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Insects as unidentified flying objects: comment

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Callahan and Mankin's article¹ was somewhat unrealistic. The electric field strengths cited and used were an order of magnitude higher than other authors' boundary-layer values; the Tesla coil used to produce their displays was a high-frequency ac device, while fields in or near thunderstorms are generally accepted as dc with some polarity reversals associated with lightning discharges; coronal discharge was not demonstrated for moderate to large numbers of insects; and the existence of strong electric fields or thunderstorm activity was not established for the times of the UFO sightings.

Callahan and Mankin stated, "a combination of thunderstorms plus a high density of particulate pollution would without a doubt give electric fields far above the 1.7–2.2 kV/cm necessary for a corona discharge."¹ Meteorological literature on boundary-layer fields during thunderstorm activity does not support this contention. It is also doubtful that triboelectric phenomena could account for significant potential gradients during thunderstorm activity because of the high relative humidity, which reduces triboelectric effects. All the literature surveyed reported atmospheric fields substantially below 1 kV/cm, and dc in nature.

Callahan and Mankin¹ stated that Gunn² found field strengths as high as 3.4 kV/cm in thunderstorms. Although this figure was reported by Gunn, it was for an altitude of ~4000 m aboveground; Gunn noted that near the ground, the field was much less.² His data show that the average field strength at just over 1000-m altitude was only 17% of the strength at 4000 m;² thus the maximum field strength between 1000 m and the ground was less than 0.7 kV/cm. Many other sources corroborate the magnitude of this estimate. Another source cited by Callahan and Mankin¹ described a thunderstorm incident where the field near the ground rose to 0.015 kV/cm.³ This occurred during blowing-sand conditions and thus must have involved substantial triboelectric effects. Johnson⁴ stated that boundary-layer fields under thunderstorms may reach 0.3 kV/cm, but that fair-weather fields average ~0.0013 kV/cm. Shvarts⁵ reported that the average field strength at the top of a thunderhead was 0.13 kV/cm. Imyanitov and Chubarina⁶ reported terrestrial fair-weather fields of around 0.0013 kV/cm, and thunderstorm fields of 0.1 kV/cm. The classical text by Chalmers⁷ noted fields of 0.37 kV/cm under thunderstorms. Uman⁸ characterized the thunderstorm field near the ground as on the order of 0.1 kV/cm; he used this as the value during lightning bolt occurrence.

It is important to realize that for the 1.7–2.2-kV/cm potential (dc) used for their corona studies, Callahan and Mankin did not report any radiant flux measurements.¹ They only reported radiant flux densities for 5–7 kV/cm high-frequency Tesla coil fields; not only was this field strength ten times the maximum strength reported under thunderstorms near the ground, it was high-frequency ac, and thus must be considered an invalid representation of natural conditions. Loeb⁹ has described the effect of frequency on ac coronas, but his results will not be elaborated on here, since ac coronas are not relevant.

The insects would have to be in swarms to be adequately visible, according to Callahan and Mankin,¹ but they did not establish the existence of coronal discharge for insect swarms in the laboratory. As described by such authors as Chalmers,⁷ Uman,⁸ and Loeb,⁹ coronal discharge involves current flow, which reduces the potential difference and electric field; a swarm of discharging insects would rapidly attenuate any local gradients high enough to create a coronal display. In the experiments which Callahan and Mankin described,¹ the charge on the capacitor was constantly replenished by the high-voltage supply, and not much current was involved because insect swarms were never used.

Callahan and Mankin should have established the presence of strong field conditions at the times of the UFO sightings. This could have been done with direct field measurements, or at least with meteorological reports which indicated thunderstorm activity. Clearly, fair-weather fields are too low to create persistent coronal phenomena with insects. Callahan and Mankin stated that the Uintah region was probably struck by orographic and frontal thunderstorms quite frequently, possibly at the times and locations of the sightings, but they claimed that they could not obtain any meteorological data from the region.¹ Presumably they could not acquire synoptic scale maps for the dates in question; anyway it could be argued that such maps might not explicitly characterize the local meteorological conditions during the sightings. However, some of the sightings described in detail by Salisbury¹⁰ contain witness sky-condition reports. Of seventeen detailed sightings, ten contain sky observations; in seven cases the sky was clear; and in only three cases, clouds were present. Thunderstorm activity was not mentioned. For instance, Callahan and Mankin quoted a sighting which occurred on 1 September 1966,¹ but neglected to mention that for this sighting, the witness noted that the sky was clear.¹⁰

I have used NOAA synoptic maps for the dates of most of the sightings reported by Salisbury¹⁰ to determine whether thunderstorm activity was possible. Activity was considered possible if (1) surface-level frontal passage was imminent or had recently occurred (within 6 h), or (2) upper-level (500-mbar) conditions indicated possible significant weather, or (3) any precipitation was reported in the region surrounding the Uintah Basin, or (4) geostrophic winds were clearly from the southeast ($135^\circ \pm 45^\circ$), so that orographic precipitation might occur. If any of the conditions listed above were

present, thunderstorm activity was considered possible, even though this technique clearly overestimated actual activity. When these assumptions were made, only 22.5% of the sightings involved nonsilver objects, possible thunderstorm conditions, and occurred at night. It was assumed that a description of the phenomena as silver, fair-weather conditions, or daytime observations precluded the coronal explanation (because the coronal discharges are not silver, and not very bright). A majority of the sightings, 58.8%, took place on clear days or nights, or involved silver objects. Approximately 19% of the sightings involved insufficient information for adequate synoptic analysis.

I do not support any particular hypothesis for the Utah UFO sightings; I simply wish to point out that in most and probably all cases, spruce budworm or other insects were not creating significant optical phenomena. Callahan and Mankin's paper¹ has been widely cited as a new plausible explanation for UFOs in such sources as *Time*¹¹ and the BBC World Service (short-wave radio broadcast).¹² The information and hypotheses forwarded in this Letter clearly demonstrate the inadequacy of the Callahan and Mankin hypothesis; unfortunately, the general public probably now believes their hypothesis to be a well-grounded theory or even fact. Entomologists should not use UFO reports to indicate insect migrations (as suggested by Callahan and Mankin¹), because UFO reports probably do not involve swarms of coronal insects.

References

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Insects as unidentified flying objects: author's reply to comment; 1

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With regard to the comment by Kyaw Tha Paw U,¹ I believe that he overlooks certain forces in nature. Paw U does not seem to be aware of the literature covering the phenomenon of St. Elmo's glow.

Ball lightning is accepted as a natural phenomenon, although no really good physical explanation has yet been de-



Fig. 1. Indian meal moth, *Plodia interpunctella* (Hübner). This scanning electron microscope photograph shows the proboscis and surrounding scales. Lepidoptera scales are loosely attached, corrugated, and pointed at their tips as shown by the scales laying on the proboscis. I am indebted to Thelma Carysle, USDA, for this photograph.

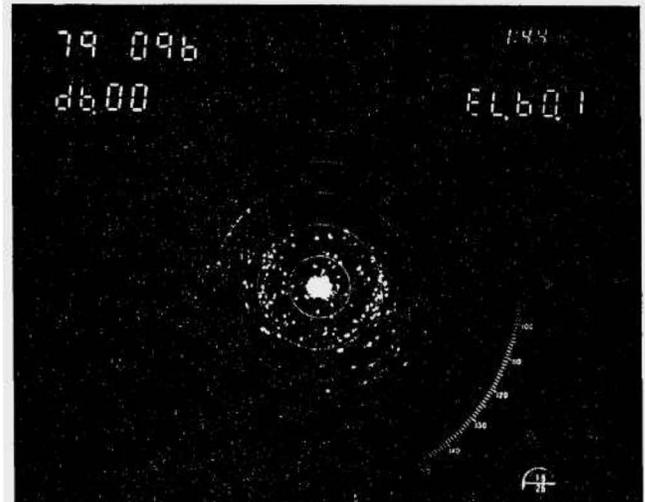


Fig. 2. The PPI scope of a 9.425-GHz (x-band) radar looking at insects over agricultural fields in Arizona (6 April 1976, 1:44 a.m.). Antenna elevation 60°; range rings 0.25 N. mi., center-ground terrain. Note that the insects tend to group and layer in the second ring (1/2 N. mi.) and can be seen dimly layered in the fourth ring (1 N. mi.). Layering and grouping of insect plankton is not at all unusual. I am indebted to Wayne Wolf, Agricultural Engineering, USDA, for this PPI photograph.