



AMOS global meteor network – status and results

prof. RNDr. Juraj Tóth, PhD.

Pavol Matlovič, Leonard Kornoš, Tomáš Paulech, Pavol Zigo, Martin Baláž, Tomáš Vörös, Mária Paprskárová, Filip Hlobik, Adriana Pisarčíková, Veronika Pazderová, Jaroslav Šimon

Katedra astronómie, fyziky Zeme a meteorológie
Fakulta matematiky, fyziky a informatiky
Univerzita Komenského v Bratislave



Astronómia na matfyzze v BA

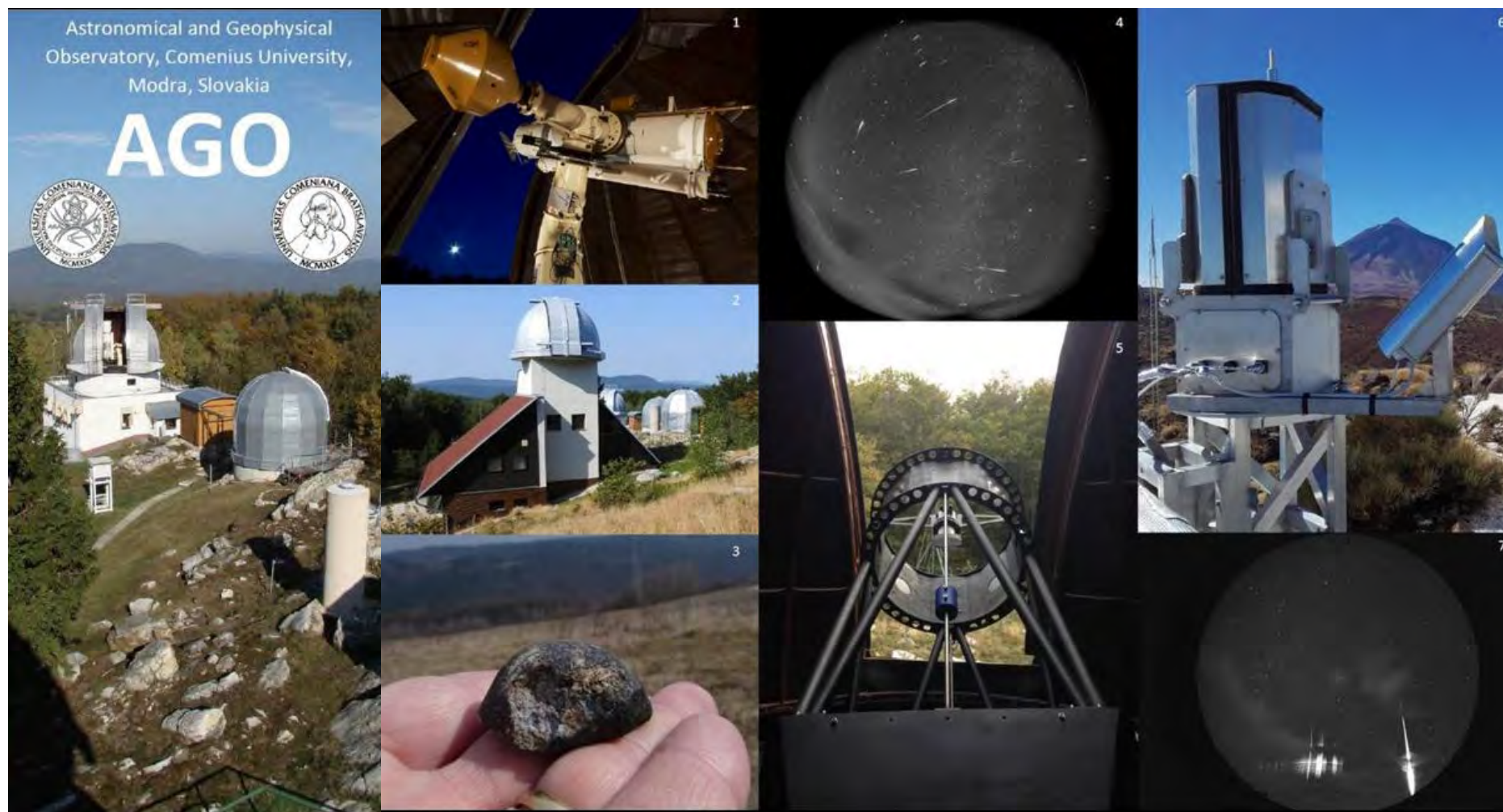
I Medziplanetárna hmota

II Meteorická astronómia

III Galaktická astrofyzika

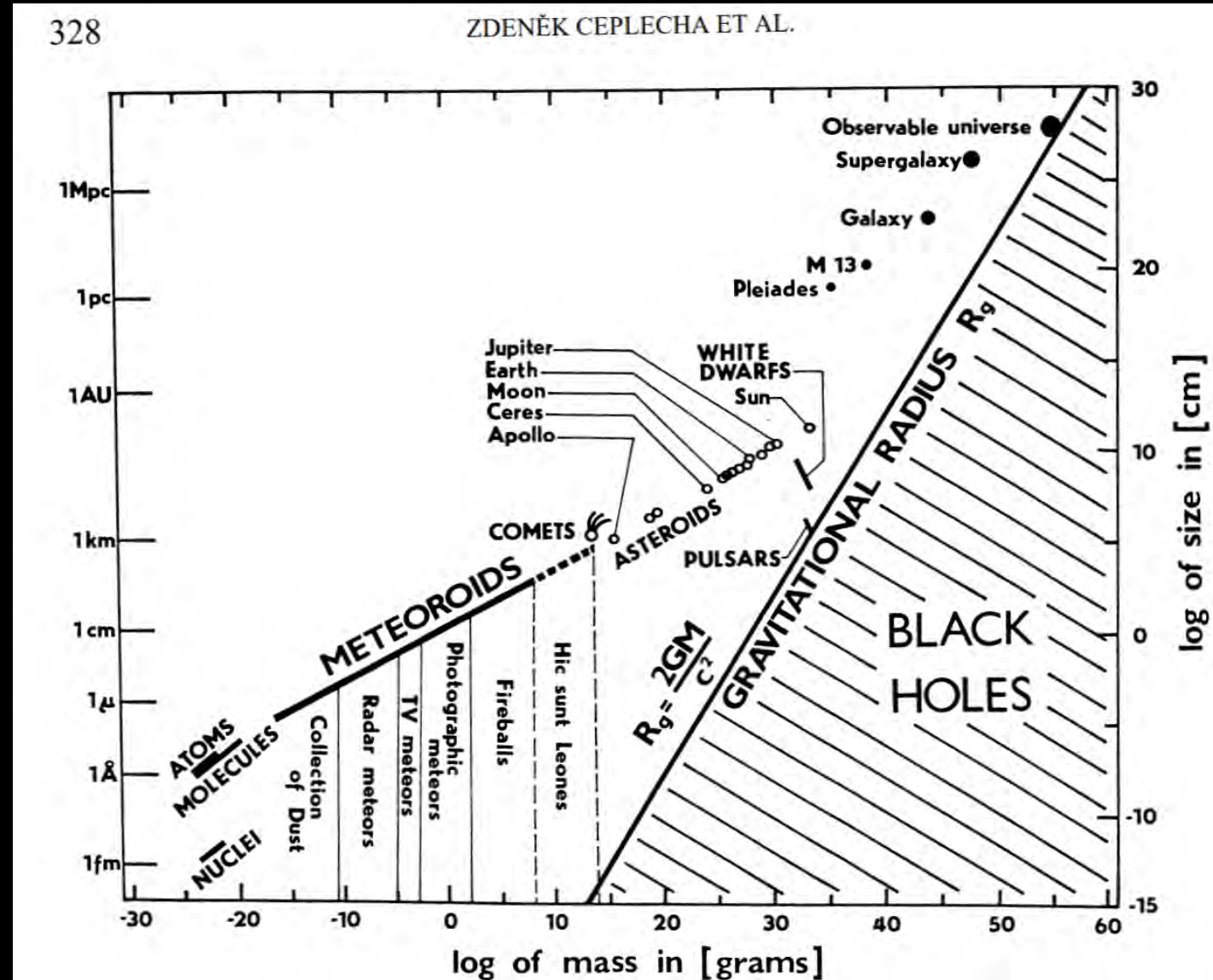
IV Výskum kozmického odpadu

Facilities

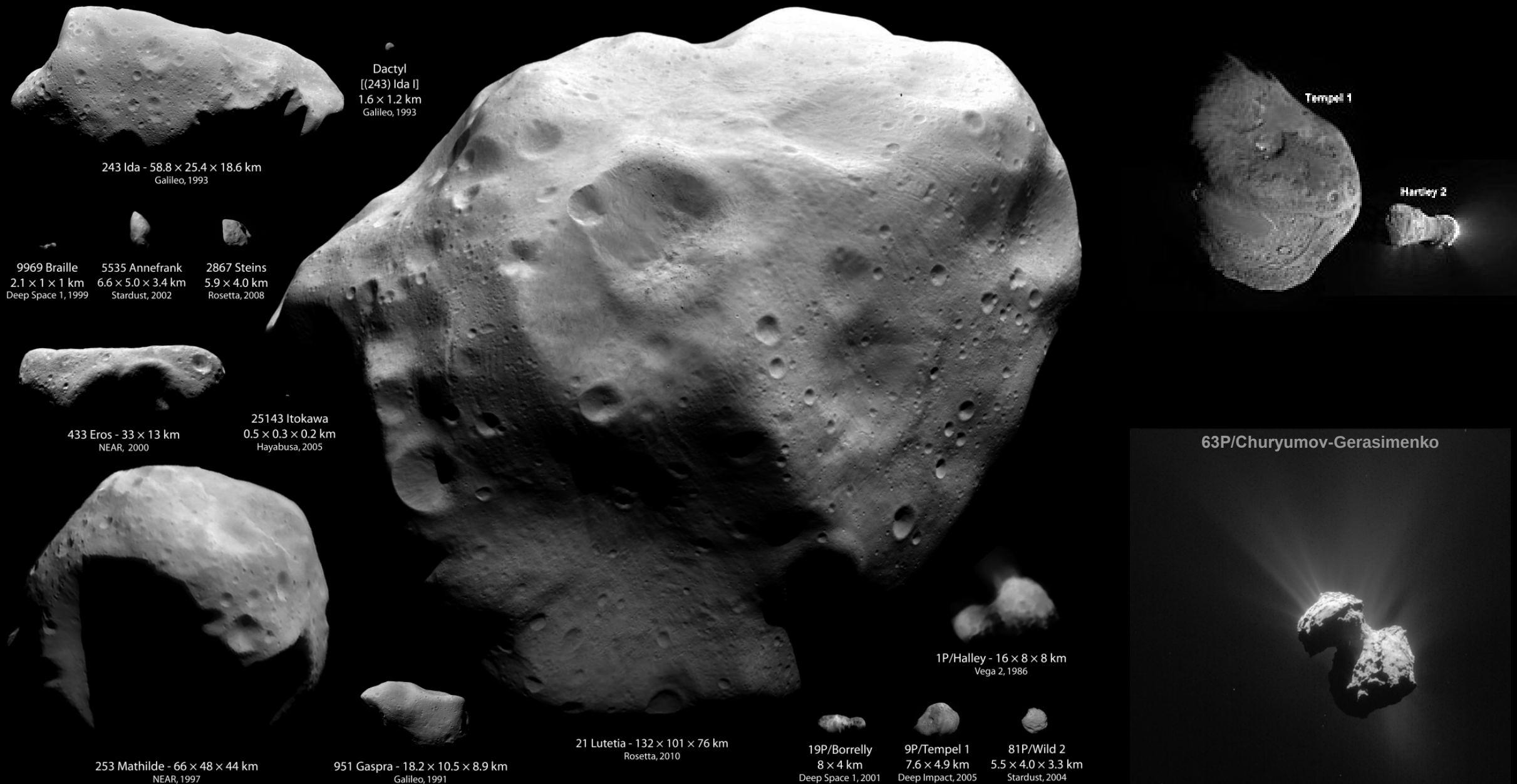


Prečo študovať malé telesá SS?

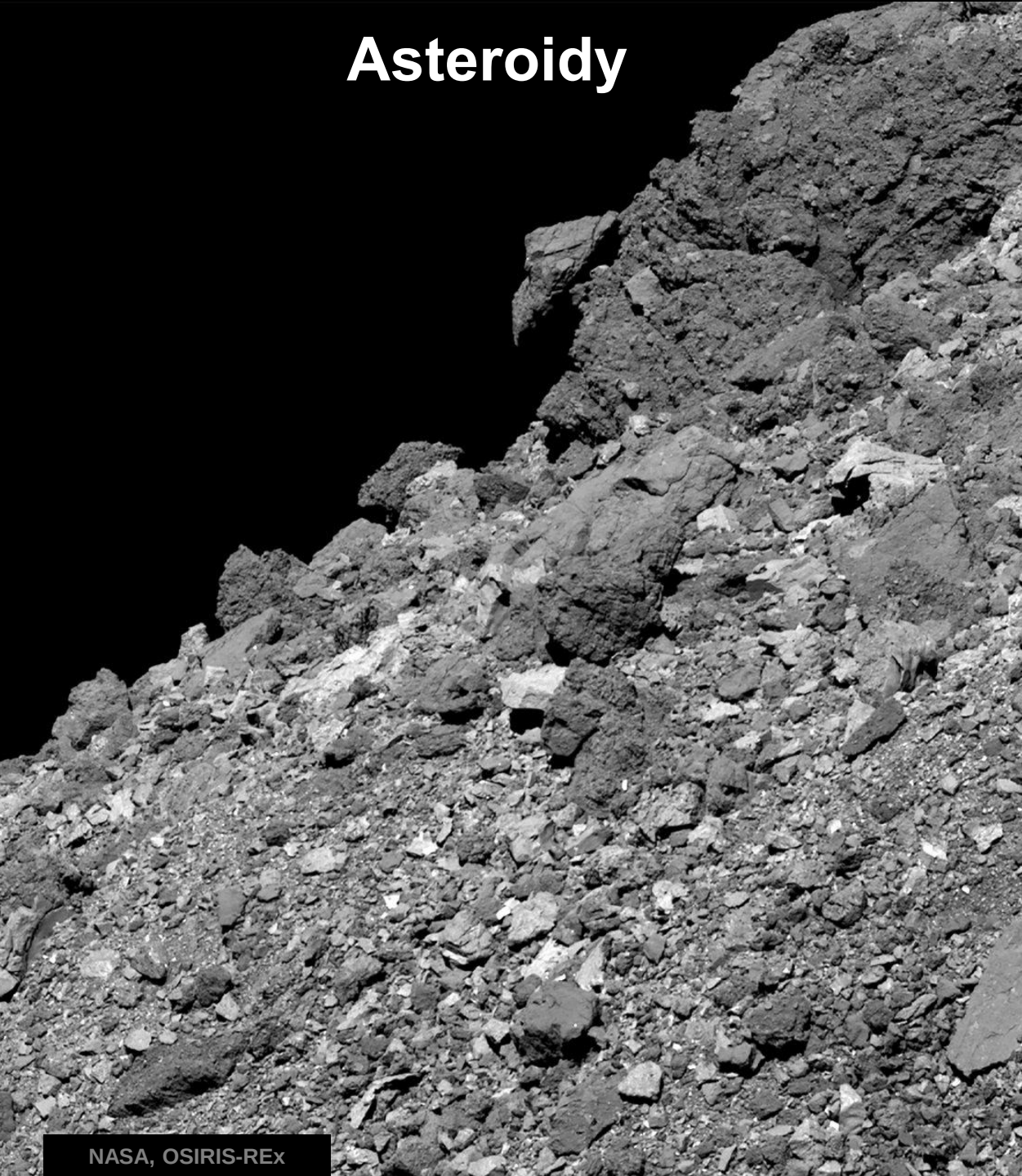
- Veľký rozsah rozmerov a hmotností
- Dostupný materiál
- Súvis s materskými kométami, asteroidmi
- Fyzikálne, mineralogické procesy
- Jednotnosť zloženia Slnka a planetárnej s.
- Nukleogenéza prvkov vo vesmíre
- Určovanie vekov
- Doteraz len z 3 vzorky z asteroidov
- Ohrozenie
- Zdroje surovín v budúcnosti



Asteroidy a kométy

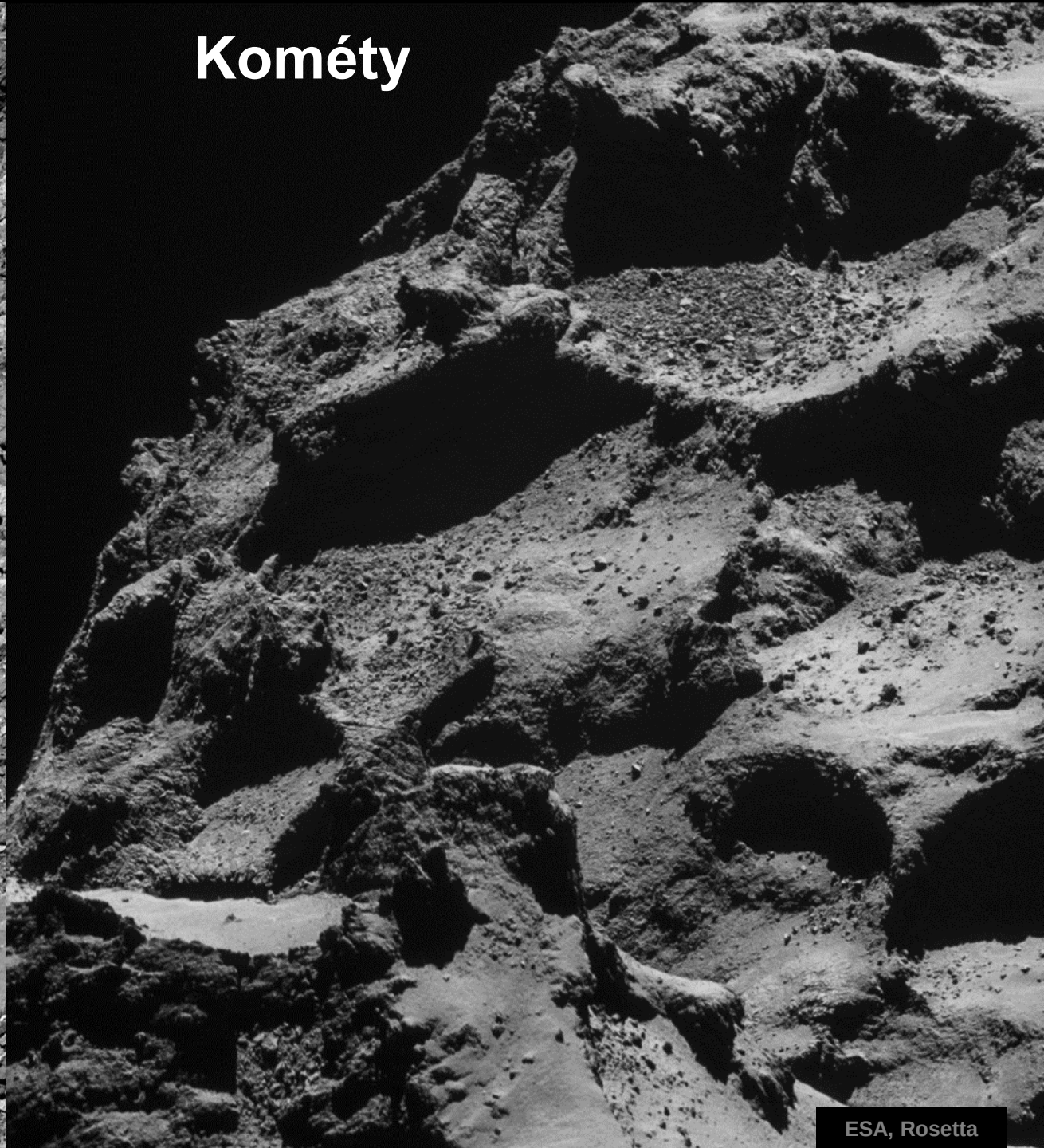


Asteroidy



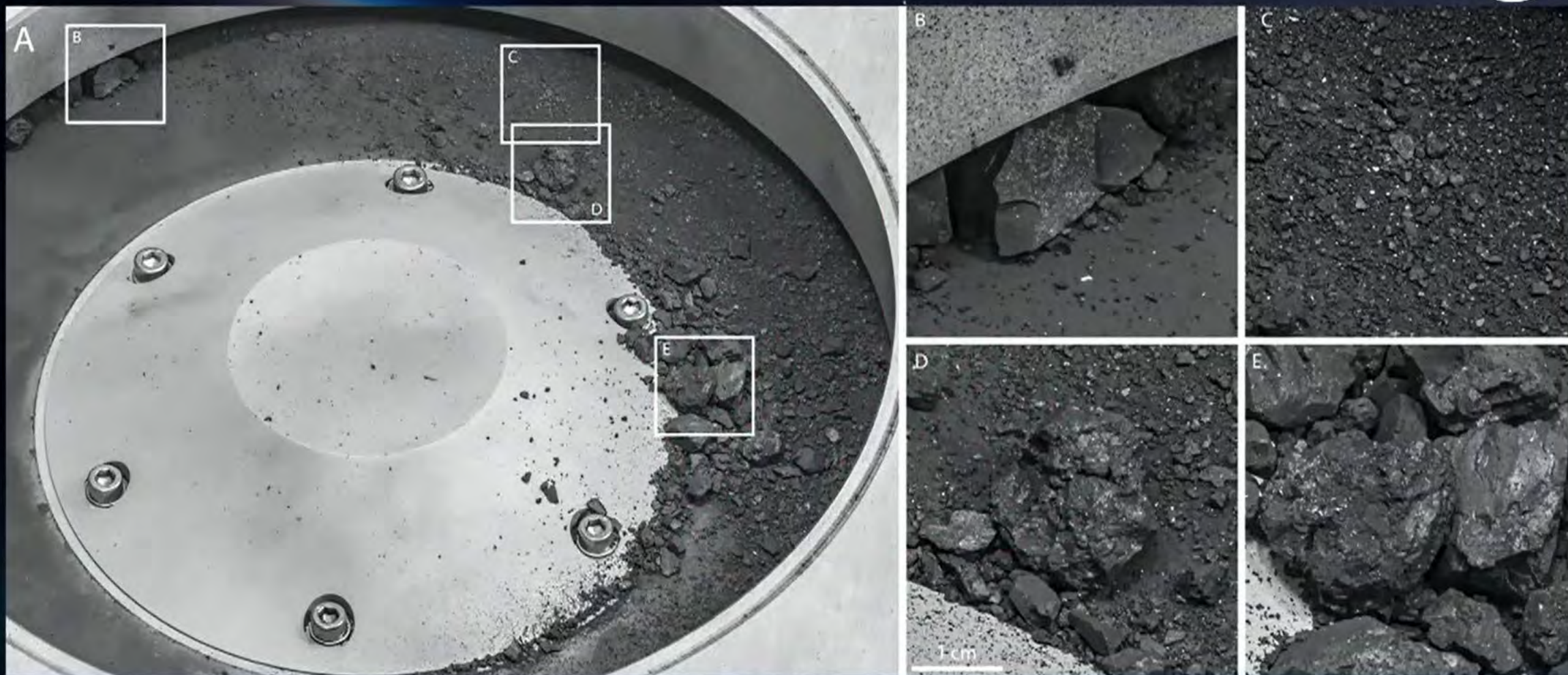
NASA, OSIRIS-REx

Komény



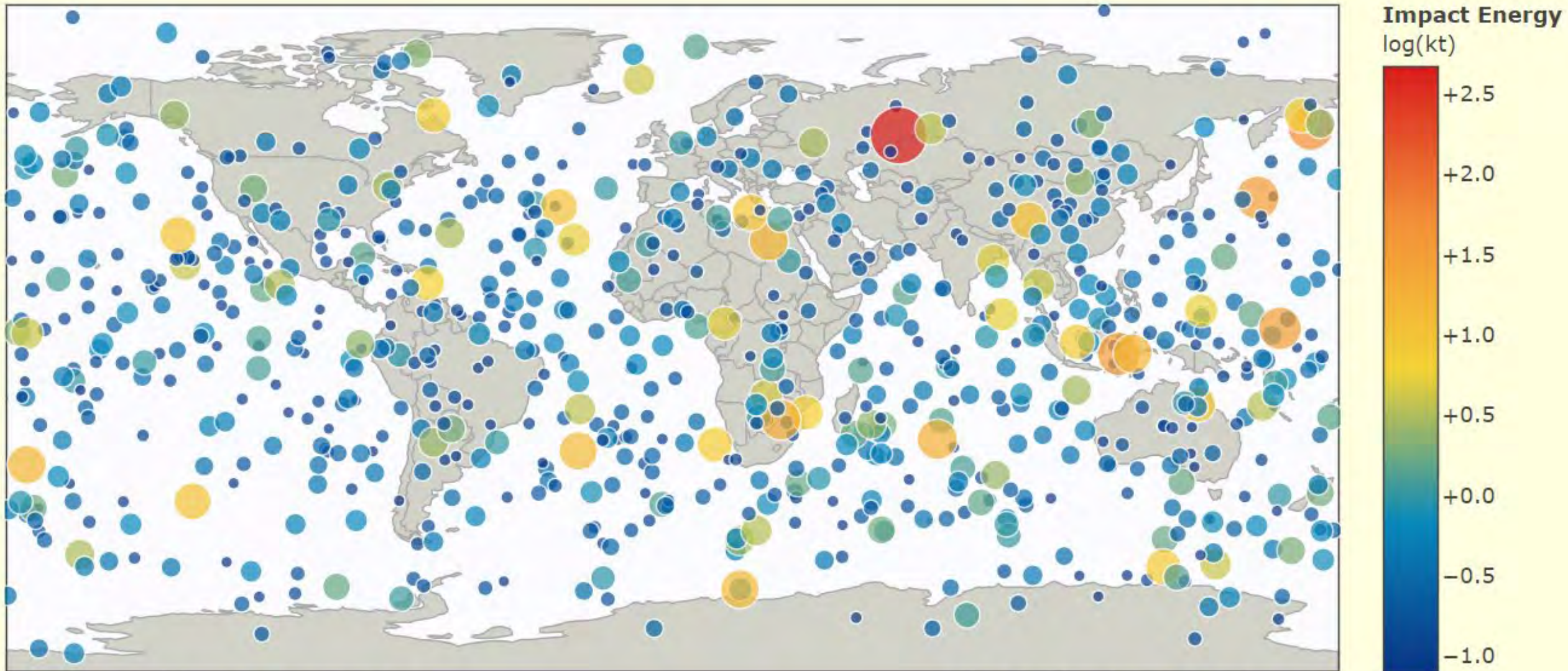
ESA, Rosetta

Materiál z asteroidu Bennu



Fireballs Reported by US Government Sensors

(1988-Apr-15 to 2023-Oct-30)



Meteorit Košice

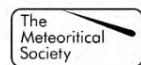
- 28. februára 2010 o 23:24:46 SEČ pozorovaný prelet jasného meteoru – bolidu
- rádiometrické senzory automatických bolidových staníc (dr. P. Spurný, AV ČR)
- zaznamenali svetlo 1000x jasnejšie ako Mesiac v splne
- 3 video záznamy bolidu z Maďarska (Borovička, Tóth et al., 2013 Meteoritics and Planet. Science)
- nález prvých dvoch meteoritov 20.marca (J.Tóth, D. Búzová)



video: Budapešť, Maďarsko, Igaz Antal

Komplexný výskum a analýzy meteoritu Košice

- Trajektória, dráha, modelovanie fragmentov, porovnanie nájdených meteoritov s modelom
- Veľkosť telesa (1 – 1.2 m), energia, chemické zloženie, mineralógia, izotopické analýzy, hustota, mag. susceptibilita

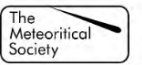


Meteoritics & Planetary Science 48, Nr 10, 1757–1779 (2013)
doi: 10.1111/maps.12078

The Košice meteorite fall: Atmospheric trajectory, fragmentation, and orbit

Jiří BOROVIČKA^{1*}, Juraj TÓTH², Antal IGAZ³, Pavel SPURNÝ¹, Pavel KALENDA⁴,
Jakub HALODA⁵, Ján SVOREN⁶, Leonard KORNOS⁷, Elizabeth SILBER^{7,8},
Peter BROWN^{7,8}, and Marek HUSÁRIK⁶

¹Astronomical Institute, Academy of Sciences of the Czech Republic, Ondřejov, CZ-25165 Czech Republic
²Faculty of Mathematics, Physics and Informatics, Comenius University, Mlynská dolina, Bratislava, SK-84248 Slovakia
³Hungarian Astronomical Association, MCSE, Pf. 148, 1300 Budapest, Hungary
⁴Institute of Rock Structure and Mechanics, Academy of Sciences of the Czech Republic, V Holešovičkách 41,
Praha 8, CZ-18209 Czech Republic
⁵Czech Geological Survey, Geologická 6, Praha 5, CZ-15200 Czech Republic
⁶Astronomical Institute, Slovak Academy of Sciences, Tatranská Lomnica, SK-05960 Slovakia
⁷Department of Physics and Astronomy, University of Western Ontario, London, Ontario N6A3K7, Canada
⁸Centre for Planetary Science and Exploration, University of Western Ontario, London, Ontario N6A 5B7, Canada
*Corresponding author. E-mail: Jiri.Borovicka@asu.cas.cz



Meteoritics & Planetary Science 50, Nr 5, 853–863 (2015)
doi: 10.1111/maps.12447

The Košice meteorite fall: Recovery and strewn field

Juraj TÓTH^{1*}, Ján SVOREN², Jiří BOROVIČKA³, Pavel SPURNÝ³, Antal IGAZ⁴,
Leonard KORNOS¹, Peter VEREŠ^{1,5}, Marek HUSÁRIK², Július KOZA², Aleš KUČERA²,
Pavel ZIGO¹, Štefan GAJDOŠ¹, Jozef VILÁGI¹, David ČAPEK³, Zuzana KRIŠANDOVÁ²,
Dušan TOMKO², Jiří ŠILHA^{1,6}, Eva SCHUNOVÁ^{1,5}, Marcela BODNÁROVÁ², Diana BÚZOVÁ⁷, and
Tereza KREJČOVÁ^{2,8}

¹Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava 84248, Slovakia
²Astronomical Institute, Slovak Academy of Sciences, Tatranská Lomnica 05960, Slovakia
³Astronomical Institute, Czech Academy of Sciences, Ondřejov 25165, Czech Republic
⁴Hungarian Astronomical Association, MCSE, P.O. Box 219, H-146,1 Budapest, Hungary
⁵Institute for Astronomy, 2680 Woodlawn Drive, Honolulu, Hawaii 96822, USA
⁶Astronomical Institute, University of Bern, Bern, Switzerland
⁷Department of Adaptation Biotechnologies, Global Change Research Centre AS CR,
664 24 Drásov, Czech Republic
⁸Department of Theoretical Physics and Astrophysics, Masaryk University, Brno 1137, Czech Republic
*Corresponding author. E-mail: toth@fmph.uniba.sk



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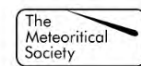
Planetary and Space Science

journal homepage: www.elsevier.com/locate/ps

Density, porosity and magnetic susceptibility of the Košice meteorite shower and homogeneity of its parent meteoroid

Tomáš Kohout^{a,b,*}, Karol Havrila^c, Juraj Tóth^c, Marek Husárik^d, Maria Gritsevich^{e,f,g,h},
Daniel Brittⁱ, Jiří Borovička¹, Pavel Spurný¹, Antal Igaz², Ján Svoren^d, Leonard Kornos^c,
Peter Vereš^{c,i}, Július Koza^d, Pavol Zigo^c, Štefan Gajdos^c, Jozef Világi^c, David Čapek¹,
Zuzana Krišandová^d, Dušan Tomko^d, Jiří Šilha^c, Eva Schunová^c, Marcela Bodnárová^d,
Diana Búzová^m, Tereza Krejčová^{d,n}

^aDepartment of Physics, University of Helsinki, P.O. Box 64, 00014 Helsinki University, Finland
^bInstitute of Geology, Academy of Sciences of the Czech Republic, Rozvojová 269, Prague 6, 16500 Prague, Czech Republic
^cFaculty of Mathematics, Physics and Informatics, Comenius University, Mlynská dolina, Bratislava, Slovakia
^dAstronomical Institute, Slovak Academy of Sciences, SK-05960 Tatranská Lomnica, Slovakia
^eFinnish Geodetic Institute, Geodetintie 2, P.O. Box 15, FI-02431 Masala, Finland
^fUral Federal University, Mira street 19, 620002 Ekaterinburg, Russia
^gDorodnitsyn Computing Centre, Russian Academy of Sciences, Vavilova street 40, 119333 Moscow, Russia
^hInstitute of Mechanics, Lomonosov Moscow State University, Michurinsky pr. 1, 119192 Moscow, Russia
ⁱDepartment of Physics, University of Central Florida, P.O. Box 161385-2385, Orlando, 32816-2385 FL, USA
^jAstronomical Institute, Academy of Sciences of the Czech Republic, CZ-25165 Ondřejov, Czech Republic
^kHungarian Astronomical Association, MCSE, P.O. Box 219, H-1461 Budapest, Hungary
^lInstitute for Astronomy, University of Hawaii at Manoa, 10 96314, USA
^mDepartment of Biophysics, Faculty of Science, P. J. Šafárik University, Košice, Slovakia
ⁿDepartment of Theoretical Physics and Astrophysics, Masaryk University, Kotlínská 2, 61137 Brno, Czech Republic



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doi: 10.1111/maps.12405

Mineralogy, petrography, geochemistry, and classification of the Košice meteorite

Daniel OZDÍN^{1*}, Jozef PLAVČAN², Michaela HORŇÁČKOVÁ², Pavel UHER¹,
Vladimír PORUBČAN^{3,4}, Pavel VEIS^{2,5}, Jozef RAKOVSKÝ², Juraj TÓTH¹,
Patrik KONEČNÝ⁵, and Ján SVOREN⁶

¹Department of Mineralogy and Petrology, Faculty of Natural Sciences, Comenius University, Mlynská dolina,
842 15 Bratislava, Slovak Republic
²Department of Experimental Physics, Faculty of Mathematics, Physics and Informatics, Comenius University,
Mlynská dolina, 842 48 Bratislava, Slovak Republic
³Astronomical Institute of Slovak Academy of Sciences, Dúbravská cesta 9, 842 28 Bratislava, Slovak Republic
⁴Department of Astronomy, Faculty of Mathematics, Physics and Informatics, Comenius University,
Mlynská dolina, 842 48 Bratislava, Slovak Republic
⁵Department of Special Laboratories, State Geological Institute of Dionýz Stúr, Mlynská dolina 1,
817 04 Bratislava, Slovak Republic
⁶Astronomical Institute of Slovak Academy of Sciences, 059 60 Tatranská Lomnica, Slovak Republic
*Corresponding author. E-mail: ozdina@fns.uniba.sk

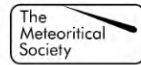


Meteoritics & Planetary Science 50, Nr 5, 880–892 (2015)
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Cosmogenic nuclides in the Košice meteorite: Experimental investigations and Monte Carlo simulations

Pavel P. POVINEC^{1*}, Jozef MAŠARIK¹, Ivan SÝKORA¹, Andrej KOVÁČIK¹, Juraj BEŇO¹,
Matthias M. M. MEIER^{2,3}, Rainer WIELER², Matthias LAUBENSTEIN⁴, and
Vladimír PORUBČAN^{5,6}

¹Department of Nuclear Physics and Biophysics, Faculty of Mathematics, Physics and Informatics, Comenius University,
SK-84248 Bratislava, Slovakia
²Department of Earth Sciences, ETH Zürich, CH-8092 Zürich, Switzerland
³Centre de Recherches Pétrographiques et Géochimiques, CNRS Nancy, F-54500 Vandœuvre les Nancy, France
⁴National Laboratory of Gran Sasso, INFN, I-67100 Assergi (AQ), Italy
⁵Department of Astronomy, Physics of the Earth and Meteorology, Faculty of Mathematics, Physics and Informatics,
Comenius University, SK-84248 Bratislava, Slovakia
⁶Astronomical Institute, Slovak Academy of Sciences, SK-84504 Bratislava, Slovakia
*Corresponding author. E-mail: povinec@fmph.uniba.sk



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A comprehensive study of distribution laws for the fragments of Košice meteorite

Maria GRITSEVICH^{1,2,3*}, Vladimir VINNIKOV², Tomáš KOHOUT^{4,5}, Juraj TÓTH⁶,
Jouni PELTONIEMI^{1,4}, Leonid TURCHAK², and Jenni VIRTANEN¹

¹Finnish Geodetic Institute, Geodetintie 2, P.O. Box 15, Masala FI-02431, Finland
²Department of Computational Physics, Dorodnitsyn Computing Centre, Russian Academy of Sciences,
Vavilova ul. 40, Moscow 119333, Russia
³Institute of Mechanics, Lomonosov Moscow State University, Michurinsky pr., 1, Moscow 119192, Russia
⁴Department of Physics, University of Helsinki, P.O. Box 64, Helsinki 00014, Finland
⁵Institute of Geology, Academy of Sciences of the Czech Republic, Rozvojová 269, Prague 6 16500, Czech Republic
⁶Faculty of Mathematics, Physics and Informatics, Comenius University, Mlynská dolina, Bratislava SK-84248, Slovakia
*Corresponding author. E-mail: maria.gritsevich@fgi.fi

Daylight bolide 25.6.2022, source P. Spurný

- 19:54:16 LSEČ
- Abs. brightness~ -12.5 mag
- Mass 50 kg
- Diameter 30 cm
- Velocity 20 km/s
- Orbit type Apollo
- Inclination 27°
- Revolution period 2.2 years



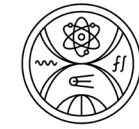
Meteorite recovery by Mateusz Zmija



„I am very pleased to announce that **on 20 August at 17:42 I found the first meteorite from the fall in Pusté Úľany!** “

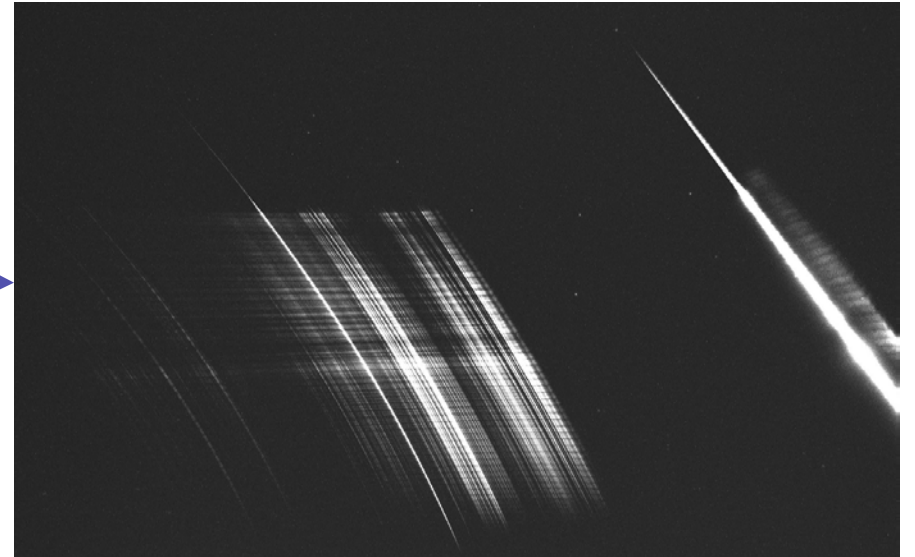
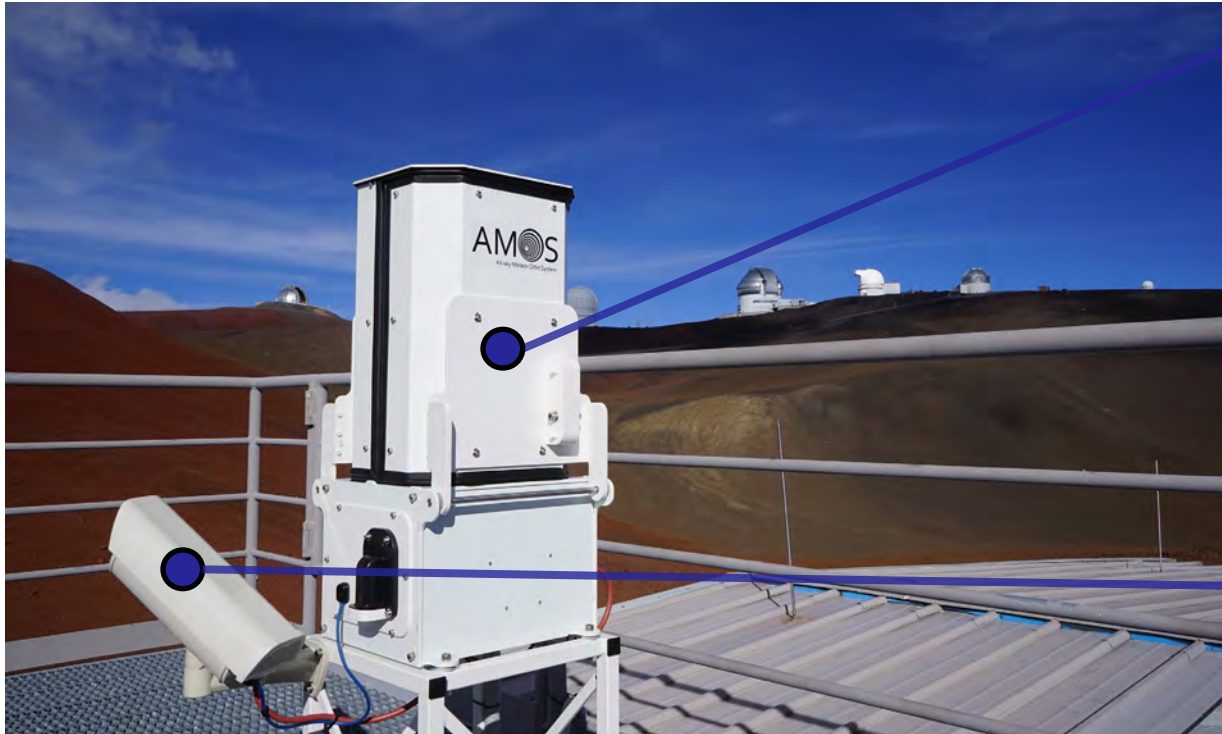


AMOS (All-sky Meteor Orbit System) network

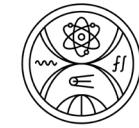


FACULTY OF MATHEMATICS,
PHYSICS AND INFORMATICS
Comenius University
Bratislava

- Vlastný originálny astronomický prístroj
- Vhodný na štatistické štúdium meteorov a charakteristiku meteorických rojov
- Štúdium špeciálnych prípadov so spektrami, clustrov meteorov, nových rojov, TLE, umelých telies a pod.



AMOS (All-sky Meteor Orbit System) network

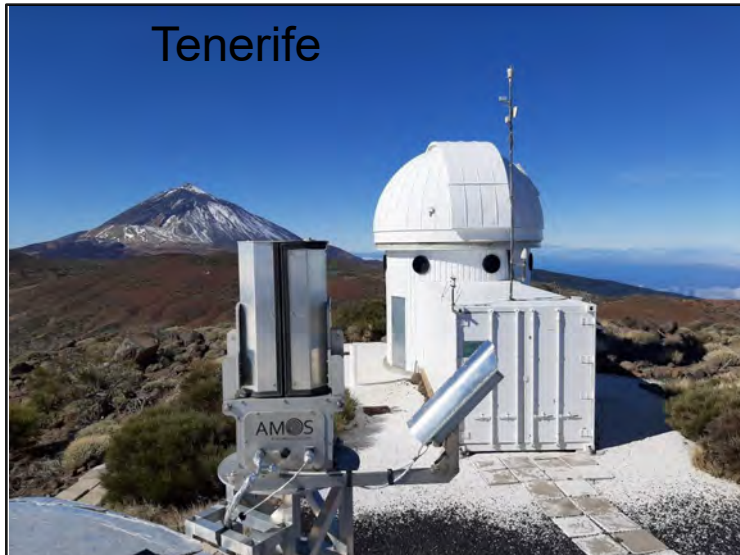


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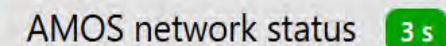


Celosvetová sieť systému AMOS na sledovanie meteorov a meteorických rojov

- 7 lokalít, 17 staníc AMOS a 17 spektorgrafov AMOS-Spec
- Automatický systém, diaľkový prístup, odolný v extrémnych púštnych a vysokohorských podmienkach
- Jeden systém zaznamená ročne $\approx 20\,000$ meteorov
- HD, SW, ľudia



 JurajToth
log out



		id		status				UFO		free disk space		last sighting		environment			local			
subnetwork		code	name	position	on	connection	📶	state	dome	all-sky	spectral	prim	perm	allsky	spectral	T _{out}	T _{env}	💧	time	🌟
SK	Slovakia	AGO	AGO Modra	✓	✓	OK	00:31	daylight	closed	off	off	286 GiB	disabled	11:54:14	11:28:25	25.3 °C	31.1 °C	44.4 %	14:50	54.49°
		ARBO	Arborétum Mlyňany	✓	✓	OK	01:01	daylight	closed	off	disabled	377 GiB	377 GiB	1d 11:37:13	never	29.2 °C	34.1 °C	37.7 %	14:50	53.93°
		KNM	Kysucké Nové Mesto	✓	✓	OK	00:08	daylight	closed	off	disabled	194 GiB	disabled	2d 12:52:10	never	23.8 °C	32.8 °C	36.9 %	14:50	53.15°
		VAZ	Vážec	?	✓	OK	00:24	daylight	closed	off	disabled	67 GiB	772 GiB	1d 13:34:40	never	19.8 °C	20.5 °C	77.0 %	14:50	52.64°
		SC	Serec	✓	✓	offline	9d 20:04:28	—	—	—	—	94 GiB	disabled	10d 13:02:34	never	29.5 °C	? °C	? %	14:50	54.52°
		RS	Rimavská Sobota	✓	✓	OK	00:24	daylight	closed	off	disabled	393 GiB	393 GiB	1d 12:53:16	never	30.1 °C	37.8 °C	31.1 %	14:50	53.01°
CI	Canary Islands	LP	La Palma	?	✓	OK	00:47	daylight	closed	off	off	186 GiB	186 GiB	07:56:50	07:44:53	13.1 °C	28.0 °C	5.8 %	13:50	82.06°
		TE	Teide	?	✓	OK	01:02	daylight	closed	off	off	297 GiB	297 GiB	5d 07:43:22	5d 08:07:55	21.3 °C	24.0 °C	24.0 %	13:50	83.09°
CL	Chile	SP	San Pedro de Atacama	✓	✓	OK	00:37	daylight	closed	off	off	222 GiB	222 GiB	02:40:54	02:53:18	4.8 °C	10.4 °C	9.2 %	08:50	19.78°
		PC	Paniri Caur	✓	✓	OK	00:33	daylight	closed	off	off	609 GiB	609 GiB	02:40:54	02:40:54	4.0 °C	13.9 °C	5.1 %	08:50	19.80°
HI	Hawaii	HK	Haleakalā	?	✓	OK	00:52	observing	open	running	disabled	198 GiB	198 GiB	05:46	never	4.6 °C	11.8 °C	14.2 %	02:50	-34.13°
		MK	Mauna Kea	?	✓	OK	00:35	observing	open	running	running	150 GiB	150 GiB	08:01	01:04:11	3.0 °C	4.7 °C	23.1 %	02:50	-34.29°
AU	Australia	FO	Forrest	✓	✓	OK	00:46	observing	open	off	disabled	365 GiB	disabled	05:21	630d 16:14:13	11.9 °C	0.0 °C	0.0 %	20:50	-54.28°
		MU	Mundrabilla	✓	✓	OK	01:07	observing	open	off	off	279 GiB	disabled	01:27:51	01:47	11.8 °C	14.7 °C	72.1 %	20:50	-53.96°
		KY	Kybo	✓	✓	OK	00:09	observing	open	off	off	351 GiB	822 GiB	47:09	56:39	14.7 °C	15.8 °C	71.3 %	20:50	-52.96°
		FOS	Forrest spectral camera South	✓	✓	OK	00:37	no dome	—	disabled	off	846 GiB	846 GiB	never	20:42	11.9 °C	? °C	? %	20:50	-54.28°
		FOSE	Forrest spectral camera SouthEast	✓	✓	OK	00:38	no dome	—	disabled	off	846 GiB	846 GiB	never	02:13:18	11.9 °C	? °C	? %	20:50	-54.28°
		FOSW	Forrest spectral camera SouthWest	✓	✓	OK	00:39	no dome	—	disabled	off	846 GiB	846 GiB	never	41:06	11.9 °C	? °C	? %	20:50	-54.28°
		FON	Forrest spectral camera North	✓	✓	OK	00:28	no dome	—	disabled	off	894 GiB	894 GiB	never	01:38:36	11.9 °C	? °C	? %	20:50	-54.28°
		FONE	Forrest spectral camera NorthEast	✓	✓	OK	00:31	no dome	—	disabled	off	894 GiB	894 GiB	never	01:06:53	11.9 °C	? °C	? %	20:50	-54.28°
		FONW	Forrest spectral camera NorthWest	✓	✓	OK	00:29	no dome	—	disabled	off	894 GiB	894 GiB	never	40:04	11.9 °C	? °C	? %	20:50	-54.28°
SA	South Africa	RC	Rogge Cloof	✓	✓	OK	00:43	daylight	closed	off	off	781 GiB	disabled	08:24:39	128d 10:13:59	15.9 °C	23.1 °C	16.0 %	14:50	26.51°
		CE	Cederberg	✓	✓	OK	00:15	daylight	closed	off	off	674 GiB	disabled	08:25:08	330d 08:08:54	13.8 °C	0.0 °C	0.0 %	14:50	27.25°
US	Continental US	MH	Mount Hopkins	✓	✓	OK	00:11	no dome	—	disabled	off	76 GiB	76 GiB	never	03:06:45	8.7 °C	? °C	? %	05:50	5.13°
XX	other	There are no stations in this subnet.																		

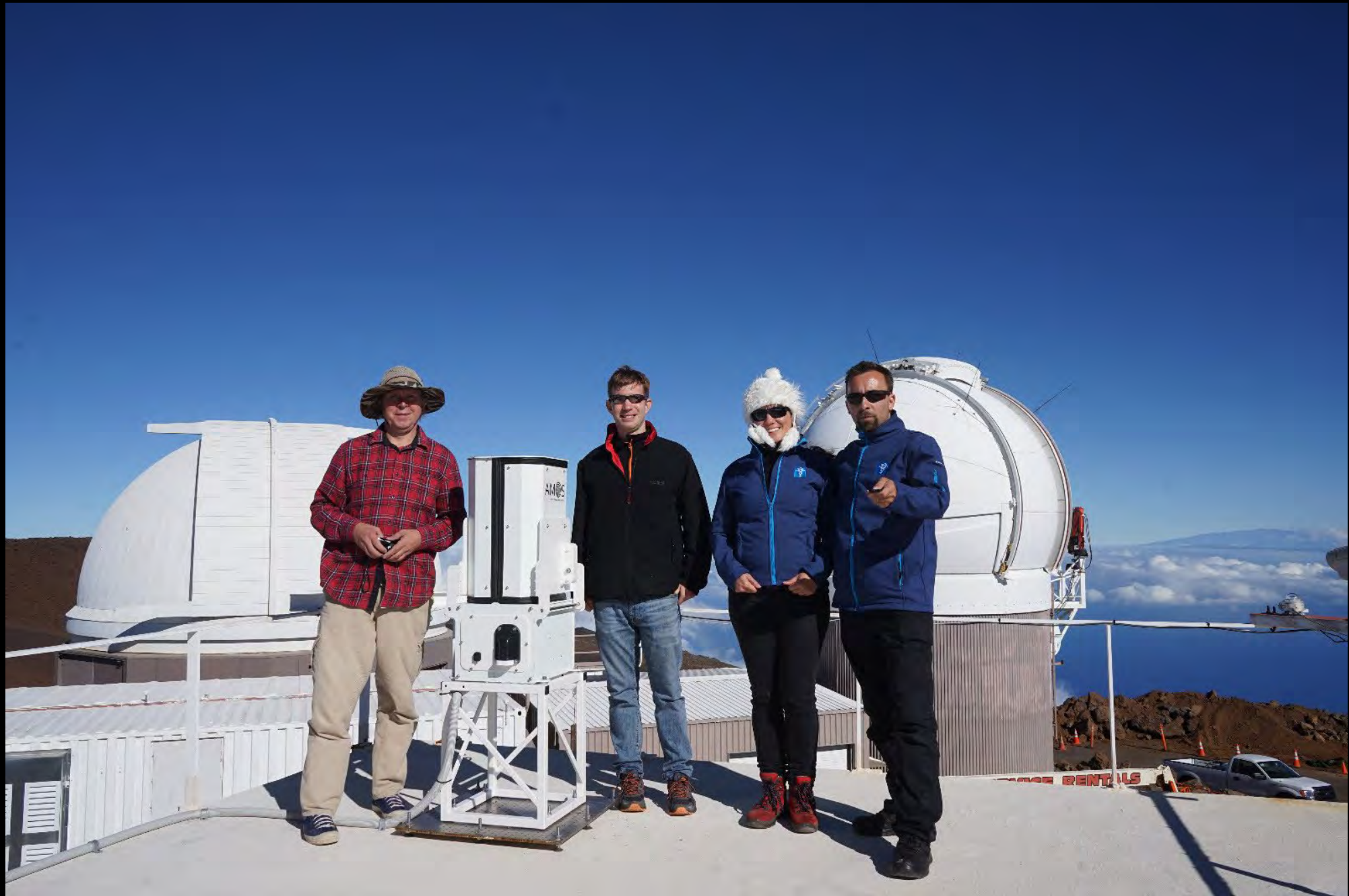


AMOS

All-sky Meteor Orbit System
Comenius University in Bratislava, Slovakia

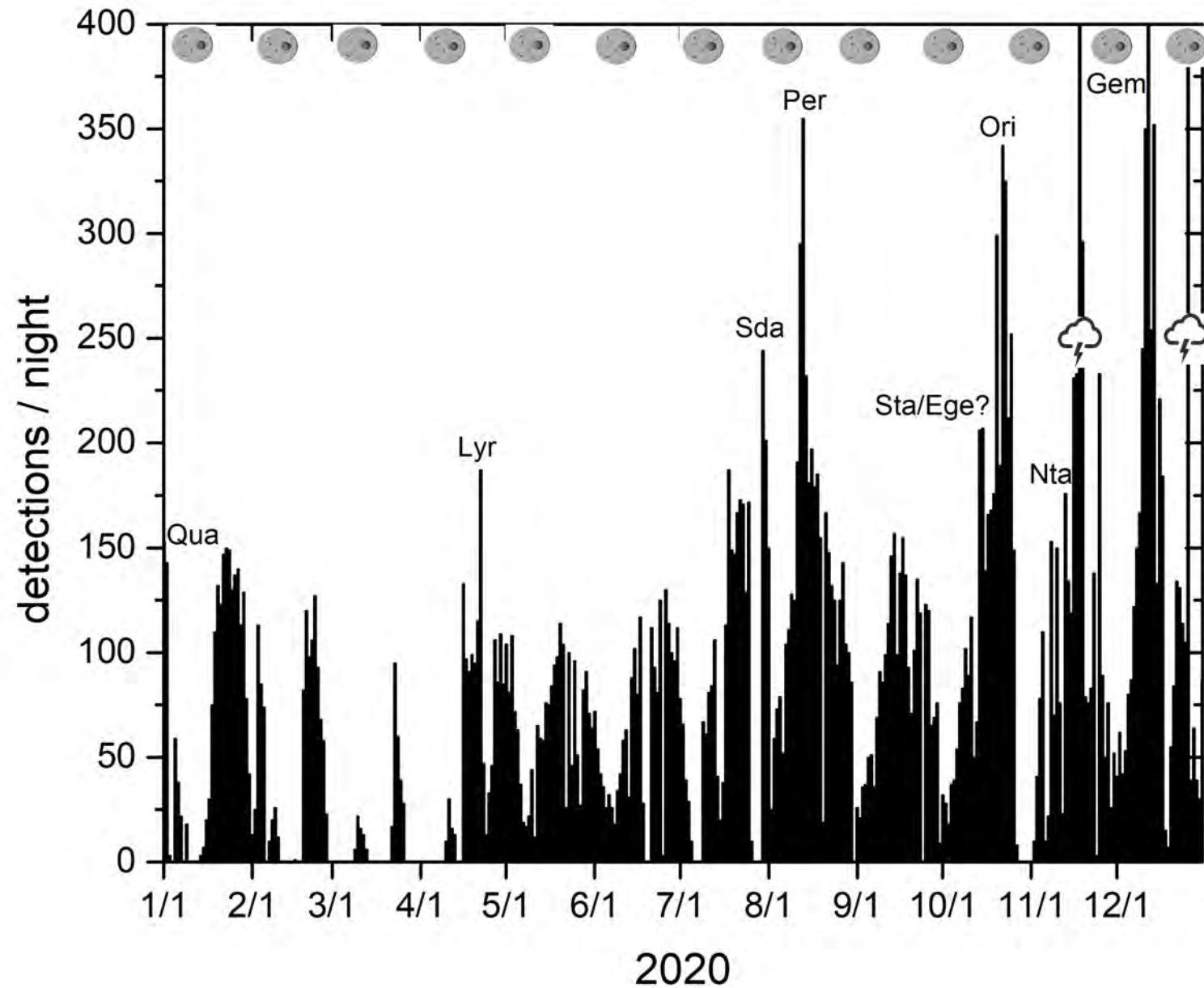


Hawaii, Haleakala Obs. - 3000m, 09/2018





AMOS from Haleakala Obs. meteor night counts, total 29611



5/31/2022 4:00:01 am

Sulawesi

Palau

Timor Sea

Port Moresby

Solomon Islands

New Caledonia

Coral Sea

Brisbane

Sydney

NEW SOUTH WALES

VICTORIA

Melbourne

TASMANIA

Hobart

Tasman Sea

Wellington

Niue

NORTHERN TERRITORY

Australia

WESTERN AUSTRALIA

SOUTH AUSTRALIA

Great Australian Bight

Kybo

Forrest

Mundrabilla

Perth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Základný výskum meteoroidných častíc za pomoci originálneho komplexného systému AMOS

- spolupráca: Kornoš, Zigo, Kalmančok, Paulech, Šimon, Šilha, Nagy a AGO Modra
- PhD. študenti: Vereš, Šilha, Matlovič, Baláž, Havrila, Čechvala, Pisarčíková, Žilková, Pazderová, Hlobík, Bartková, Paprskárová, Vörös, Kuksenko



All-sky Meteor Orbit System AMOS and preliminary analysis of three unusual meteor showers

Juraj Tóth^{a,*}, Leonard Kornoš^a, Pavol Zigo^a, Štefan Gajdoš^a, Dušan Kalmančok^a, Jozef Világi^a, Jaroslav Šimon^a, Peter Vereš^a, Jiří Šilha^{a,b}, Marek Buček^a, Adrián Galád^{a,c}, Patrik Rušňák^a, Peter Hrábek^a, František Duriš^a, Regina Rudawska^a

^a Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Mlynská dolina, 842 48 Bratislava, Slovakia
^b Astronomical Institute, University of Bern, Sidlerstrasse, CH-3012 Bern, Switzerland
^c Astronomical Institute, Academy of Sciences of the Czech Republic, 251 65 Ondřejov, Czech Republic



Meteor spectra from AMOS video system

Regina Rudawska^{a,b,*}, Juraj Tóth^a, Dušan Kalmančok^a, Pavol Zigo^a, Pavol Matlovič^a

^a Comenius University, Faculty of Mathematics, Physics and Informatics, Mlynská dolina, Bratislava SK-84248, Slovakia
^b ESA European Space Research and Technology Centre, Noordwijk, The Netherlands

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Astronomy
& Astrophysics

Spectral and orbital survey of medium-sized meteoroids*

Pavol Matlovič¹, Juraj Tóth¹, Regina Rudawska², Leonard Kornoš¹, and Adriana Pisarčíková¹

¹ Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia
e-mail: matlovi@fmph.uniba.sk
² ESTEC/ESA, Keplerlaan 1, 2201 AZ Noordwijk, The Netherlands



Hydrogen emission from meteors and meteorites: mapping traces of H₂O molecules and organic compounds in small Solar system bodies

Pavol Matlovič^{1,*}, Adriana Pisarčíková¹, Juraj Tóth¹, Pavel Mach¹, Peter Čermák¹, Stefan Loehle², Leonard Kornoš¹, Ludovic Ferrière³, Jiří Šilha¹, David Leiser³ and Ranjith Ravichandran³

¹ Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Mlynská dolina, 84248 Bratislava, Slovakia
² High Enthalpy Flow Diagnostics Group, Institute of Space Systems, University of Stuttgart, D-70569 Pfaffenwaldring, Stuttgart, Germany
³ Natural History Museum Vienna, Burggasse 7, 1010 Vienna, Austria

A&A 636, A122 (2020)
<https://doi.org/10.1051/0004-6361/202037727>
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Astronomy
& Astrophysics

Characterization of the June epsilon Ophiuchids meteoroid stream and the comet 300P/Catalina

Pavol Matlovič¹, Leonard Kornoš¹, Martina Kováčová¹, Juraj Tóth¹, and Javier Licandro^{2,3}

¹ Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia
e-mail: matlovi@fmph.uniba.sk
² Instituto de Astrofísica de Canarias (IAC), C/Vía Láctea s/n, 38205 La Laguna, Spain
³ Departamento de Astrofísica, Universidad de La Laguna, 38206 La Laguna, Tenerife, Spain

nature astronomy

Article <https://doi.org/10.1038/s41550-022-01844-3>

Direct measurement of decimetre-sized rocky material in the Oort cloud

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Denis Vida^{1,*}, Peter G. Brown¹, Hadrien A. R. Devillepoix², Paul Wiegert³, Danielle E. Moser⁴, Pavol Matlovič⁵, Christopher D. K. Herd⁶, Patrick J. A. Hill⁵, Eleanor K. Sansom⁷, Martin C. Towner⁸, Juraj Tóth⁵, William J. Cooke⁶ & Donald W. Hladik¹



An Outburst Meteor Event Captured by Subaru-Asahi ...



Pozrieť nes...



Zdieľať



Prehrať na  YouTube

3:58:21

Live from Subaru Telescope, Haw

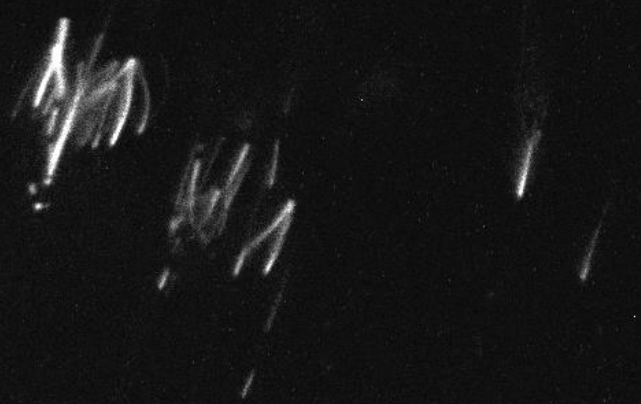
Video: The "meteor cluster event" captured by the "Subaru-Asahi Sky Camera" which occurred at 3:58 a.m. Hawai'i time on July 14 (1:58 p.m. UTC). In the foreground are the domes of other Maunakea Observatories. (Credit: Subaru Telescope, National Astronomical Observatory of Japan, and [Asahi Shimbun Company](#))

Arids – new meteor shower from Chile, SpaceObs

Oct. 6/7 2021 (23:30 – 2:30 UT)

- scattered clouds
- 21 Arids from 1st station
- 12 Arids from 2nd station
- mag. range from -3 to +2.5
- one spectrum with Na line
- paper in preparation ...

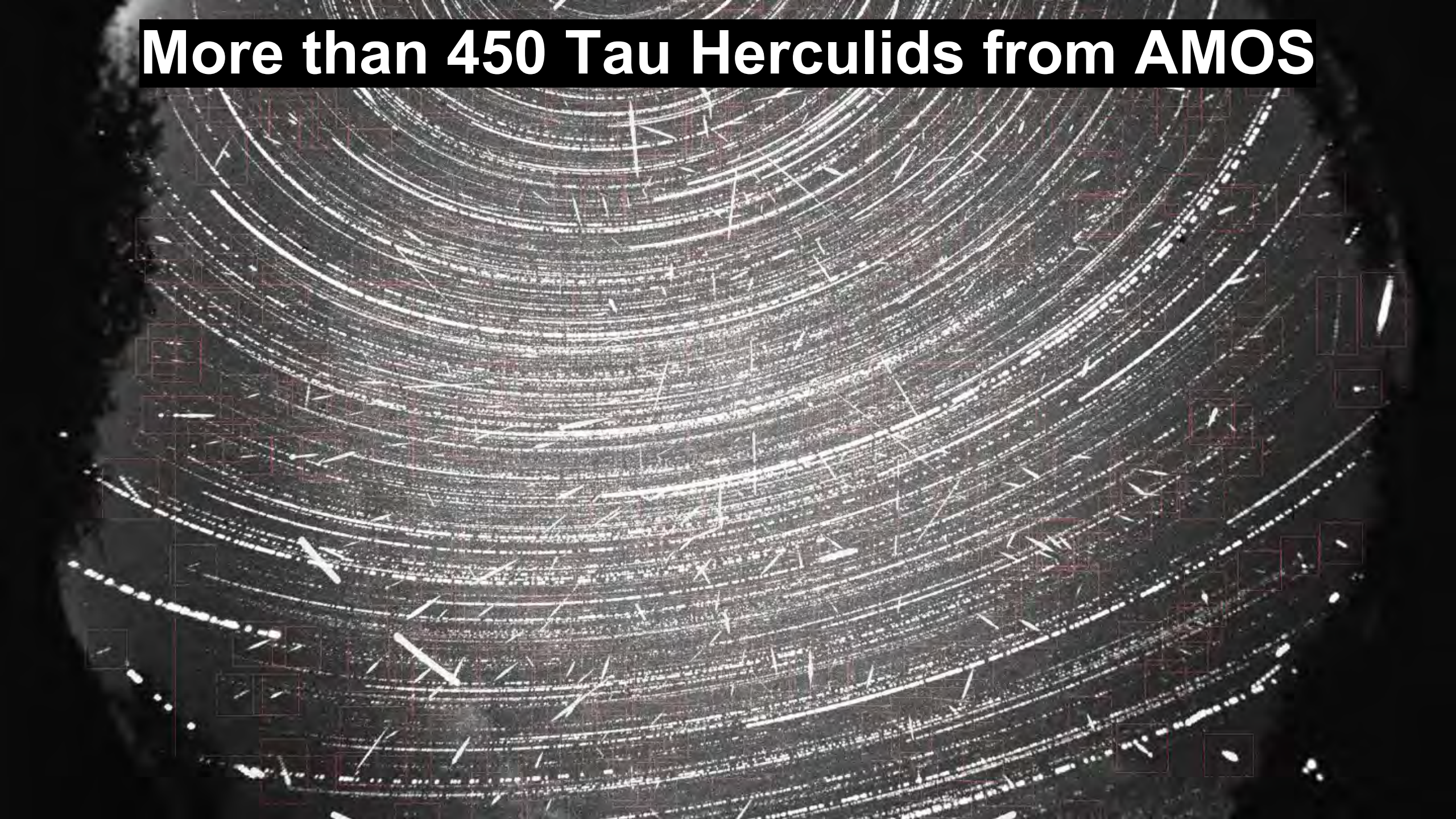
Občas naše kamery zachytia aj iné „javy“





Ground Tau Herculids 2022 mission

More than 450 Tau Herculids from AMOS





r. barsa



Air based Tau Herculids 2022 mission

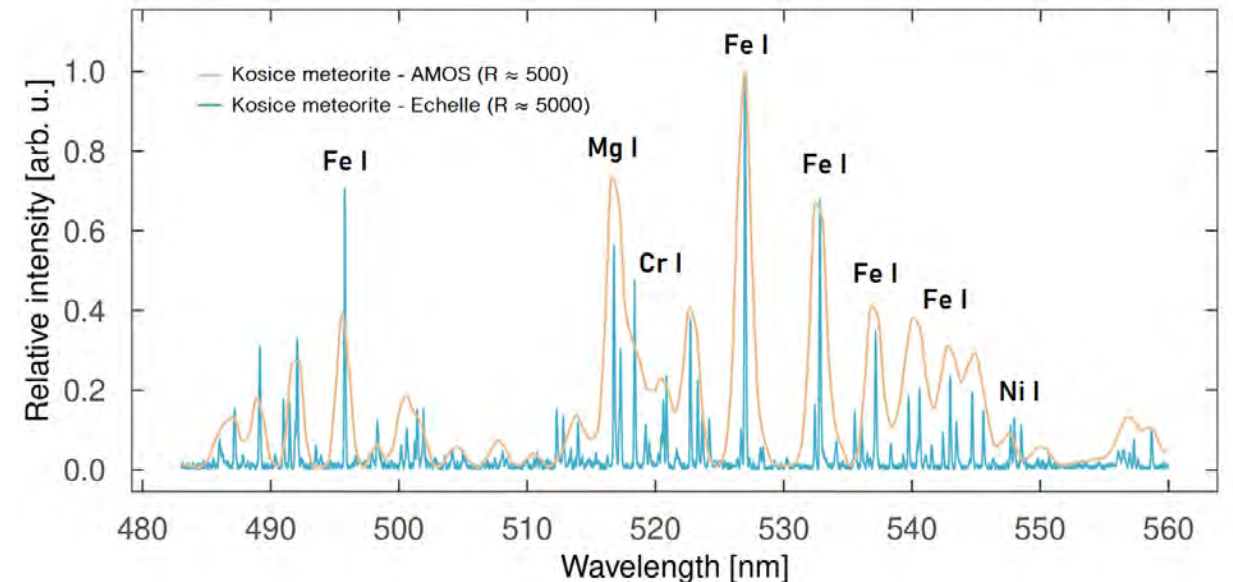
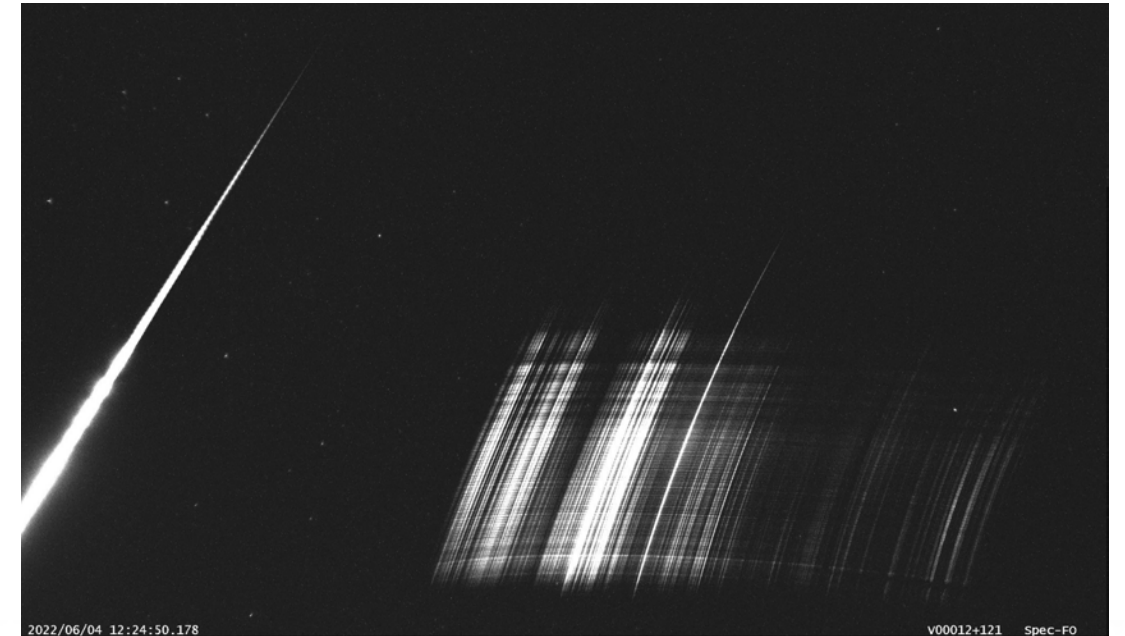
Rocket Technologies International (RTI, **Australia**), the University of Southern Queensland (**Australia**), HEFDiG (High Enthalpy Flow Diagnostics Group, Institute of Space Systems, University of Stuttgart, **Germany**), IMCCE (Observatory Paris, **France**) and Comenius University Bratislava (**Slovakia**)

Charakteristika

- Emisné spektrá meteoroidného materiálu a atmosféry
- Dve spektrálne komponenty:
 - hlavná / nízкотеплотná (~ 5000 K, plazma v okolí telesa)
 - sekundárna / horúca ($\sim 10\,000$ K, rýchle meteory)
- Teplota plazmy závisí na rýchlosti meteoru
→ spektrálna závislosť emisie jednotlivých čiar

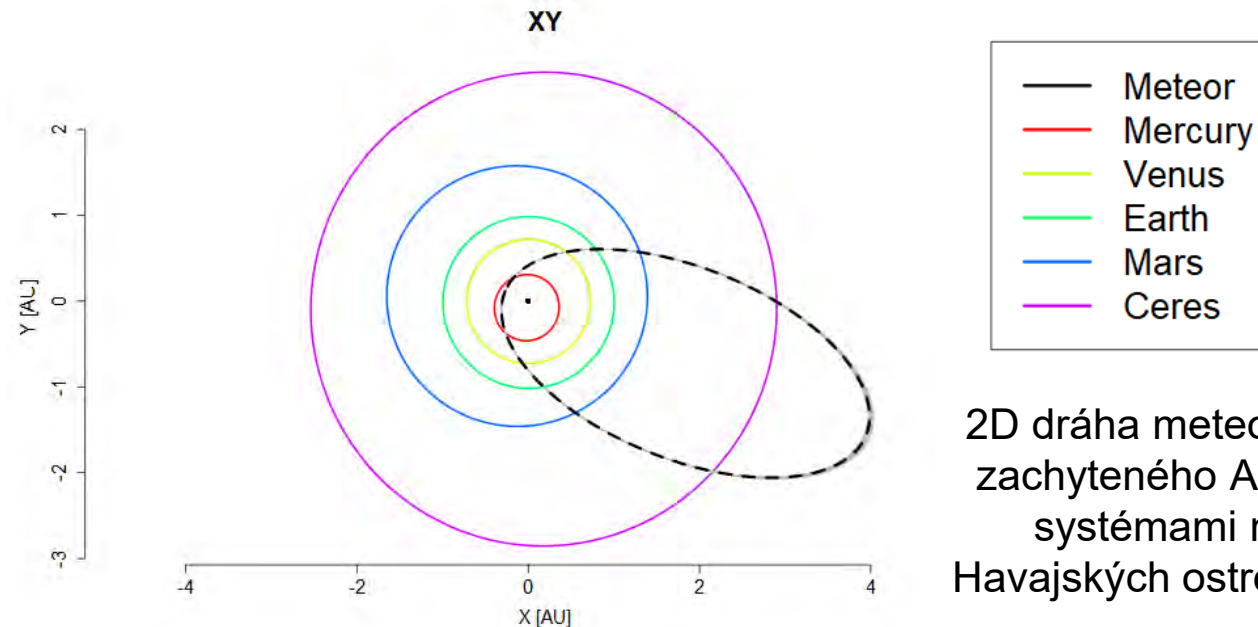
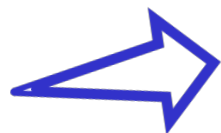
Štúdium spektier

- Low resolution spectra → variácie pomerov intenzít spektrálnych čiar
- High resolution spectra → radiative transfer models, relatívne abundancie prvkov



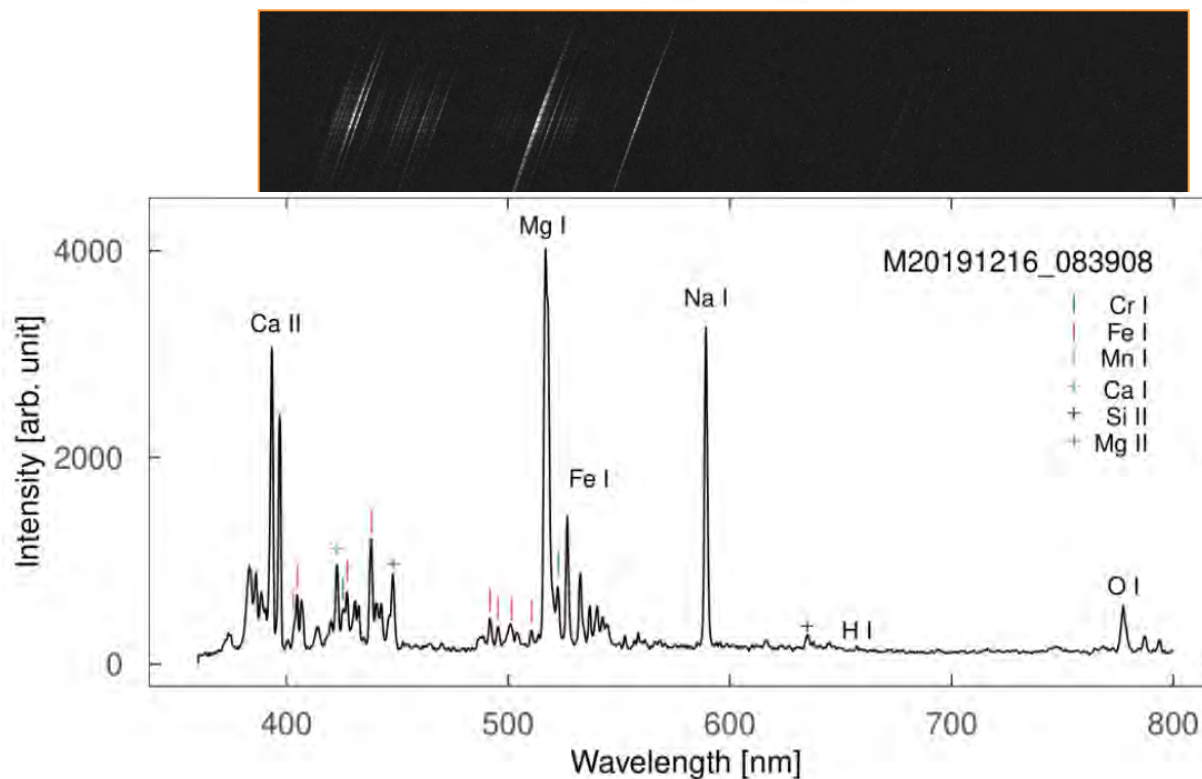
Náš výskum

výpočet dráhy - priradenie k meteorickému roju/ sporadickému pozadiu



2D dráha meteoroidu zachyteného AMOS systémami na Havajských ostrovoch.

spektrálna analýza meteorov – chemické zloženie, fyzikálne vlastností meteorov (pevnosť materiálu, hustota, ...)



Spektrum meteoru zachyteného AMOS spektrogramom na Havajských ostrovoch.

Ca rich meteoroids over Australia, Hawaii



Ďakujem za pozornosť!

toth@fmph.uniba.sk

