

MAY 2 1968

DB

→ Dr. Rutchford
for

ASTRONOMY DEPARTMENT
NORTHWESTERN UNIVERSITY

MAY 2 1968 Reed

Astronomy Colloquium

Dr. J. Allen Hynak
Northwestern University

"Dr. Condon, Science and Look"

4 P.M. Friday, 3 May 1968

Lecture Rm. 4 Technological Institute

Coffee available at 3:30 p.m. Dearborn Observatory

FINAL EXAMINATION
ASTRONOMY A20
Spring Quarter 1968
11:00 a.m. June 8, 1968

Note: The following are true-false questions. If you think the statement is true as stated, check the T; if you think the statement is false, check the F. The manner of grading true-false questions is to subtract the number wrong from the number right, thus adjusting for guesswork. (A five-year old might be expected to get 50% on a random guess basis.) Therefore, if you are not sure of the answer, it is best to leave entry blank. This is one case in which gambling generally does not pay.

1. T F The familiar spectral classification OBAFGKM represents a temperature sequence.
2. T F An upper-main sequence star (O or B type) cannot be as old as the sun.
3. T F The sunspot cycle is 17 years long on the average.
4. T F Hubble's constant refers to the speed of precession of comets.
5. T F Double stars obey all of Kepler's laws.
6. T F The twinkling of stars is caused by the earth's atmosphere.
7. T F Sunspots are hotter than their surrounding areas.
8. T F Stars on the main sequence obtain their energy by the conversion of hydrogen into helium.
9. T F Imagine an observer enclosed in a large opaque box traveling through open space. There is no way in which that observer can determine his speed.
10. T F The faster an object travels with respect to an observer, the less massive it appears.
11. T F Kepler and Newton were contemporaries.
12. T F The sun is a member of a spiral galaxy.
13. T F Globular clusters are condensed open clusters.
14. T F The majority of meteors can be traced to the disintegration of the planet Pluto.
15. T F The current theory of the formation of the solar system is that the planets were produced by the sun's close encounter with another star.
16. T F The presence of matter curves the space-time continuum.

17. T F In Einstein's universe a photon of light could never return to its source.
18. T F From the examination of currently available data, pulsars are a later evolutionary form of quasars.
19. T F In Relativity, the Interval is absolute.
20. T F The Michelson-Morley experiment showed that the velocity of light is unaffected by the velocity of the earth.
21. T F Venus exhibits the same phases as the moon.
22. T F For an observer at the North Pole the celestial equator coincides with the horizon.
23. T F Kepler's second law states that two janitors with equal training, sweep out equal areas in equal time.
24. T F Stars evolve "down" the main sequence.
25. T F Stars down to the tenth magnitude can be seen with unaided eye.
26. T F The masses of stars can be obtained from the study of double stars.
27. T F The sun is a middle-aged star.
28. T F Copernicus invented the telescope.
29. T F Stefan's law states that the energy output in a star is proportional to the fourth power of the temperature.
30. T F According to Wien's Law, the sun radiates its maximum energy in the ultraviolet region of the spectrum.
31. T F Cepheid variable stars are found below the sun on the main sequence.
32. T F The Andromeda Galaxy is best described as an elliptical type galaxy.
33. T F All stars on the main sequence have equal masses.
34. T F An event in Relativity is represented by the intersection of two world-lines in the space time continuum.
35. T F The speed of light was first measured in the 17th century.
36. T F A rapidly receding M star in the constellation of Pisces is known as a red herring.
37. T F The velocity diagram for galaxies is based on the red shift.
mainly
38. T F The dark patches in the Milky Way are due/to the irregular distribution of stars in the Milky Way.

39. T F The Center of the Milky Way galaxy is best observed by radio telescopes.
40. T F The largest optical telescope in the United States is located on Mt. Palomar.
41. T F The largest refracting telescope in the world is located at the Yerkes Observatory.
42. T F The closest star is 93 million miles from the earth.
43. T F The red-shift is generally interpreted as a Doppler effect.
44. T F There is no positive assurance of the existence of life on any planet in the solar system.
45. T F The solar constant is the rate at which energy is received at the distance of 1 AU from the earth.
46. T F The Carbon-Nitrogen cycle method of energy production occurs predominantly in the cooler stars.
47. T F An epicycle is a Ptolemaic device to account for the retrograde motion of the planets.
48. T F Galaxies have absorption spectra.
49. T F The earth is closest to the sun in January.
50. T F The solar electromagnetic energy is primarily due to radioactivity.
51. T F The sidereal day is longer than a solar day.
52. T F The orbit of Halley's comet is very nearly a circle.
53. T F A supernova is a cluster of novae.
54. T F Giant stars are larger than dwarf stars.
55. T F Perigee and Perihelion represent the same basic idea.
56. T F For electromagnetic radiation, the higher the frequency, the longer the wavelength.
57. T F The astronomical unit is the mean distance of the earth from the sun.
58. T F A radio telescope cannot be used in the daytime.
59. T F The days of the week were named after the planets.
60. T F The age of a star cluster can be estimated from its H-R diagram.
61. T F The earth rotates from west to east.
62. T F At the equator all stars rise and set.

63. T F Population I stars are found in the spiral arms of galaxies.
64. T F Mariner IV to Mars showed that Mars has craters similar to those on the surface of the moon.
65. T F Eclipses of the sun are possible because the sun and moon have approximately the same linear size.
66. T F The blackness of the night sky can be used as an argument for an expansion of the universe.
67. T F The sky is blue because air molecules are blue.
68. T F To place a star on the H-R diagram it is necessary to know its temperature and absolute magnitude.
69. T F The moon rotates once for each time the earth rotates.
70. T F The moon sets in the west.
71. T F The moon moves eastward among the stars.
72. T F A total eclipse of the moon can be seen by more people than a total eclipse of the sun.
73. T F Light from a blast furnace would show a continuous spectrum.
74. T F Radial velocity is measured by the Doppler effect.
75. T F The head of a comet is composed of a nucleus and a coma.
76. T F We use the Gregorian Calendar.
77. T F The ancient mariner was an obsolete spaceship to Venus.
78. T F A parsec is equal to 3.26 light years.
79. T F Bode's law does not apply to Mercury.
80. T F The Milky Way is the center of the Universe.
81. T F Asteroids exist mainly between the orbits of Jupiter and Mars.
82. T F A-type stars have the strongest hydrogen lines because A-type stars have the most hydrogen.
83. T F Galaxies frequently occur in clusters.
84. T F The solar wind is a stream of ionized particles.
85. T F The photosphere of the sun is best seen at midnight.
86. T F An annular eclipse of the sun is one which occurs every year.

87. T F The sun keeps the same face toward us at all times.
88. T F Tycho Brahe invented the telescope.
89. T F An eclipse of the sun can occur only at new moon.
90. T F Jupiter is the largest planet in the solar system.
91. T F The moon can sometimes pass in front of Venus.
92. T F The moon rises later every day.
93. T F According to the mass-luminosity relation, the luminosity of a star increases with increasing mass.
94. T F Vernal equinox is one of the intersections of the ecliptic and celestial equators.
95. T F When it is 10 p.m. in New York it is 7 p.m. in San Francisco.
96. T F In the steady-state theory the universe is not regarded as expanding.
97. T F The sun is completely gaseous throughout.
98. T F The Aurora Borealis, or northern lights, occur most frequently at times of the sunspot maximum.
99. T F Syzygy is an asteroid that comes very close to the earth.
100. T F The current theory of the formation of the solar system is due to Weizsacher-Kuiper.
101. T F Terrestrial planets have no atmosphere.
102. T F The radio telescope was invented in the 19th century.
103. T F Meteors are seen most numerous after midnight.
104. T F The altitude of the pole is equal to the latitude of the observer.
105. T F The cyclical motion of the north celestial pole in the sky and the precession of the equinoxes are caused by the same thing.
106. T F Population II stars are older than Population I stars.
107. T F The Lindheimer Astronomical Research Center (LARC) uses reflecting telescopes.
108. T F The Pleiades are an example of a globular star cluster.

109. T F The sun is a G-type star.
110. T F Pulsars are so-called because they show extremely regular radio pulses.
111. T F The Unified Field Theory attempts to explain electromagnetic phenomena as geometrical properties of the space-time continuum.
112. T F If the sun continues to lose mass at its present rate, it will have dwindled to half its present mass in one billion years.
113. T F It is the mass loss mentioned above which is causing the period of the earth's rotation gradually to increase.
114. T F Due to relativistic effects in a strong gravitational field, the light of white dwarf companion of Sirius is considerably blue-shifted.
115. T F The Newtonian or Galilean Relativity Principle states that "(the) motions of bodies included in a given volume of space are the same among themselves whether that volume of space is at rest or moves uniformly forward in a straight line."
116. T F The proton-proton cycle requires carbon as a catalyst.
117. T F Einstein's universe is finite but unbounded.

8 January 1965

Mrs. Joan M. Doan
Quarters 4208G
U. S. Air Force Academy
Colorado

Dear Mrs. Doan:

This is in answer to your letter of December 9. Thank you for being so cooperative.

I am struck by one thing, and that is by a fact you failed to mention. Comparison with the almanac shows that the crescent moon was in the precise part of the sky you saw your crescent shaped object. It seems almost impossible that this could be so, but obvious mistakes are frequently made, and the moon, when rising, and viewed through scudding clouds and perhaps additional meteorological conditions, can fool people. We do have documented cases in which the setting moon has been the source of several UFO reports.

I'd appreciate your opinion on this, and, of course, if you saw the moon separately from this object, this could hardly be the explanation. The fact is, however, that the moon was in almost the precise spot you described. May I have your reaction on this hypothesis?

Sincerely yours,

B. Allen Hynek
Director

JAH:krf



UNITED STATES AIR FORCE ACADEMY, COLORADO

Whenever your findings are published in book form, I would certainly like to read it. It must be a fascinating study and yet frustrating when an answer does not appear to be in sight.

I am so glad there were other observers along on the trip to see it. I have had quite a few fairly serious experiences with extrasensory perception and I'm afraid if I'd seen it alone, my family would be more or less tempted to call me a "withh."

Thank you for your letter, Dr. Hynek, and I hope I have been of at least a small bit of help.

Sincerely yours,

Joan M. [redacted]
Joan M. [redacted]

Quarters 4-2G
US Air Force Academy
Colorado

Rob Mercer

SMITHSONIAN INSTITUTION
ASTROPHYSICAL OBSERVATORY
60 GARDEN STREET CAMBRIDGE MASSACHUSETTS 02138
TELEPHONE 617 864-7910

Major Quantrell
from
H. H. H. H.
1/12/67

9 January 1968

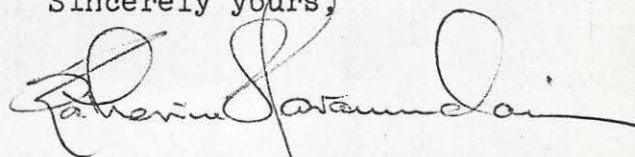
Dr. J. Allen Hynek
Dearborn Observatory
Northwestern University
Evanston, Illinois 60201

Dear Dr. Hynek:

I enclose the current list of "naked eye" satellites for your use in evaluating UFO reports. Moonwatch observations seems somewhat scanty for objects with maximum magnitudes fainter than fifth, although magnitudes fainter than fifth are often reported for satellites with brighter maxima. I am unable to determine the reason for this hiatus, but expect that nevertheless the list will be of service to you.

Good hunting!

Sincerely yours,



Mrs. K. Haramundanis

KLH:bha

Artificial satellites brighter than $m_v = 6.0$ observed by Moonwatch
prior to 1 January 1968^v.

SPADATS no.	International no.	Name	m_v
43	600601	Midas 2	4
49	600901	Echo 1	1
163	6101801	Midas 3	4
255	6200601	OSO	5
271	6201001	-	5
285	6201501	S51/Ariel	4
288	6201502	rocket	5
520	6206706	-	3
527	6300301	-	3
574	6301401	-	5 *
612	6302601	Geoph.Res.	5 *
613	6302701	-	2
683	6304301	Polyot 1	5
694	6304701	Centaur 2	3
714	6305301	S56B/Exp.19	5
717	6305402	rocket	4 *
727	6400101	-	6 *
733	6400201	rocket	4 *
740	6400401	Echo 2	-1
746	6400601	Elektron 1	5
759	6401101	-	3
872	6405201	Nimbus A	3 *
878	6405202	rocket	2
876	6405301	Cosmos 44	5
922	6407201	-	2 *
953	6408301	debris	4 *
973	6500301	-	5 *
1085	6500901	Pegasus A	1 *
1090	6501102	Cosmos 55	5 *
1092	6501104	debris	2
1097	6501401	Cosmos 58	3
1098	6501402	rocket	4
1245	6501609	rocket	3
1346	6502016	debris	4 *
1381	6503901	Pegasus B	1
1422	6505001	-	4 *
1448	6505306	rocket	2

* estimated from 3 or fewer observations

1447	6505501	-	2
1468	6506002	debris	3
1510	6506503	-	4 *
1575	6507006	rocket	4 *
1589	6507306	rocket	5 *
1625	6508102	rocket	4 *
1804	6509801	Alouette B	5 *
1843	6510601	Cosmos 100	4
1844	6510602	rocket	4 *
1868	6511201	Cosmos 103	4
1869	6511202	rocket	2
2169	6603802	rocket	3
2253	6605601	Pageos-A	3
2254	6605701	Cosmos 122	4 *
2257	6605702	rocket	5 *
2324	6606301	OV-8	5
2481	6608901	-	5
2519	6609702	rocket	5
2634	6611801	-	1
2696	6701802	rocket	3 *
2697	6701901	Cosmos 145	1 *
2720	6702701	Cosmos 151	5
2721	6702702	rocket	2
2762	6703901	Cosmos 156	5 *
2763	6703902	rocket	4 *
2780	6704302	-	1 *
2825	6705301	-	5
2890	6707101	-	2
2901	6707204	OV 1-12	2 *
2895	6707301	OGO-D	3 *
2920	6708001	-	5
2940	6708002	rocket	5 *
2958	6708606	debris	1 *
3010	6710201	Cosmos 184	4 *
3011	6710202	rocket	4 *
3013	6710401	Cosmos 185	2
3019	6710402	rocket	2
3021	6710801	Cosmos 189	3
3023	6710802	rocket	2

SMITHSONIAN INSTITUTION
ASTROPHYSICAL OBSERVATORY
60 GARDEN STREET CAMBRIDGE, MASSACHUSETTS 02138
TELEPHONE 617 864-7910

11 March 1968

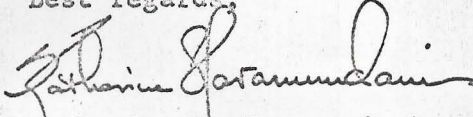
Dr. J. Allen Hynek
Director
Department of Astronomy
Lindheimer Astronomical Research Center
Northwestern University
Evanston, Illinois 60201

Dear Dr. Hynek:

In your letter of 6 March, you enclosed a list of retrograde satellites in which many naked-eye magnitudes were reported. It seems probable that the disagreement between this list of Major Quintanilla and the one which I sent you results from different source material and different time of compilation. The few bright objects in the Air Force list which do not occur on the current SAO list were not observed during the past nine months by the Moonwatch teams. It seems best, therefore, for your purposes to use both lists.

With regard to the number of retrograde satellites, there certainly are a large number orbiting. They comprise perhaps 15% of orbiting objects (or about 150 objects).

Best regards,


Katherine L. Haramundanis

KLH/mk

RECEIVED

MAR 14 1968

ASTRONOMY DEPARTMENT
NORTHWESTERN UNIVERSITY

Very Likely Hot Air Balloon
TYPED COPY OF ATTACHED LETTER

3/15/68
151 Center St.
Metuchen, N. J.

Dear Mr. Hynek:

I was told by Mrs. Burk of the Hayden Plan. to write you about my observation on March 14, 1968.

My name, Sir, is Raleigh Moore. I am a amature ast. and have been very active in this field for quite for quite a number of years.

Sir, my observation, March 14, 1968, was as follows. I was out walking my dog time 8:00 P.M. while in the park located in Metuchen, N.J. I noticed a object coming from the north west sky traveling east. I noticed the object was traveling a little faster than a planet and not quite as fast as a airplane. I also noticed the difference in the light plane vs. planet. The color of the object was a bright orange color, quite large, bright and steady. By sight I realized it was not a meteor or comet.

I continued to watch the object as it continued to move in the easterly direction the object was just about over my head at this time then I began to notice the object began to break up. I first noticed one chunk break off fall still reflecting light for a few seconds then as the object continued to move I noticed a few seconds later another chunk broke off falling and again reflecting light then the climax of the bright object was what appeared to me. Implosion ocured and in a second the bright object became black no light or reflecting at all then the object disappeared. Seeing this I went home called the Hayden Plant. there was no but a clerk to receive the information, I then called the Hayden Plan. the next day. This event took place time 8:00 P.M. approx breaking of object 8:15 P.M. implosion of object approx 8:30 P M date March 14, 1968, location of observation, Metuchen, N.J Height to me 90°, direction northeast, color orange before implosion.

I called the Hayden Plan. they informed me that Echo I was due to break up but they did not no when. They received no reports of Echo ~~f~~ breaking from the Smithsonian Inst. They said they observed nothing and did not know what it was, therefore I am sending this report to you.

Sir, I hope to hear from you soon. I hope this report is clear and understandable. It is my first report of this nature.

Yours Respectfully,

Raleigh Moore

RECEIVED

MAR 19 1968

ASTRONOMY DEPARTMENT
NORTHWESTERN UNIVERSITY

3/15/68

151 CENTER ST.

METUCHEN N.J.

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I continued to watch the object as it continued to move in the East by direction the object was just about over my head at the time then I began to notice the object began to break up. I first noticed one chunk broke off fell still reflecting light for a few seconds then as the object continued to move I noticed a few seconds later another chunk broke off falling and again reflecting light then the climax of the bright object was what appeared to me. implosion occurred and in a second the bright object became black no light or reflecting at all then the object disappeared. Seeing this I went home called the Hayden plat. there was no one but a clerk to receive the information, I then called the Hayden Plan. the next day. This event took place time 8:00 Pm. approx
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approx 8:30 Pm. date March 14, 1968. location
of observation, Putnam N.S. height to me. 90°
Direction North East. Color Orange before implosion

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Sir I hope to hear from you soon. I hope the report is clear and understandable it is my first report of the nature.

Yours Respectfully
Raleigh Moore

see 2Tr. 28 JUN 68
DR. HYNEK

I observed these balloons at 2210 hrs Monday June 10 -- (My G-D, I hope they were the balloons). In case you have any cases come up for comparison, my sighting follows:

I was standing in the yard at 2210, looking directly south. The temperature was 73 - 75, humidity very high, very smoggy, with a high misty overcast. Only objects visible were Jupiter, very hazy, and the full moon, rising very hazy and red.

I noticed a star-like object rising slowly out of the South, heading straight North. It was about -1 in apparant magnitude, and a steady white light. It's motion was slow and continuous, about comparable to "Echo." Through 7 X 50 glasses this object remained a white point source: no other lights, no shape, and no sound. When this object was within a few degrees of the zenith, it began a course change, orbiting over to the east, preserving the same smooth flight. Then it slowed, finally remaining stationary high in the E. Then it blinked several times, with no apparant frequency or pattern, and slowly drifted back toward the S, getting fainter, as if it were climbing.

At intervals of about 5 minutes, three other objects followed, covering the same path across the sky; the only difference being the last three objects did not blink. All objects eventually drifted back toward the South and faded.

These objects definitely could have given the impression that they were under positive control.

JRH.

2639 Burnaby Drive
Columbus, Ohio 43209

June 12, 1968

Dear Dr. Hynek,

I called Ridge Ave. Monday night (June 10) to ask your permission to go out after the object described in the enclosed clipping "A". Joel said you were out of town so I did just what you'd expect me to -- I went after it anyway.

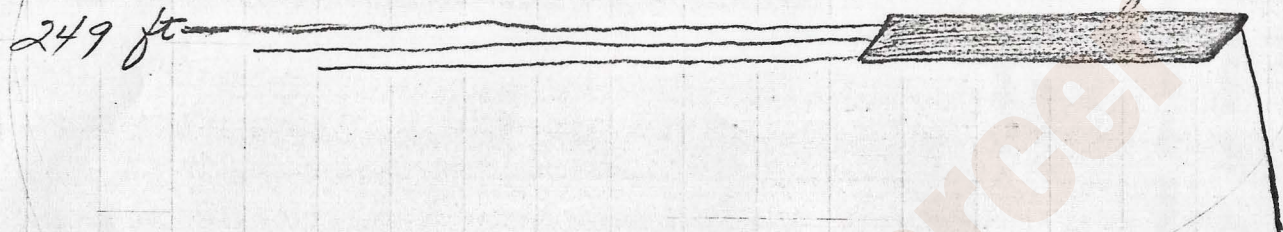
After I talked to Joel, I called this Mrs. Dunn. She seemed intelligent and willing to discuss the sighting. Before long, she was giving me a description of an object which certainly did smack of "jellyfish" and "falling leaf." There were eight observers with two pairs of binoculars. I made an appointment to see her the next day.

Meanwhile, another person had called Mrs. Dunn re: her letter. This caller, a Mr. Marmet, had observed an identical object in the same location the week before. He was driving at the time and decided to track it down. He soon arrived at Bishop Reedy High School (1½ miles from Mrs. Dunn) and found an extraordinary kite and an extraordinary kite-flyer. Seems there was an eccentric little fellow, about 30, who lives in a rented room near High & Mound (pretty crummy). He built the kite and transports it to the school grounds via City bus (!). The kite body is 30 inches high, several feet long, and has wide plastic streamers for tails -- the longest tail is 249 feet long. The enclosed drawing was made by Mrs. Dunn. She added the dimensions as given by Mr. Marmet. In their phone conversation they agreed they had undoubtedly seen the same object. Only thing left is to verify with the kite flyer that he was actually flying it On June 2 at 1900, but Mr. Marmet doesn't know how to reach him. As far as I'm concerned, I consider the case closed.

Glad I solved this one so easily, but sorry it wasn't a good juicy Type I which I personally observed from a distance of 10 feet. Better luck(?) next time.

249 ft

Platform
30" high



Drawing by Mrs. Dunn - Object seen 2 June 68, 2100 EDST, Columbus, Ohio