Fireball and Meteor Event 20130824190218UTC'Pilis'

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Introduction: The medium sized fireball events are hardly (or mostly non) documented analytically. The small meteor events, for example meteor showers are caused by sand sized grains and almost all of them disintegrate and never reach the Earth's surface. However, they are observed on thy sky as paths radiating when they entry to the higher atmosphere. They can be analyzed chemically from spectrograms of pictures and videos of meteor surveillance cameras and have a large documented data. Large meteor events are well documented from physical and chemical analysis of pieces. **'Medium'** sized meteor events are not well documented because they overwhelm and overflow the usual meteor shower surveillance cameras and it is hard to find any pieces from falling, because of small amount of fallen mass. Let we try to document a new event.

Our earlier work (Vizi et al. 2012)[1] documented the falling camera images which were used to identify the touchdown region of the meteorites. In the case of the Košice meteorite fireball and falling event, all steps from webcam pictures of fireball throughout collection at the falling site and the petrological analysis of the pieces have been documented in this way.

The Pilis Event on 24th August, 2013: There was a fireball event above Slovakia and Hungary on 2013.08.24. 21:02 UT. As we documented with tables and calculations in our earlier work (Vizi et al.)[2], we have collected web camera sources from the internet, nine photographs and one video record and some well documented descriptions from witnesses, like Molnar. Images were taken by eight web cameras, two of them were ski webcams of ski-truck at slopes, one was a meteorological webcam and others were panoramic webcams. The video is a record of a car dashboard camera. The place was near to Radom, Poland, but only approximately known. The image sources were Cerna Hora, Nadejkov, Medvedin, Ondrejov, Paprsek, Stitna nad Vlari, Temelin, Vsetin (Slovakia). [3] In Hungary the sky was covered by clouds, so only the strong lightning of the final explosion was observed for example at Dorog, or Pilisszentlélek, both in Hungary. One well documented witness wrote she heard a serial of sonic booms, the first sound come 160-170 seconds after the last light at Perbal, Hungary. Several significant information were collected by Biro, Molnar and Tepliczky. [4]

Early, quick processing conception by Vizi (2011) [1] was carried out in order to select at least two well computable webcam pictures which are relatively long distance observations from each other both in km-s and in angle of view. Google Earth and other maps were used to calculate the positions. GPS positions of cameras were identified first, which was a bigger task for several hours. Finally Medvedin and Temelin were selected for first quick computing.

Picture Processing: Černá Hora, Czech Republic, Europe, 'Zinneckerovy boudy' ski house, 1095 m, 50.644073°N 15.762633°E, Camera direction: azimuth:132,5° ±1° declination: -3° ±1° below of the horizon.

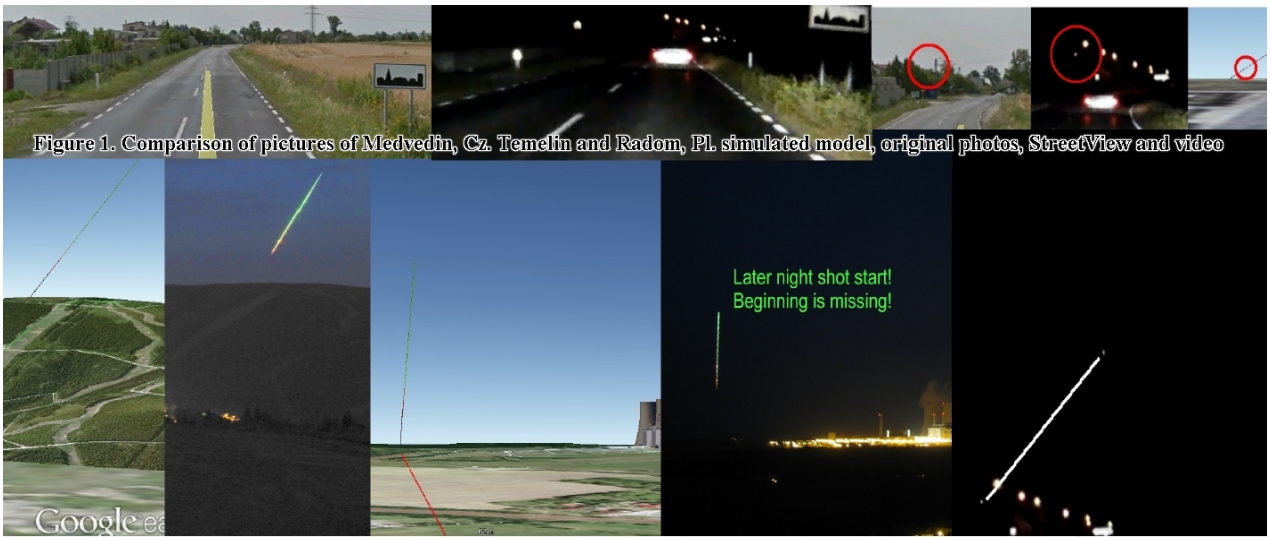

Figure 1. Comparison of pictures of Medvedin, Cz. Temelin and Radom, Pl. simulated model, original photos, StreetView and video

http://kamery.humlnet.cz/archiv.php?kamera=cerna_hora&datum=1377371040&velikost=2048

Medvedin: Medvědín, Krausovy Boudy, Královéhradecký kraj, Czech Republic, Europe; ski house, 1231m 50.741430°N 15.580742°E, Camera direction: azimuth: 115,5 ° ±1° declination: -2,765° ±1° below of the horizon, (came from arc tan of perpendicular leg from height: 1231-990m and from distance leg: 5000m of measurable triangle from height data of Google Earth) .Start of fireball 149,92°, end of fireball 145,25°, orbit line at horizon 142,6° azimuth

Significant surface objects were available to pinpoint the vertical planes of begin and end of fireball and stab point of orbit.

Temelin: Temelin Webcam of Meteorological Tower, Czech Republic, Europe, webcam: 535m, 49.197937°N 14.342840°E

End of fireball 115,19° azimuth, orbit line at horizon 114,52° azimuth. The early begin of fireball is missing in Temelin, because of the local start of the exposition, but from other full long fireball orbits it was usable especially to pinpoint the end of fireball and the end of the orbit. Other cameras were processed later by Hegedűs and Csizmadia [2][5]

Video processing can be used to determine the start, orbit and the end of the fireball light, the brightness (from the known distance), the timing of the event (frame by frame) and form this info the estimated time of the fireball by Vizi. The only available info was: car video which was taken near the town Radom, Poland [4]. The position of camera was calculated from direction of fireball, the angle of the turn of the road and from several available objects, like the settlement early warning traffic sign table and reflective lane guide plastic bollards of road, concrete fence and its corner on left side, lamps of lighting poles. The searching was successful on Google Earth and Street View. The position of the video camera: 51.258840°N 21.095921°E, azimuth. 21° frames, 7frames/s, fireball 3s.

The quick approx results (Vizi)**:** Initial 100kg, speed Solar 14km/s, at atmosphere 20km/s fall 47.67°N 18.96°E fall 1-5 kg (no pieces certificated until now)

Numerical Processing: As published [2] the initial mass range:12-230kg, probable 49kg. Absolute brightness is -8.5 +/- 1.5 mag. Min terminate mass is 0,51 kg. Fall: 47°37' 10" = Uncertainty: 5' 57" and 19°01' 28" Uncertainty: 5' 28"; in decimal the fall is: **47.617915°N 19.025647°E**

Speed of Meteor: According to our calculations [2] the atmosphere contact speed was 14,5 +/- 2,5 km/s

Orbit of the Pilis Meteor in the Solar System: According to the plane of orbit and the acceleration effect of Earth's gravitation the Pilis meteor came on an orbit from the inner part of Solar System approaching the near vicinity of the Sun.

Analytical: Can we estimate any analytical information from available pictures until we haven't fallen pieces? Considerations: If light is generated by thermal process then colors are 10000K cyan, 6000K white, 5000K yellow, 4000K orange and 2500K red, which would also be assigned to the following emission centers in the electromagnetic spectrum. A wavelength range between 400 and 500 nm (blue region) is associated with Fe, dominantly. This region also contains Ca (at 398, 423 and 448 nm). The spectral area ranged between 580 and 630 nm is related to Na, respectively. Absence of the olivine-induced green color (due to the chondritic material) may also indicate the cometary formation of the Pilis meteorite (Refs), however, its origin is still a matter of further discussion. Let we look at the fireball picture made by a Canon EOS 1100D on a webcam network, optimized for humans

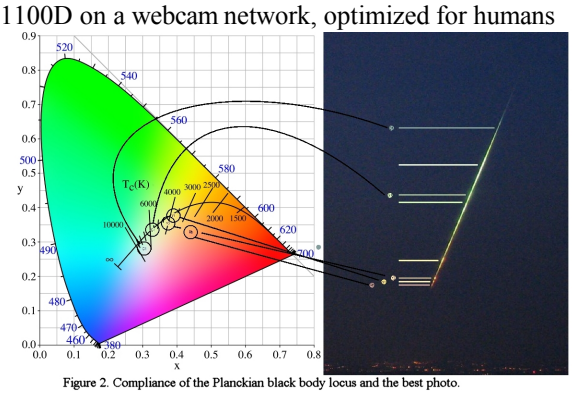

Figure 2. Compliance of the Planckian black body locus and the best photo.

We are continuously searching for new data and meteorite pieces. We are in connection with local restaurants, post offices and mayors at fall place.

Conclusion: Last few meteor events and the new detection possibilities implied: it is necessary to collect the available web cameras, its positions and it seems to be necessary to investigate the building up a network - which is a combined surveillance system both for small and bigger meteor events, - with meteor cameras to record and analyze time and timing, orbit and direction, spectrum of fireball and the falling position.

References: [1] Vizi et al., (2012) Summarized Analysis and Conclusion of Fireball-Meteorite 2010. 02.28. Košice" nipr symposium2012/ E31_M_PalVizi_1.pdf [2] Fireball and meteor event 20130824'Pilis' www.nipr.ac.jp/symposium2013/abstract/abstract/OS_ViziPal_1_v2.pdf [3] Hulmnet, Cz. kamery.humlnet.cz, kamery.humlnet.cz/archiv.php?kamera=cerna_hora&datum=1377371040&velikost=2048 [4] Biro et al.: Fireball blog, http://tuzgomb.blogspot.hu/2013/08/fenyes-tuzgomb.html [5] Csizmadia Sz., priv. comm.)