Hydrids
23	epsilon Geminids	184	July Gamma Draconids	317	theta Centaurids
24	mu Pegasids	185	Dayt. beta Andromedids	318	mu Velids
25	North. October delta Ar:etids	186	epsilon Ursae Majorids	319	January Leonids
26	North. delta Aquariids	187	psi Cassiopeiids	320	omega Serpentids
27	kappa Serpentids	188	Dayt. xi Orionids	321	theta Coronae Borealids
28	South. October delta Arietids	189	Dayt. mu Cancrids	322	lambda Bootids
31	eta Aquariids	190	beta Perseids	323	xi Coronae Borealids
32	Dec. Leonis Minorids	191	eta Eridanids	324	epsilon Perseids
33	North. iota Aquariids	192	August Triangulids	325	Dayt. lambda Taurids

upsilon Cetids

zeta Arietids

beta Indids

197 August Draconids

beta Hydrusids

199 August delta Capricornids

196 nu Phoenicids

200 eta Serpentids

epsilon Pegasids

sigma Serpentids

Oct. Ursae Majorids

334 December Alpha Draconids

December Chi Virginida

alpha Hydrids

330

alpha Lacertids WWW.ta3.sk/IAUC22DB/MDC2007

ORBITAL CATALOGUES

IAU Meteor Orbit Data Center Video Meteors Radar meteors Observational stations

METEOR SHOWERS

New meteor shower reports List of all showers List of established showers Working list of showers List of shower groups Shower nomenclature rules Shower nomenclat, task group

OTHER SITES

Mirror of this site RASC&IMO Radiant Databases SonotaCo Meteor Data Sets Shower activity estimator IAU: Minor Planet Center NEODYS risk page ASTDYS main page IMO main page

Current shower compilations

IMO
Working List

Currently

33 showers

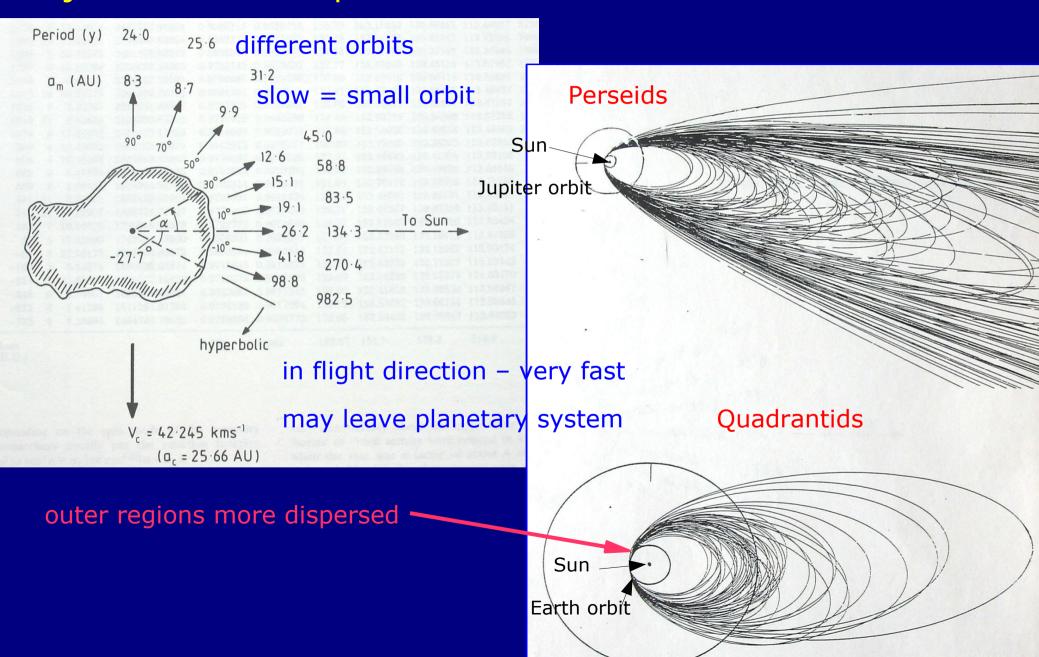
+ANT source

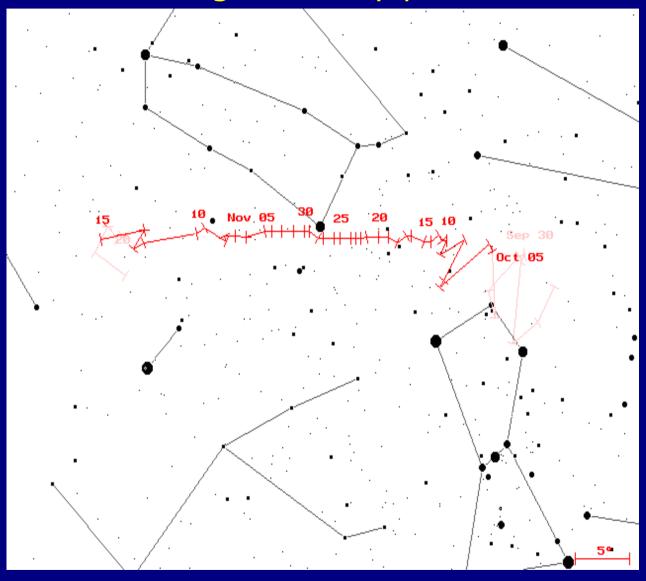
(IMO Shower

Calendar 2010)

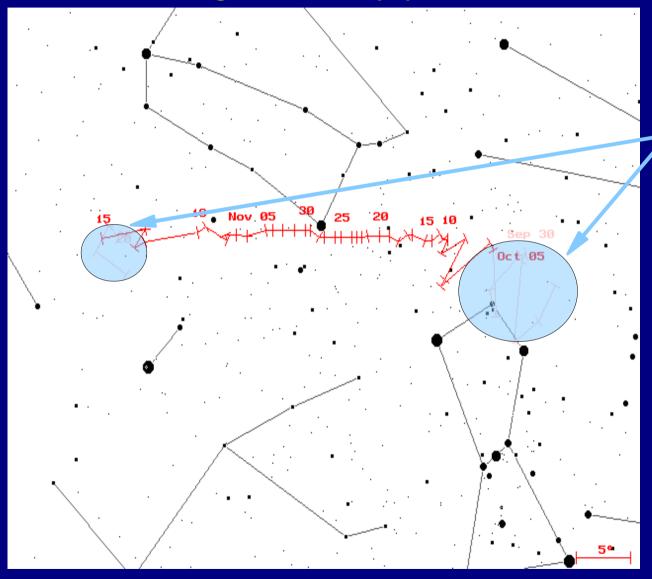
Shower	Activity	IV	<i>A</i> axii	mum	Rad	liant	V_{∞}	T	ZHR
		Dat	te	λ_{\odot}	α	δ	$\rm km/s$		
Antihelion Source (ANT)	Nov 26-Sep 24	Marc	h–A	pril,	see T	able 6	30	3.0	4
				late June					
Quadrantids (QUA)	Dec 28-Jan 12	Jan	0.3	$283^{\circ}16$	230°	$+49^{\circ}$	41	2.1	120
α -Centaurids (ACE)	Jan 28–Feb 21	Feb	08	319 °2	210°	-59°	56	2.0	6
δ -Leonids (DLE)	Feb 15-Mar 10	Feb	25	336°	168°	$+16^{\circ}$	23	3.0	2
γ-Normids (GNO)	Feb 25-Mar 22	Mar	14	354°	239°	-50°	56	2.4	6
Lyrids (LYR)	Apr 16-Apr 25	Apr	22	32:32	271°	$+34^{\circ}$	49	2.1	18
π-Puppids (PPU)	Apr 15-Apr 28	Apr	23	33 ° 5	110°	-45°	18	2.0	Var
η-Aquariids (ETA)	Apr 19-May 28	May	06	45 ° 5	338°	-01°	66	2.4	85*
η-Lyrids (ELY)	May 03-May 12	May	09	48 °.4	287°	$+44^{\circ}$	44	3.0	3
June Bootids (JBO)	Jun 22-Jul 02	Jun	27	95:7	224°	$+48^{\circ}$	18	2.2	Var
Piscis Austrinids (PAU)	Jul 15-Aug 10	Jul	28	125°	341°	-30°	35	3.2	5
South. δ -Aquariids (SDA)	Jul 12-Aug 19	Jul	28	125°	339°	-16°	41	3.2	16
α-Capricornids (CAP)	Jul 03-Aug 15	Jul	30	127°	307°	-10°	23	2.5	5
Perseids (PER)*	Jul 17-Aug 24	Aug	12	140 0	48°	$+58^{\circ}$	59	2.2	100
κ-Cygnids (KCG)	Aug 03-Aug 25	Aug	18	145°	286°	$+59^{\circ}$	25	3.0	3
α-Aurigids (AUR)	Aug 25-Sep 08	Sep	01	158 ° 6	84°	$\pm 42^{\circ}$	66	2.5	6
Sept. Perseids (SPE)	Sep 05-Sep 17	Sep	09	166 °.7	60°	$+47^{\circ}$	64	3.0	5
δ-Aurigids (DAU)	Sep 18-Oct 10	Sep	29	186°	82°	$\pm 49^{\circ}$	64	3.0	2
Draconids (DRA)	Oct 06-Oct 10	Oct	08	195 %	262°	$\pm 54^{\circ}$	20	2.6	Var
ε-Geminids (EGE)	Oct 14-Oct 27	Oct	18	205°	102°	$+27^{\circ}$	70	3.0	3
Orionids (ORI)	Oct 02-Nov 07	Oct	21	208°	95°	$\pm 16^{\circ}$	66	2.5	30*
Leonis Minorids (LMI)	Oct 19-Oct 27	Oct	23	211°	161°	$\pm 38^{\circ}$	62	3.0	2
Southern Taurids (STA)	Sep 25-Nov 25	Nov	05	223°	52°	$+15^{\circ}$	27	2.3	5
Northern Taurids (NTA)	Sep 25-Nov 25	Nov	12	230°	58°	$+22^{\circ}$	29	2.3	5
Leonids (LEO)	Nov 10-Nov 23	Nov	17	235 ° 27	152°	$+22^{\circ}$	71	2.5	20*
α-Monocerotids (AMO)	Nov 15-Nov 25	Nov	21	239 °32	117°	$+01^{\circ}$	65	2.4	Var
Phoenicids (PHO)	Nov 28-Dec 09	Dec	06	$254^{\circ}25$	18°	-53°	18	2.8	Var
Puppid/Velids (PUP)	Dec 01-Dec 15	(Dec	07)	(255°)	123°	-45°	40	2.9	10
Monocerotids (MDN)	Nov 27-Dec 17	Dec	09	257°	100°	$+08^{\circ}$	42	3.0	2
σ-Hydrids (HYD)	Dec 03-Dec 15	Dec	12	260°	127°	$+02^{\circ}$	58	3.0	3
Geminids (GEM)	Dec 07-Dec 17	Dec	14	262 °2	112°	$+33^{\circ}$	35	2.6	120
Dec. Leonis Minorids (DLM	Dec 05-Jan 31	Dec	20	268°	161°	$+30^{\circ}$	64	3.0	5
Comae Berenicids (COM)	Dec 12-Dec 23	Dec	20	268°	185°	$+21^{\circ}$	65	3.0	3
Ursids (URS)	Dec 17-Dec 26	Dec	22	270 °7	217°	$\pm 76^{\circ}$	33	3.0	10

Ejection from the parent and orbit distribution:





Radiant position
varies significantly
at start & end

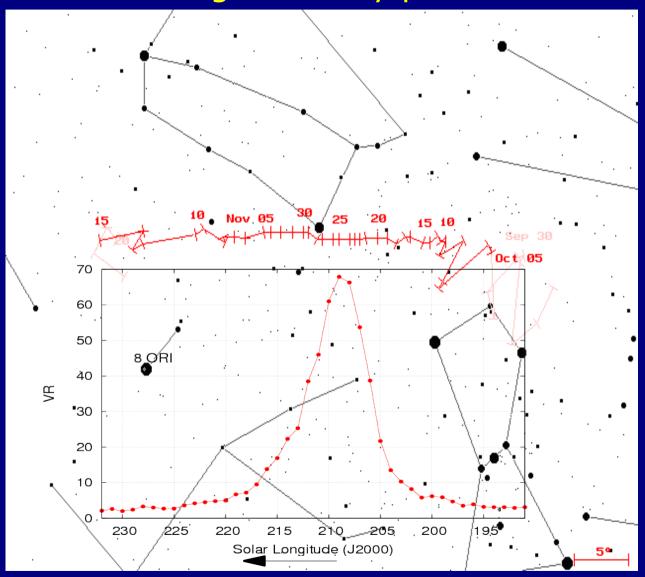


Radiant position
varies significantly
at start & end

Obviously still ORI

- but defining a source?

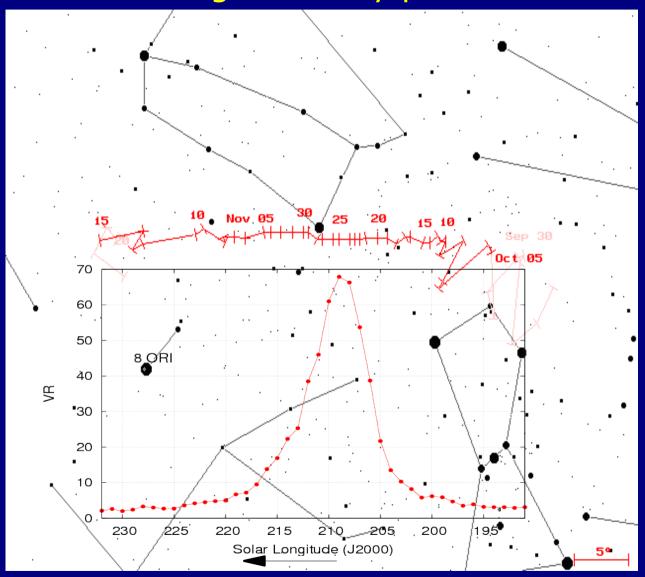
Consequence for a new detection: $\Delta \alpha$, $\Delta \delta < 3^{\circ}/1^{\circ}$ solar long.



Radiant position
varies significantly
at start & end

rate low approaching detection limit

ORI remain above threshold VR=0.7



Radiant position

varies significantly

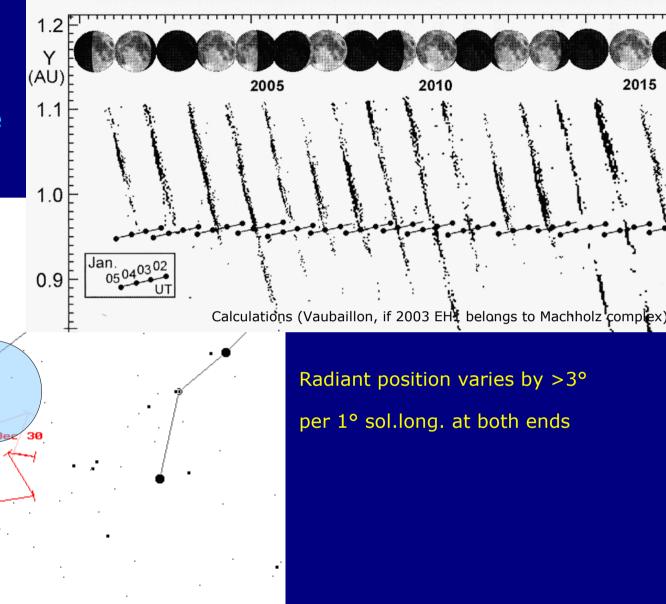
at start & end

rate low
approaching detection limit
only outside the shown period

Conclusion: rate above detection limit and radiant well defined

Quadrantids

Almost vertical orbital plane Very short activity period

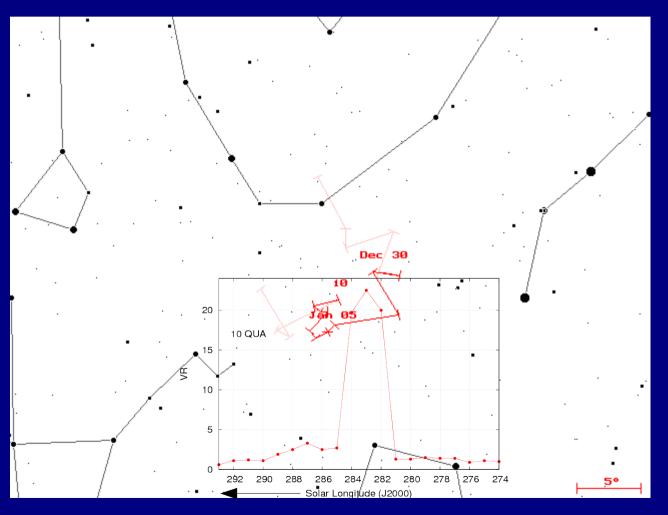


2015

Quadrantids - extended activity?

Activity only in central bins high

Wide peak because of binning data and peak time variations



Uncertain radiants very likely QUA

VR>1 (above threshold)

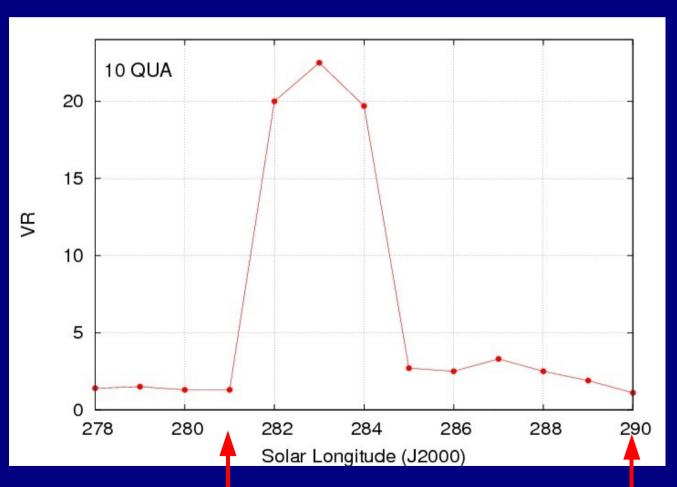
Conclusion:
Activity period
281-290° (Jan 02-10)

[Jan 01-05]

Quadrantids - extended activity?

Activity only in central bins high

Wide peak because of binning data and peak time variations



Uncertain radiants

very likely QUA

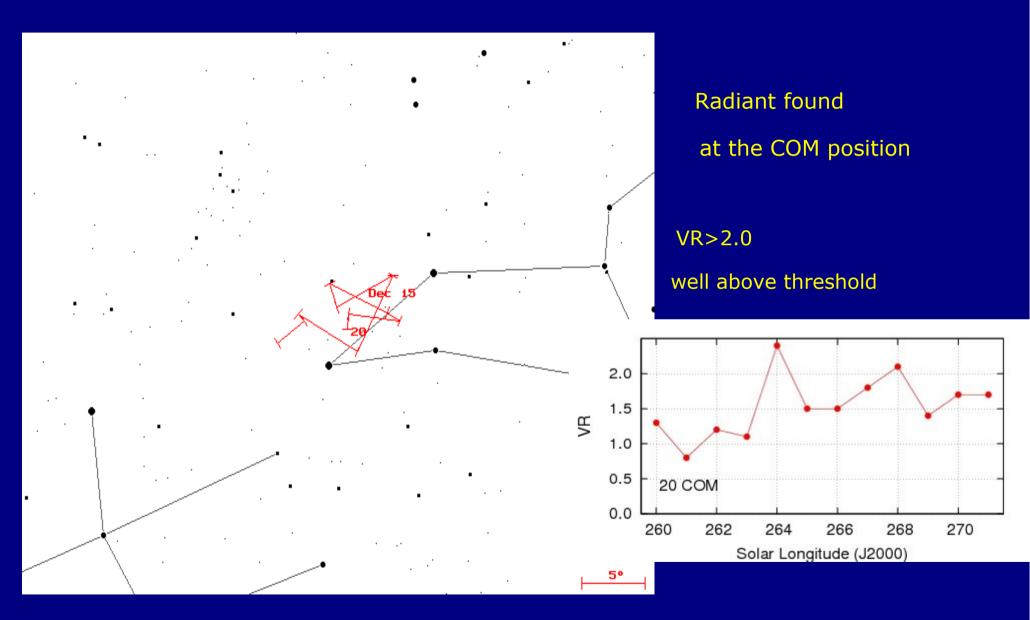
+

VR>1 (above threshold)

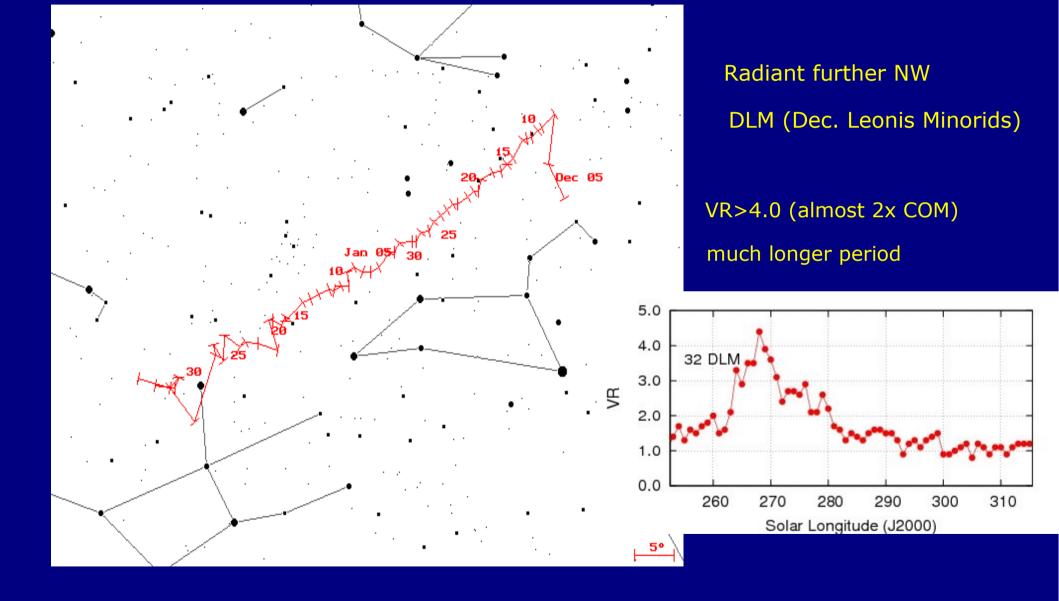
Conclusion:
Activity period
281-290° (Jan 02-10)

[Jan 01-05]

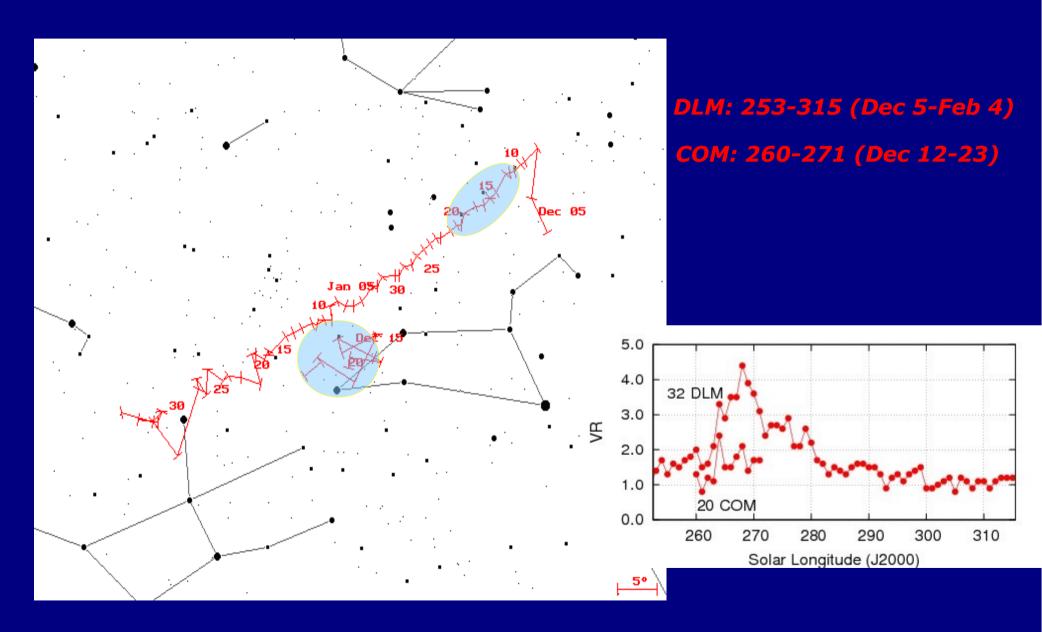
Mysterious Comae Berenicids?



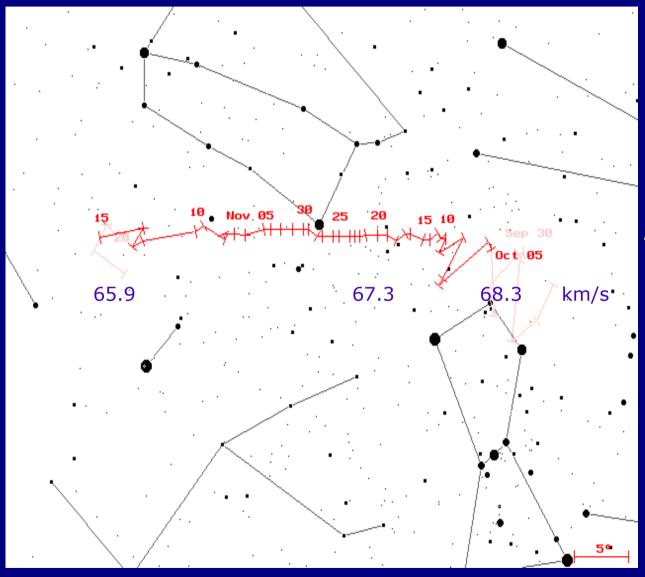
Another shower!



Conclusion from video data: 2 showers



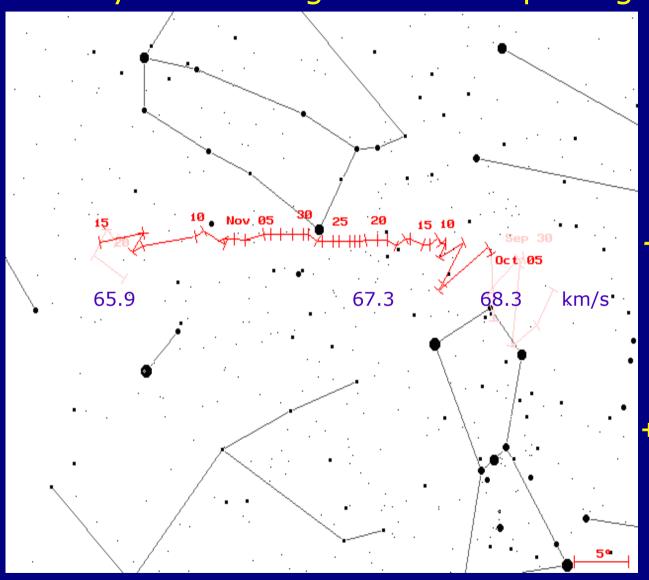
Velocity shift during the stream passage: Orionids



Systematic shift of the meteoroid entry velocity over the activity period:

-0.06 km/s per 1° sol.long.

Velocity shift during the stream passage: Orionids ...



Systematic shift of the meteoroid entry velocity over the activity period:

-0.06 km/s per 1° sol.long.

Opposite shift direction

Over ETA profile:

+0.12 km/s per 1° sol.long.

Velocity shift during the stream passage: Results ...

Shower	Period	V_inf (Peak)	Shift per 1°
	Sol.long.	km/s	km/s
6 LYR	26-35	46.2	+0.18
31 ETA	38-60	66.8	+0.12
175 JPE	105-126	68.1	-0.16 (July Pegasids)
1 CAP	109-138	23.7	-0.18
5 SDA	118-150	43.6	-0.26
12 KCG	134-146	22.7	+0.22
2 STA	165-237	28.9	-0.05
8 ORI	191-232	67.3	-0.06
17 NTA	206-258	28.5	-0.09
250 NOO	230-254	44.1	-0.22 (Nov. Orionids)
16 HYD	244-269	60.8	-0.11
10 QUA	281-290	42.2	-0.23

New detections from the video data

(total sample > 450000 video meteors!)

Shower	Period	Radiant	V_inf	VR	#meteors
409 NCY nu-Cygnids	28- 44	305 +39	42 km/s	1.8	508
410 DPI delta-Piscids	89- 93	11 + 6	71	4.2	105
411 CAN c-Andromedids	102-114	32 +48	59	2.3	491
412 FOP f-Ophiuchids	96-100	266 + 9	21	0.7	81
413 MUL mu-Lyrids	113-118	273 +39	23	0.6	129
414 ATR alpha-Triang.	119-124	29 +28	71	3.6	192
73 ZDR zeta-Draconids	122-126	262 +68	25	0.6	148
415 AUP August Piscids	130-137	8 +18	66	1.1	433
81 SLY Sep. Lyncids	165-172	107 +55	61	1.4	467
416 SIC Sep iota-Cas.	166-171	37 +65	50	0.8	278
417 ETT eta-Taurids	211-221	56 +24	47	1.2	323
418 beta-Herculids	322-326	246 +24	- 56	1.4	99

New detections from the video data

(total sample > 450000 video meteors!)

Shower Max. (λ_{\square}) Period		Period (λ_{\odot})	Radiar	nt positi	on and d	V_{∞}	VR	Data	
	["]	[°]	α	$\Delta \alpha$	δ	$\Delta\delta$	[km/s]		Met.
409 NCY ν-Cygnids	30	28- 44	305.2	+1.8	+39.4	+0.7	42	1.8	508
410 DPI &-Piscids	92	89- 93	10.9	+0.3	+5.5	+0.4	71	4.2	105
411 CAN c-Andromedids	110	102-114	32.4	+1.0	+48.4	± 0.4	59	2.3	491
412 FOP f-Ophiuchids	98	96-100	266.4	+4.0	+8.5	-0.6	21	0.7	81
413 MUL μ-Lyrids	116	113-118	273.1	-0.0	+39.4	-0.5	23	0.6	129
414 ATR α-Triangulids	120	119-124	28.9	-0.2	+28.1	-2.2	71	3.6	192
73 ZDR \(\zefarbolds\)-Draconids	122	122-126	261.7	+5.8	+67.8	+0.8	2.5	0.6	148
415 AUP August Piscids	132	130-137	7.5	+0.9	+18.3	± 0.1	66	1.1	433
81 SLY September Lyncids	167	165-172	107.4	+1.7	+55.0	+0.3	61	1.4	487
416 SIC Sep. t-Cassiopeiids	169	166-171	36.7	-0.2	+65.0	+1.0	50	0.8	278
417 ETT η-Taurids	211	211-221	55.5	+0.9	+23.7	-0.0	47	1.2	323
418 BHE β-Herculids	324	322-326	246.0	+0.9	+23.5	-0.9	55.5	1.4	99

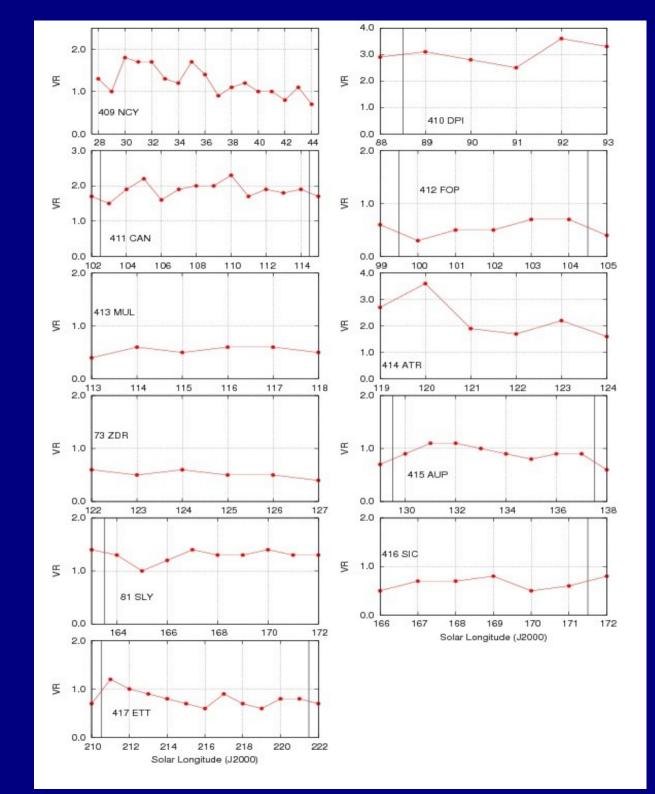
New detections

Most are very weak showers

Exceptions:

410 delta-Piscids (Jun 20-25)

414 alpha-Triangulids (Jul 22-27)



Conclusions:

Video data provide

- * limits of shower activity
- * radiant position + drift
- * velocity data
- * new detections → working status
- * IMO shower list includes

"established showers" (aim: coordinate data collection) → only few updates per year

* further work: Showers in Aur-Per (Sep-Oct),
Antihelion source(s)



