33rd International Meteor Conference

Giron, France

18 – 21 September 2014

Thursday, 18 September 2014

14:00 - 19:00 Arrival and **registration IMC participants in Giron at "La Fauconnière"**

19:00 - 19:15 Welcome speeches by local authorities (La Fauconnière)

19:15 - 19:20 Opening of the 33rd IMC by Cis Verbeeck (La Fauconnière)

19:20 - 19:30 *LOC:* "Welcome speech and announcements" (La Fauconnière)

19:30 - 20:00 Welcome drink at "La Fauconnière"

20:00 - 21:00 Cold buffet in "La Fauconnière" (available until midnight for late arriving participants)

21:00 - 23:00 Workshop: "Planning of the new IMO website"

Friday, 19 September 2014

07:30 - 08:30 **Breakfast** (Restaurant "Fauconnière/Hotel Kyriad")

08:45 Session 1: Meteor networks (video and others) (Chair Jürgen Rendtel) - (Lecture room "La Fauconnière")

09:00 - 09:30 ***Detlef Koschny:*** **"CILBO - lessons learned from the operation of a double-station meteor camera setup"**

Abstract: The CILBO double-station meteor camera setup has been operational now for about 1.5 years. This paper will give an impression of the obtained data and provide 'lessons learned' from such an automated setup.

09:30 - 09:50 ***Esther Drolshagen:*** **"Meteor velocity distribution from CILBO double station video camera data"**

Abstract: This paper is based on data from the double-station meteor camera setup on the Canary Islands - CILBO. The data have been collected from July 2011 until 2014. The CILBO meteor data were used to analyze the velocity distribution of sporadic meteors and compare it to a reference distribution for near-Earth space. The velocity distribution derived from the Harvard Radio Meteor Project (HRMP) for 1 AU outside of the influence of Earth was used as reference. This HRMP distribution was converted to an altitude of 100 km by considering the gravitational attraction of Earth. The new velocity distribution ranges from 11 - 71 km/s and peaks at 16.5 km/s. Measured and predicted velocity distributions are compared. Fast meteors are usually greatly over-represented in optical and radar measurements of meteors. Special attention is paid to the relatively slow meteors and an attempt is made to extrapolate fluxes to lower velocities. This paper presents first results of the ongoing analysis of the meteor velocity distribution.

09:50 - 10:10 ***Theresa Ott:*** **"Meteoroid flux determination using image intensified video camera data from the CILBO double station"**

Abstract: This paper is based on data from the double-station meteor camera setup on the Canary Islands - CILBO. The data have been collected from July 2011 until 2014. As a first step the statistical distribution of all observed meteors from both cameras was analyzed. Parameters under investigation include: the number of meteors observed by either one or both cameras as a function of the seasons, magnitude and angular velocity. It was found that typically one third of observed meteors were detected by both cameras (when both were operating). In a second step a bias correction was applied. The meteors were separated into sporadic and stream meteors. Masses were calculated first for identified stream meteors with their known velocity. Furthermore, the detection probability and the true velocity of the meteors are calculated from the data. The equation from Verniani [1965] is used to convert brightness and velocity to the mass of the incident particle. This paper presents first results of the meteor flux analysis.

10:10 - 10:20 ***Felix Bettonvil:*** **"High-resolution velocity determination on meteors"**

Abstract: No abstract submitted.

10:20 - 10:40 ***François Colas:*** **"FRIPON and "Vigie Ciel" networks"**

Abstract: The aim of the FRIPON network is to collect future meteorite falls over France coupled with accurate orbit determination. The project started on january 2014. We made technical tests in order to define a new camera holder. we will show all our results and the descrition of the reduction pipe line.

10:40 - 10:50 ***Yoan Audureau:*** **"New acquision and detection sofware"**

Abstract: The Fireball Recovery and InterPlanetary Observation Network (FRIPON) is a French project started in 2014 which will monitor the sky using 100 all-sky cameras to detect meteors and retrieve connected meteorites at the ground. There are several softwares of detection over the World. Some of them are proprietary. Also, some of them are hardware dependent. We are developing now an open source software for meteor detection to be installed on the FRIPON network's stations. The software will turn on Linux with gigabit ethernet cameras and we plan to make it crossplatform. This talk is focused on the meteor detection method used for the pipeline development and the actual capabilities.

10:50 - 11:00 ***Min-Kyung Kwon:*** **"Astrometry with fish eye lens and orbit determination"**

Abstract: No abstract submitted.

11:00 - 11:30 **Coffee break & Poster Session**

11:30 ***Session 1: (continued) Meteor networks (video and others) (Chair Thomas Weiland)*** **- (Lecture room)**

11:30 - 11:50 ***Pete Gural:*** **"Offbeat and Wacky Projects using a Video Meteor Camera"**

Abstract: The relatively easy access to low-light sensitive video cameras makes doing meteor astronomy reachable by most amateur enthusiasts. But why just do standard moderate FOV collection and monitoring in either single station mode or as part of a network? Included herein are some projects that may appeal to the more adventurous and those with an experimental nature in the IMO. Discussion will include a directional cosmic ray detector, MACHO detection, all-aspect meteor spectroscopy, robotic fireball tracker, short baseline telescopic triangulation, daylight meteor detection, RGB triplet camera, and spinning mirror sporadic detector.

11:50 - 12:00 ***Auriane Egal:*** **"Low dispersion meteor velocity measurements with CABERNET"**

Abstract: The "CAmera for BEtter Resolution NETwork" provides still photographies of meteors from a 3-station network based in Southern France and Spain. We present here the method we developed to compute the velocity of the meteor, based on an estimate of the apparent velocity in the images. The dispersion found for the 3D-velocity is much lower than in the classical computation of the velocity (by a factor of roughly 10 or more).

12:00 - 12:10 ***Meryem Guennoun:*** **"Meteor observations from double station in Morocco"**

Abstract: We are working on the first meteor network in Morocco and the whole African continent, for more information, here is the first initiative :http://cdsads.u-strasbg.fr/abs/2013JIMO...41..121R . Optimising the direction of the cameras, in order to conduct permanent meteor obervations from double station, one located at Oukaimden Obervatory and the other at AGM (Atlad Golf Marrakech), has been one of our main goals. Here we present our first scientific results.

12:10 - 12:25 ***Juraj Toth:*** **"Expeditions 2014 with AMOS Cameras"**

Abstract: Slovak Video Meteor Network (SVMN) is a project of Comenius University in Bratislava for continuous monitoring of meteor activity over Slovakia and surrounding countries. The network is based on AMOS (All-sky Meteor Orbit System) Cameras, which astrometric precision was calibrated using several commonly observed fireballs within European Fireball Network. The cooperation with other national video meteor networks and amateur observers yielded to EDMOND video meteor database. The results of AMOS cameras as well as from SVMN database will be presented. The extension of the AMOS-Cam(s) for Canary Islands and Chile to cover Southern hemisphere is planned. We will

present results from expedition on Canary Islands (ACO) and from Canada (Camelopardalids).

12:25 - 12:35 ***Felix Bettonvil:*** **"The Benelux CAMS network"**
Abstract: No abstract submitted.

12:35 - 12:45 ***Denis Vida:*** **"CMN_ADAPT and CMN_binViewer software"**
Abstract: Lecture will be about the new CMN_ADAPT software which uses CAMS capture&detect + CMN methods of calibration and processing. It provides completely autonomous operation and uploads fully processed and calibrated data to the server at the end of the day.

12:45 - 12:55 ***Ana Georgescu:*** **"ROAN - from analog to digital solutions"**
Abstract: development of digital video solutions after analyzing the problems of analog cameras.

13:00 - 14:00 Lunch - (Restaurant Fauconnière)

14:00 ***Session 2: Meteor shower observations (Chair Jérémie Vaubaillon)*** **- (Lecture room)**

14:00 - 14:30 ***Sirko Molau:*** **"Obtaining population indices from video observations of meteors"**
Abstract: No abstract submitted.

14:30 - 14:40 ***Roman Piffl:*** **"Double station meteor train from brightest Lyrid in EDMOND database"**
Abstract: We managed to record a meteor train of brightest Lyrid from two stations. The lecture provides a summary of the evolution of the track measurements and a good results of the speed of movement of matter at high layers of the atmosphere.

14:40 - 14:55 ***Damir Šegon:*** **"A Possibe New Shower On Eridanus-Orion Border"**
Abstract: No abstract submitted.

14:55 - 15:10 ***Mariusz Wiśniewski:*** **"Camelopardalids expedition"**
Abstract: Preliminary results from Camelopardalids expedition to Canada.

15:10 - 15:20 ***Bill Ward:*** **"Camelopardalids 2014. A radio view"**
Abstract: A time lapse video was generated using audio spectrum analyser software to produce images of meteor pings recorded during the Camelopardalid outburst on May 24, 2014. (Radio source: GRAVES Radar 143.050MHz) Using these images a count was made of activity through the predicted peak. Although a major increase in activity was not seen there were two maximums in the meteor counts at the times predicted by David Asher (http://star.arm.ac.uk/~dja/209P/).

15:20 - 15:40 ***Przemysław Żołądek:*** **"Future plans of the Polish Fireball Network"**
Abstract: No abstract submitted.

15:40 - 16:00 ***Thomas Weiland:*** **"Geminids 2012 - a spectacular show from Oman"**
Abstract: No abstract submitted.

16:00 - 16:30 Coffee break & Poster Session

16:30 ***Session 2: (continued) Meteor Shower observations (Chair Detlef Koschny)*** **- (Lecture room)**

16:30 - 16:50 ***Jürgen Rendtel:*** **"Daytime meteor showers"**
Abstract: No abstract submitted.

16:50 - 17:00 ***Regina Rudawska:*** **"Independent identification of meteor showers in EDMOND database"**

Abstract: Cooperation and data sharing among national networks and International Meteor Organization Video Meteor Database (IMO VMDB) resulted in European viDeo MeteOr Network Database (EDMOND). The current version of the database (EDMOND 4.0) contains 83 369 orbits collected from 2001 to 2013. In our survey we used EDMOND database in order to identify existing meteor showers in the database. In the first step of the survey we found groups around each meteor within similarity threshold. Mean parameters of the groups were calculated and compared using a new function based on geocentric parameters (solar longitude, RA, DEC, and Vg). Similar groups were merged into final groups (representing meteor showers), and compared with IAU Meteor Data Center list of meteor showers. This talk presents the results obtained by the proposed methodology.

17:00 - 17:15 ***Anna Kartashova:*** **"Meteor observations in Russia"**

Abstract: No abstract submitted.

17:15 - 17:35 ***Kristina Veljković & Ilija Ivanović:*** **"Software for analysis of visual meteor data"**

Abstract: In this paper, we will present new software for analysis of IMO data collected from visual observations. Software consists of package of functions written in statistical programming language R, as well as JAVA application which uses these functions in a user friendly environment. R code contains various filters for selection of data, methods for calculation of Zenithal Hourly Rate (ZHR), solar longitude, population index and graphical representation of ZHR and distribution of observed magnitudes. JAVA application allows everyone to use these functions without any knowledge of R. Both R code and JAVA application are open source and free with provided user manuals and examples.

17:35 - 18:00 ***Oleg Ugolnikov:*** **"Perseids and Sporadic Meteor Dust in the Earth's Atmosphere by All-sky Polarization Measurements of the Twilight Background"**

Abstract: In this talk the results of all-sky polarization observations started in 2011 in central Russia are presented. The device provides fast simultaneous measurements of sky background intensity and polarization over wide sky area up to 70 degrees from the zenith from the day until the deep night.

Using the procedure of multiple scattering separation based on the observational data, the Stokes vector field of single scattering in the mesosphere (up to 85-87 km) is obtained. It is used for two purposes. First, the mesosphere temperature can be measured in the summer period, when it fall down to 130-140 K, allowing the polar mesospheric (or noctilucent) clouds (NLC) to appear. Opposite to "global warming" process on the Earth's surface, fast cooling is observed in mid-latitude and polar summer mesosphere.

Second, polarization data allows to detect the effects of meteoric dust moderation. The effect has several maxima, one of these was registered during the Perseids activity in 2013. Effect also has the daily variations with maximum in the mornings that can be explained by sporadic meteor dust. Estimated altitude of maximum dust concentration is about 81-83 km, which is also typical for NLC particles created on the meteoric dust.

18:00 **Poster Session:**

01. ***Zeljko Andreic, Damir Segon and Denis Vida:*** **"A statistical walk through the IAU MDC database"**

Abstract: The IAU MDC database is an important tool for the study of meteor showers. Trough the history, the amount of data for particular showers, and also their extent, in the database varied significantly. Thus, a systematic check of the current database (as of. 1st of June, 2014) was performed, and the most important issues are reported and discussed. The most obvious one is that the database contains showers for which only basic radiant data are available, and showers for which full set of radiant and orbital data is provided. As a lot of current work on meteor showers involves D-criteria for orbital similarity this automatically excludes showers without the orbital data from such work. More, data for some showers were derived on the basis of only a few orbits which seems inadequate today, and such cases are also discussed. Last, a few inconsistencies were found and an attempt to correct them was made.More numerical and graphical datat is presented on the poster, than is possible in the talk itself.

02. *Peter Dolinsky, Ivan Dorotovic, Marian Vidovenec:* "Report on Radio Observation of Meteors (Iža, Slovakia)"

Abstract: During the period from 1 to 17 August 2014 were experimentally registered meteors using radio waves. This experiment was conducted in the village of Iža, Slovakia. Its main objective was to test the technical equipment intended for continuous registration of meteor echoes, which will be located in the Slovak Central Observatory in Hurbanovo. These tests are an indirect continuation of previous experiments of observation of meteor showers using the technology available in Hurbanovo at the end of the 20th and the start of the 21st century.The device consists of two independent receiver systems. One recorded echoes of the transmitter Graves 143.050 MHz (N47.3480° E5.5151°, France) and the second one recorded echoes of the TV transmitter Lviv 49.739583 MHz (N49.8480° E24.0369°, Ukraine). Apparatus for tracking radio echoes of the transmitter Graves consists of a 9-element Yagi antenna with vertical polarization (oriented with elevation of 0 ° to azimuth 270°), receiver Yaesu VR-5000 in CW mode, and a computer with registration using the program HROFFT v1.0.0f. The second apparatus recording the echoes of the transmitter Lviv consists of a LP antenna with horizontal polarization (elevation of 0° and azimuth of 90°), receiver ICOM R-75 in the CW mode, and also a computer with registration using HROFFT v1.0.0f. Total of about 78000 echoes have been registered during around 700 hours of registration. Probably not all of them are caused by meteors. These data were statistically processed and compared with visual observations in the IMO database. Planned own visual observations could not be performed due to unfavourable weather conditions lasting from 4 to 13 August 2014. The registered data suggest that in this configuration were performed observations in the back-scatter mode and not in the planned forward-scatter mode. Deeper analysis and longer data sets are, however, necessary to calibrate the observation system and this will be subject of our future work. It is also considered a realization of an own radio beacon similar to the BRAMS system. This is still at the stage of a legislative procedure.

03. *Abderrahmane Ibhi:* "Tighert: A New Eucrite Meteorite Fall from Morocco"

Abstract: The fall of the Tighert meteorite took place the night of 9 July 2014 at 22h 30 min. The bolide traveled from North-West to South-East and experienced several fragmentation events along its atmospheric trajectory. Eyewitnesses in several locality of the Guelmim-Es-Semara (Tata, Tirhert, Foum El Hisn, Douar Imougadir, Taghjijt, Assa, …) saw the bolide and heard audible detonations a few minutes later. Immediately after the fireball event the authorities of the area organized a field search to check for possible security problems. Detailed mineralogical and petrological examination of the meteorite have revealed that it is comparable to an Eucrite, meteorite "magmatic" that comes from the asteroid belt, exactly Vesta-4.

04. *A. Terentjeva, E. Bakanas:* "Meteorite producing fragment on the Apophis' orbit"

Abstract: No abstract submitted.

05. *Maria Hajdukova Jr., Regina Rudawska, Leonard Kornos, and Juraj Toth:* "April ρ Cygnids"

Abstract: We have examined the recently-established April ρ Cygnid meteor shower (ARC, IAU#348). The ARC was discovered by the Canadian Meteor Orbit Radar survey (CMOR; Brown et al., 2010), and later confirmed by video observations made by the Cameras for Allsky Meteor Surveillance project (CAMS; Phillips et al., 2011). As reported by Neslusan and Hajdukova (2014), the stream could be part of a broader complex of showers, possibly associated with the long-period comet C/1917 F1 (Mellish), which is the known parent body of the December Monocerotids (MON, IAU#019). According to their model of the meteoroid stream originating from the comet, one of the filaments corresponds to the April ρ Cygnids. However, the similarity between the mean characteristics of the predicted and the real showers is not clear. The present study is based on an analysis of the orbital parameters of the April ρ Cygnids, extracted from several catalogues, using an independent identification methodology proposed by Rudawska et al. (2014). The catalogues used include the EDMOND database (Kornos et al., 2014 a, b), and the SonotaCo shower catalogue (SonotaCo, 2009). The results of the orbital evolution of the comet and the stream meteoroid orbits, including the published orbits of ARC from CMOR and CAMS, are presented. The conclusion as to their common origin is also discussed.

06. *R. Rudawska, J. Toth, D. Kalmancok, P. Zigo:* "Slovak Video Meteor Network - Meteor Spectra"

Abstract: After the great success of the All-Sky Meteor Orbit System (AMOS), we upgraded the system by adding AMOS-Spec camera, for recording meteor spectra. The long-term AMOS-Spec program aims to measure the main element abundances of meteors detected by AMOS. Installed in Modra Observatory station camera is based on AMOS camera, equipped with 30 mm f/3.5 lens and 500 grooves/mm grating. Having trajectory and orbit from AMOS, and merging it with simultaneously measured spectrum from AMOS-Spec, allow us to identify the source of the meteoroid. Here, we report on preliminary results from a sample of meteor spectra collected by AMOS-Spec camera since November 2013.

07. *Tudor Georgescu, Mirel Birlan, Cezar Leseanu, Octavian Ghita, Cosmin Banica:* "Evolution - ROAN 2014"

Abstract: Evolution - ROAN 2014.

08. *Mike Hankey, Vincent Perlerin:* "Meteor Terminology poster translated into different languages"

Abstract: Meteor Terminology poster translated into different languages.

09. *Roman Piffl:* "Open Meteor Data"

Abstract: Overview freely available databases of meteors and meteor orbits. Call for general data sharing on meteor obtained by different techniques.

10. *Peter Zimnikoval:* "Activity and Observability of Meteor Showers throughout the Year"

Abstract: No abstract submitted.

11. *Vasily Dmitriev, Valery Lupovka, and Maria Gritsevich:* "Determination of meteoroid orbits using numerical integration of equation of motion"

Abstract: The article describes a technique for determining orbit of meteorites based on strict transformations of coordinate and velocity vectors recommended by the IAU International Earth Rotation and Reference Systems Service (IERS) and integration of differential equations of motion. The obtained results show good correspondence with different implementations of the traditional technique which are based on zenithal attraction assumptions. The considered technique takes into account the perturbations from the Earth (as point mass), perturbations from the non-central part of the geopotential perturbations of the Moon and other planets in the Solar System and Earth atmosphere. Analysis of perturbations in the motion of meteors in time preceding meteorite collision with the ground was done. Performed comparison of the proposed technique with classical methods. Software for calculation of meteor orbit and its analyzing was developed Software for calculation of meteor orbit was developed. Using this software is able to analyze orbital motion of meteoroids in time before falling and to calculate location of collision meteorite with ground.

12. *Tioga Gulon:* "RETRAM : A network of passive radars to detect and track meteors to help in fireball recovery"

Abstract: Meteors detection and tracking is the main activity of the RETRAM group, part of the French ARRL organization. Our project uses passive radar techniques and real-time processing to detect and recognize falling objects and tries to estimate their trajectory. Experiment started in the vicinity of Paris, France. This paper shows our observations and analyses. Then it describes our technical approach and our first passive radar station and first meteor 3D localization. Finally, we describe the evolution of the system and subsequently its extension in the form of a network of stations grouping radio and optical detectors.

13. *Victor Stefan Roman:* "Automatic detection of meteors using artificial neural networks"

Abstract: No abstract submitted.

14. *Daria Kuznetsova, Maria Gritsevich, Vladimir Vinnikov:* "Košice meteoroid investigation: from observational data to analytic model"

Abstract: Impact rate estimates for the upper atmosphere are significantly higher than for the Earth's surface due to the presence of atmosphere. Thus to account for this properly

one need to model drag and ablation processes along the atmospheric trajectory. The best way to validate the resulting model is to apply it to meteorite-producing fireballs with complete observational record. We consider the recent meteorite fall – Košice – which is the result of the fireball event over central-eastern Slovakia on February 28, 2010. The landing area was successfully computed using the data from the surveillance cameras operating in Hungary. 218 fragments of the Košice meteorite, with a total mass of 11.285 kg, have been documented. In this investigation, we propose a special model based on the analytical solution of the drag and mass-loss equations. Using the observational data, two key dimensionless parameters (ballistic coefficient and mass loss parameter) are obtained which allow us to describe the mass and velocity changes of the main fragment of the meteoroid entering the atmosphere, as well as to estimate the preatmospheric meteoroid mass. Good agreement between the calculated functions and real trajectory characteristics is shown. We also apply statistical methods to describe the fragmentation process. The most probable scenario suggests that the Košice meteoroid, prior to further extensive fragmentation in the lower atmosphere, consisted of two independent pieces with cumulative residual masses of approximately 2 kg and 9 kg respectively. We also conclude that two to three larger Košice fragments of 500-1000 g each should exist in addition to already known data. The fragment distribution was studied by MG and VV under support of the Academy of Finland No. 260027 (MG) and Russian Foundation for Basic Research, projects No. 13-07-00276 (VV) and 14-08-00204 (MG). The numerical simulations and development of the analytical model were carried out by DK and MG at MIIGAiK and supported by the Russian Science Foundation, project No. 14-22-00197.

15. ***Jim Wray & Dave Samuels :*** **"The Performance of New Low Cost 1/3" Security Cameras for Meteor Surveillance"**
Abstract: No abstract submitted.

16. ***Sirko Molau :*** **"Obtaining population indices from video observations of meteors"**
Abstract: No abstract submitted.

17. ***N. Rambaux, D. Galayko, J.F. Mariscal, M-A Breton., J. Vaubaillon. M. Birlan, F. Colas, T. Fouchet. :*** **"Detection of spectral UV of meteor from a cubesat"**
Abstract: Here, we present a cubesat space mission concept devoted to the UV detection of meteor from space. Space observations have the advantages to continuously observed meteor independently of weather conditions on large portion of the atmosphere and, specifically, to perform ultra-violet light measurement because it is outside the ozone layer. The UV spectrum is interesting for the detection of elements such as Fe, C, and OH that can bring signature on the solar system formation.

19:00 - 20:00 Dinner - (Restaurant Fauconnière)

20:00 - 20:45 26th IMO General Assembly - (Lecture room La Fauconnière)

20:45-..:.. Reception offered by the IMO (wine - juice - water)
Informal socializing (Bar)

Saturday, 20 September 2014

07:30 - 08:30 **Breakfast** - (Restaurant Fauconnière, Hotel Kyriad)

08:45 Session 3: Meteoroid streams, structure and evolution (Chair Jean-Louis Rault)

09:00 - 09:30 ***Jérémie Vaubaillon:*** **"Key note lecture: The future of meteor shower forecasting"**
Abstract: The field of meteor science is rapidly changing, with many more parent bodies found thanks to constant surveys of meteor showers and detailed analysis. In this talk I will

present some latest findings regarding the parent bodies identification, as well as reflections regarding the future of meteor shower forecasting, now that the amount of parents is growing.

09:30 - 09:45 ***Maria Hajdukova:*** **"The prediction of meteor showers from all potential parent comets"**

Abstract: The objectives of this project are to predict new meteor showers associated with as many as possible known periodic comets and to find a generic relationship of some already known showers with these comets. For a potential parent comet considered, we model a theoretical stream at the moment of its perhelion passage in a far past, and follow its dynamical evolution until the present. Subsequently, we analyse the orbital characteristics of the parts of the stream that approach the Earth's orbit. Modeled orbits of the stream particles are compared with the orbits of actual photographic, video, and radar meteors from several catalogues. Th whole procedure is repetaed for several past perihelion passages of the parent comet. The procedure allows us to map the whole complex of meteoroid particles released from a parent comet, which can reveal some details in the structure of a corresponding stream. The relationship between a particular comet and known showers can be either confirmed or shown doubtful, or a new relationship can appear. To keep our description compact but detailed, we present only a single or a few parent comets with their associated showers in one paper. Here, an overview of the results from the modeling of the meteor-shower complexes of more than ten parent bodies will be presented. This enables their diversities to be shown. Some parent bodies may associate meteor showers which exhibit a symmetry of their radiant areas with respect to the ecliptic (ecliptical, toroidal, or showers of an ecliptic-toroidal structure), and there are showers which have no counterpart with a similar ecliptical longitude on the opposite hemisphere. A symmetry of the radiant areas of the pair filaments with respect of the Earth's apex was also found.

09:45 - 10:00 ***Rachel Soja:*** **"Interplanetary Meteoroid Environment for eXploration"**

Abstract: The 'Interplanetary Meteoroid Environment for eXploration' project, funded by the European Space Agency (ESA), aims to characterize dust trails and streams produced by comets in the inner solar system. We are therefore developing a meteoroid stream model that consists of a large database of cometary streams from all known comets in the inner solar system. This model will be able to predict meteor showers from any known comet, that can be observed anywhere in the inner solar system, at any time between ~1980-2080. This is relevant for investigating meteor showers at the Earth, other planets, or at spacecraft locations. Such assessment of the dust impact hazard to spacecraft is particularly important in the context of human exploration of the solar system. Examples will be shown.

10:00 - 10:15 ***Aswin Sekhar:*** **"Resonances in 209P Meteoroid Stream"**

Abstract: Various solar system dynamicists expect a spectacular meteor storm on 24 May 2014 from the comet 209P/LINEAR. Now we examine the role of some plausible mean motion resonances in the meteoroid stream which could create similar meteor outbursts or storms in the future. Some interesting dynamics pertaining to these aspects are presented.

10:15 - 10:25 ***Regina Rudawska:*** **"DON QUIXOTE -- a possible parent body of a meteor shower"**

Abstract: This talk addresses the topic of meteoroid stream parent body in relation to meteor showers observed on Earth. We carry out a further search to investigate the possibility of meteor shower observations caused by particles ejected from (3552) Don Quixote. The (3552) Don Quixote asteroid was discovered in 1983 as Amor asteroid. The Tisserand parameter for the orbit has a value of 2.315 with respect to Jupiter, which indicates a comet-like orbit. Diameter of the object calculated from the absolute magnitude, is in the range of 12.3-24.5 km. It all makes the Don Quixote a good candidate for a short-period comet among known NEOs, which recently observed cometary activity confirms it. We have investigated the orbital evolution of meteoroid stream originated from the Don Quixote. If the object was active in the past, it might be a parent body for a meteor shower observed on Earth. We modelled generation and evolution of meteoroid stream in the Solar System. The ejections of meteoroids from the asteroid surface took place when the asteroid was passing its perihelion between 5000 B.C. and 2013 A.D. Next, the orbits of ejected meteoroids were integrated to year 2050.

10:25 - 10:55 **Coffee break & Poster Session**

10:55 Session 4: Fireball events & various (Chair Ana Georgescu)

10:55 - 11:10 ***Mike Hankey & Vincent Perlerin:*** **"IMO Fireball Reports"**

Abstract: We will discuss / explain the new IMO fireball form, website efforts and future mobile app efforts. Explain work we did in the last year and what we have planned for next year. Will submit more formal abstract asap.

11:10 - 11:20 ***Vasily Dmitriev*****: "New meteorite recovered in northern Russia based on observations made by the Finnish Fireball Network"**

Abstract: We present results on the trajectory reconstruction, dark flight simulations and pre-impact orbit determination for the bright fireball which appeared in the night sky over Kola Peninsula, close to Finnish border, on April 19, 2014. The fireball was instrumentally recorded in Finland from Kuusamo, Mikkeli and Muhos observing sites belonging to the Finnish Fireball Working Group. Additionally, a publicly available video made by Alexandr Nesterov in Snezhnogorsk, Russia, from the opposite side of the fireball track, was carefully calibrated and taken into account in trajectory reconstruction. The fireball reached a magnitude of at least -18 during its peak brightness, and it was reported by many eye-witnesses in Finland, Russia, and Norway.

Deceleration analysis revealed that the pre-atmospheric mass of the meteoroid was about 500 kg. Furthermore, based on the analysis of fireball observations [1], it was predicted that part of the meteoroid survived the atmospheric entry and reached the ground. The derived physical parameters responsible for the meteoroid drag and mass loss rate in the atmosphere matched a meteorite-production criteria described in [2]. It was decided to conduct detailed dark flight simulations for survived fragments with account for the wind effects, and organize a meteorite recovery expedition in the calculated landing area. The 5-day expedition with 4 participants from Russia and Finland took place at the end of May following snow melt and preceding vegetation growth. On May 29, 2014, first 120.35 g meteorite fragment was found on a local forest road within the predicted impact area. Second 47.54 g meteorite fragment fully covered with fusion crust was recovered nearby on the following day. Mineralogical and physical analysis of the main mass was done at the Czech Geological Survey and at the University of Helsinki, respectively, using methods and instruments described in [3]. The meteorite was classified as H5 ordinary chondrite (S2, W0). Bulk density is 3.5 g/cm3, grain density is 3.8 g/cm3.

Acknowledgements. The expedition and laboratory research were supported by Academy of Finland and Ural Federal University. Orbit determination and analisys was done by Vasily Dmitriev and Valery Lupovka in MIIGAiK and supported by Russian Science Foundation, project #14-22-00197

References:

[1] Lyytinen E. and Gritsevich M. 2013. Proceedings of the International Meteor Conference 2012, pp. 155-167.

[2] Gritsevich M. et al. 2012. Cosmic Research 50:56-64.

[3] Kohout T. et al. 2014. Icarus 228:78–85.

11:20 - 11:30 ***Chris Peterson:*** **"Early Education Opportunities in Metoritics"**

Abstract: Cloudbait Observatory and the Denver Museum of Nature and Science have been operating an allsky camera network in Colorado since 2001. Most of the cameras are hosted at middle schools (ages 11-13) and high schools (ages 14-18), with some notable exceptions targeting even younger students. In addition to generating a rich collection of scientific data, this program has been very successful at introducing students to "real science", where relevant data is collected and analyzed, and the opportunity for new discovery and even publication is present. I will discuss our experience with exploring meteoritics with pre-college age students and the value to both our science program and to early science education.

11:30 - 11:45 ***Zeljko Andreic, Damir Segon and Denis Vida:*** **"A statistical walk through the IAU MDC database"**

Abstract: The IAU MDC database is an important tool for the study of meteor showers. Trough the history, the amount of data for particular showers, and also their extent, in the database varied significantly. Thus, a systematic check of the current database (as of. 1st of June, 2014) was performed, and the most important issues are reported and discussed. The most obvious one is that the database contains showers for which only basic radiant

data are available, and showers for which full set of radiant and orbital data is provided. As a lot of current work on meteor showers involves D-criteria for orbital similarity this automatically excludes showers without the orbital data from such work. More, data for some showers were derived on the basis of only a few orbits which seems inadequate today, and such cases are also discussed. Last, a few inconsistencies were found and an attempt to correct them was made.

11:50 - 12:35 Lunch - (Restaurant Fauconnière)

12:45 Departure for excursion to CERN

14:00 - 17:00 Guided visit at CERN

17:00 - 17:30 CERN Shop and Lavatories

18:30 Return at Giron

18:30 - 19:00 Closing reception (Restaurant Fauconnière)

19:00 - 20:00 Closing dinner (Restaurant Fauconnière)

20:00-..:.. Last night of the IMC in the bar, free entertainment and informal chat

Sunday, 21 September 2014

09:00 - 10:00 **Breakfast** (Restaurant Fauconnière/Hotel Kyriad)

10:00 Session 5: Radio and Radar observations (Chair Cis Verbeeck)

10:00 - 10:15 ***Jean-Louis Rault:*** **"Radio observation for Fripon Network"**
Abstract: No abstract submitted.

10:15 - 10:30 ***Giancarlo Tomezzoli:*** **"EARS, MARS Combined Meteor Radio Observations - 2014"**
Abstract: The Lyrids meteor shower was generated on 21-22/04/2014 by the passage of our Earth in the path of the debris let by the comet C/1861 G1 (Thatcher). The EurAstro Radio Station (EARS) and the Malta Astro Radio Station (MARS) were operated for a combined Lyrids meteor radio observation campaign. The study of the results thought for an improvement in the meteor shower characterisation. An attempt is here described for better characterising the Camelopardalidis 2014. However, the problems of estimating of the number of background meteor echoes per hours and of estimating the airplane hidden meteor radio echoes need further meteor radio observations for finding solutions.

10:30 - 10:45 ***Chris Steyaert:*** **"The Global Radio CAMs"**
Abstract: No abstract submitted.

10:45 - 11:00 ***Stijn Calders:*** **"Automatic detection of meteors in the BRAMS data"**
Abstract: No abstract submitted.

11:00 - 11:20 ***Tom Roelandts:*** **"Meteor Detection for BRAMS Using Only the Time Signal"**
Abstract: No abstract submitted.

11:20 - 11:40 ***Antonio Martinez Picar:*** **"Modeling and calibration of BRAMS antenna systems"**
Abstract: Because of the geometry associated with the forward-scatter method for observing meteors via radio, knowing the radiation pattern of the involved antennas is essential to obtain parameters of scientific interest such as the meteoroid flux density. In this paper results of simulations of the antennas belonging to the Belgian radio-meteor stations network (BRAMS) that are directly managed by the Belgian Institute for Space Aeronomy (BISA) are presented as well as plans for verifying their patterns using an Unmanned Aerial Vehicle (UAV).

11:40 - 11:55 ***Geert Barentsen:*** **"Conference summary"**
Abstract: No abstract submitted.

11:55 - 12:05 Closing of the 33rd IMC by Cis Verbeeck

12:30 - 13:30 Lunch (Restaurant Fauconnière)

13:30 Departure of participants