A critical review of Zhilyaev's ***opus*** etc. ***"Unidentified aerial phenomena I. Observations of events" BE***

After listening to the seminar, I became convinced of the frank anti-scientific nature of these studies. Instead of a critical analysis of observations (taking into account errors, adequacy of models, accuracy in post-processing), the authors fit the data to absolutely non-physical results. The author of the "research" openly refuses to lead a discussion, answer questions, etc. As colleagues noted, the author openly professes a "religious" method of cognition, belief in UFOs or UAP, which is incompatible with the methods of modern science. He repeatedly weaves in the words or visions of some military personnel as an argument of the discussion, which have nothing to do with his observations or the topic under discussion. For uncomfortable questions or explanations of the unreality of the results of the interpretation of his observations within the framework of modern physics, the author refers to some metaphysical, supernatural laws or extraterrestrial technologies. Skeptical views on the accuracy of observations, remarks about the uncertainty or outright fallacy of the models are ignored or rejected by the author. Accordingly, further scientific discussions are absolutely impossible, the place of such "research" is somewhere in a sect of "UFO witnesses" or a church, where "faith" and "miracles" are the main arguments for knowing the world. Nevertheless, I present my main comments and questions to the "article":

Photometry

1. The uncertainty of the shape of the object leads to significant errors in distance measurement even under otherwise ideal conditions. For example, an asymmetry of only 2 times leads to an error in determining the distance up to 3 times in the lower layers of the atmosphere and up to tens of times at heights of more than 5-6 km, where the nonlinearity of the contrast-altitude dependence is the largest.

2. The uncertainty of the object's albedo leads to similar errors, even under otherwise ideal circumstances. The assumption of zero albedo is very far-fetched, if only because the authors themselves observe both bright and dark objects. And in nature, it is difficult to find surfaces whose albedo is less than 0.05 and more than 0.95. Accordingly, the uncertainty of albedo can introduce an error in determining the distance by tens of times in the direction of decreasing distance.

Colorimetry 1.

The authors use color cameras with a 6mm lens. Appropriate scale for the camera ASI 178MC (2.4 µm pixel) = 80 arc.sec./pixel = 1.3 arc.min./pixel ASI 294MC (4.63 µm pixel) = 2.6 arc.min/pixel Both values contradict the parameters given in the article (10 pixels = 3 angle minutes) respectively 4 and 8 times approximately.

2. At this scale, the distance between blue and red pixels is proportional to angular dimensions of objects, which makes any colorimetry impossible. For example, for the ASI 294MC camera, the distance between color pixels (6.5ÿm) becomes about 11 meters at a distance of 10 km. Accordingly, it simply does not make sense to measure the color of the declared objects with a size of 3-12 meters.

3. The article does not consider the problem of camera lens aberrations, but as can be seen from

Fig.21 they are quite significant. The best wide-angle lenses have chromatic aberration values at the level of 0.5-1 pixel, which can significantly affect the colors in the neighboring pixels of the Bayer matrix and, accordingly, introduce huge errors in colorimetry. **Methodology** 1. The authors use the adobeRGB format for processing, which is inconvenient and very inaccurate for data manipulation, because it is non-linear and contains some simplifications (covers approximately 50% of colors visible to the eye). 2. When converting RAW data from .SER to aRGB space, interpolation is used for neighboring pixels using reference points (white balance). This nullifies all further colorimetry. **Errors and problems in the text:** Page 1 and 7 1. It is not clear how the authors measured the width of the flash in one hundredth of a second (10 ms), if in Fig. 23 the pulses contain 3-4 points at 125Hz? That is, the pulses last at least 20-30 ms. Page 2 1. The ASI 178MC and ASI 294MC cameras use CMOS sensors, not CCD. This is important, because the advantages are used: speed, low reading noise, cutting ROI.

2. 10 pixels = 3 arc minutes does not coincide with the given camera parameters or with given graphs, where the diameter of the Moon has a size somewhere from 20 to 50 unclear what (pixels?) 3. Colors are compared with the indicators (BV) of the Sun, although what are they here for

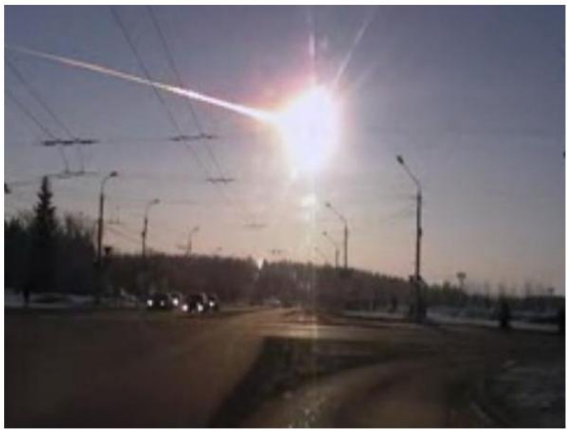
it is not clear, because the authors observe against the background of diffuse light of the sky. Obviously, blue skies have a very different BV.

4. The authors discovered a "dependency", the brighter the object, the greater its speed (it is not clear what the truth is), turning everything upside down. This dependence becomes obvious if we assume the observation of objects with a high albedo (poplar fluff, for example) at distances of 1-100 m. Their speed is approximately the same and constant within the wind speed (up to several m/s). Accordingly, the closer they are to the camera, the brighter they are in sunlight and, accordingly, the angular velocity is greater. Page 3 1. It is not clear what Bouguer's law of absorption (or Bouguer - Lambert -

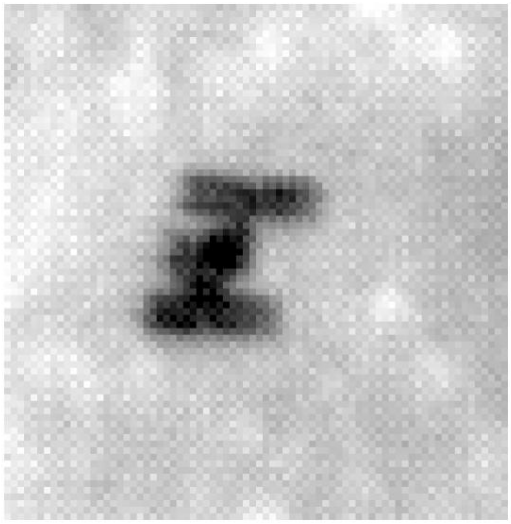
Bera), because scattered light is already observed. In this case, this formula should be integrated along the path of the ray, and the value ***I*** should be calculated depending on the zenith angle of the object and the height of the Sun. In addition, the quantities ***I and I0*** are described identically.

2. The given values of absorption at 0.2m and 0.34m depend significantly on the zenith angle. In addition, they do not correspond to formula (4), differing by one and a half times, if we substitute the parameters of 0.44ÿm and 0.55ÿm wavelengths for the B and V ranges. Page 4 1. An object with a size of 5 pixels at a distance of 5 km (Fig. 7) corresponds to the physical

10-20m in size. A similar object with a speed of more than 7 km/s looks approximately like this (Chelyabinsk bolide size 15-17 m, speed 17 km/s, height 20-24 km):



2. In Fig.7, the brightness of the object has 4 units, and the background has about 10 units. The article does not mention image calibration (noise, background leveling, etc.), which calls into question the accuracy of the data and complicates their correct interpretation. If, for example, the noise is 2 units, then the contrast of the object increases by almost 2 times, accordingly, the distance decreases significantly.
3. The article does not mention the accuracy or errors of measurements or results at all,
   which calls into question the professionalism of the authors.
4. If we assume that the object is fast and shadows the sky in the frame for only a fraction of the exposure, then the contrast generally grows to large values, and the distance to zero.
5. At a speed of 52 degrees/sec for an exposure time of 1 ms, the object moves at least by 3 arc minutes, which is either 10 pixels according to the authors' data or 2-3 pixels according to the calculations of the sensor parameters. If the size of the object is 5 by 10 pixels, this gives a huge uncertainty in measuring the brightness of the object.
6. The image of Fig. 7 from a color camera looks like this only after debayerization,
   that is, assigning two colors to each sensel by interpreting the adjacent ones. Accordingly, the colors of the object at each point already take into account a certain white balance set during interpolation, which nullifies colorimetry and introduces large errors in the determination of brightness. Here is a typical view of the original image in RAW before debayerization (the ISS flyby on the background of the Moon, ZWO 294MC, exposure 0.5 ms, 19 fps) with fair Bayer color matrix values:



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In Fig.9, the surface of the Moon is surprisingly uniform and has a size of more than 350 units (pixels?), which contradicts the previous available descriptions of the equipment. But the background of the sky in Fig. 7 has a rather noticeable noise structure. 2. Fig. 10, 11, 12, 14 show colorimetric measurements of objects on a clear sky background. At the same time, the background colors have the same brightness in all colors. This contradicts the light scattering formula given by the authors and simple observations, where the clear sky has a pronounced blue tint. 3. In Fig. 8, 10, 11, the contrast of dark objects also has the same value in all colors, which contradicts the main postulate of the authors for measuring the distance to such objects.

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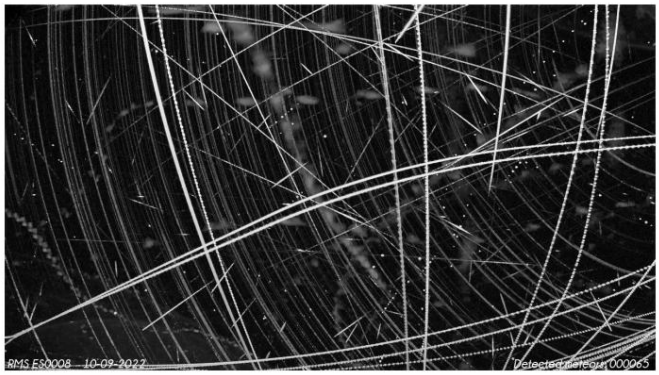
The software-hardware method of time synchronization for frames with precision is not described 1 ms. Commonly used OS usually cannot guarantee the accuracy of time stamps (in a recorded file or a program label) more precisely than 10-20ms. Accurate synchronization requires a hardware source of time signals (GPS receiver, etc.) and a hard real-time OS. Since the authors use a normal OS and standard software for capturing frames from the camera, the synchronization of individual frames with an accuracy of 1ms seems doubtful. 2. The appearance of an object on two frames synchronously with an accuracy of 20ms is a simple coincidence

circumstances of registration of various objects (butterflies, birds, insects, dust, etc.). Accordingly, a similar flicker frequency, if there was one, around 20 Hz is typical for insects or birds, for example, of the same species or size. Just look at a typical meteor station session:



General remarks:
1. The article is completely sloppy, out of 23 graphs, 19 do not have axis labels at all! 2. Graphs with symmetrical axes are for some reason stretched along one axis. Are the pixels, for example, not square for the authors? 3. The given formulas are unclear in the context, the description contains errors, the simplifications are huge. Who writes like that in formula (3) with two "/" in a row?

4. Only two references, one of which is a self-citation. 5. The text is full of terms and words inherent in the yellow press and pseudo-scientific publications, such as the Pentagon, are interested in UFOs, trans-medium objects, we see them everywhere, we see these ships, squadrons of ships, etc.

General conclusion:

The article is pseudo-scientific in form and content, the methods are simply full of inaccuracies, simplifications, fabrications and outright manipulations. The conclusions are mostly absurd, far-fetched and have nothing to do with simple natural explanations of observed phenomena. Considering that the authors quite knowingly passed off this work as an already printed article in a professional peer-reviewed journal, I consider it a deception and falsification that casts the shadow of pseudoscience on the entire GAO.

September 12-18, 2022 Chief AKIOC of the GAO of the National Academy of Sciences, Ph.D. Veles O.A.