Today in Astronomy 106: space travel, by us and them

- SETI.
- Score of the search: have other civilizations found us yet?
- Bad Astronomy

Flying saucer? No, it's just a lenticular cloud.

The search for extraterrestrial intelligence

SETI, as it's called, is thus proceeding mostly through targeted broadcasts and searches (mostly the latter) at radio frequencies. Main effort of the SETI Institute, the professional home of Frank Drake and Jill Tarter:

- Observations with the Arecibo 305-m telescope in the direction of stars, taking data whenever the ALFA receiver is on.
- Search through the data for signals by a vast array of PCs in the hands of amateurs: SETI@Home.
- No detections yet. You would have heard about it if there had been.

Arecibo as it looks today (Cornell/NAIC).

SETI (continued)

There are occasional, additional searches conducted with other radio observatories, to exploit wavelengths or parts of the sky inaccessible to Arecibo:

- The Very Large Array (VLA) in New Mexico, a 27-element array of 26-m telescopes, acting as a single telescope many km across.
- The Robert C. Byrd Green Bank Telescope (GBT), a 100-m diameter fully steerable radio telescope in West Virginia.

The VLA in its most compact configuration (upper), and the GBT (lower).

SETI (continued)

We are currently well-equipped to detect extraterrestrial signals at radio wavelengths, though the effort is traditionally underfunded and little appreciated.

- Although the culture of radio astronomy is changing, most of depiction of SETI in the movie *Contact* still applies: Ph.D. thesis advisors don't like to see their students going into SETI.
- The ongoing search for extrasolar planets – especially projects like NASA's *Kepler*, which targets Earth-size planets – will provide more and better targets to which to broadcast, and toward which to search for signals.
- And sensitivity, bandwidth and analysis power will continue to improve.

SETI (continued)

And it's cost effective, too:

- Telescope surfaces have to be accurate to a small fraction of the wavelength they receive. For radio SETI, that's easy (wavelengths = 1-30 cm) and relatively cheap.

Examples: in 2006 US dollars, from the NSF Senior Review:

- the VLA cost $360M to build and $11M per year to operate; it has been with us for almost 30 years.
- the GBT cost $85M to build and $10M per year to operate.
- Both of these facilities spend the vast majority of their hours doing observational astronomy, not SETI, but their cost shows an upper bound on the cost of facilities for communication with extra-solar-system civilizations.

Is SETI a respectable field of science, in your opinion?

A. Yes. B. It would be, if it weren't so expensive.
C. It isn't, til it produces its first positive result. D. No.

Have we been visited or otherwise contacted?

If cost is the main issue: it is possible that other civilizations have solved that problem by now.

So have extra-solar-system contacted or visited us?

Easy answer: **NO**.

- In fifty years of SETI we have yet to receive our first signal from intelligent civilizations on other planets. You will hear about it loud and clear as soon as we do.
- We expect communication to be more frequent than visits, of course.
- There are no credible reports of visits by extraterrestrial space travelers to Earth, nor credible evidence that this has happened at any point in our past.

Do you believe that some unidentified flying objects (UFOs) represent visits to Earth by intelligent extraterrestrials?

A. Yes B. Not sure C. No

"But scientists may be concealing evidence of communication by extraterrestrials!"

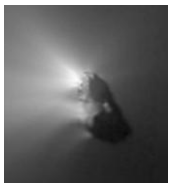
Oh, *puh*-**leeze**. Scientists – especially astronomers and those involved in SETI – would be the first to detect signals from extraterrestrials…

- Not the military! They're looking down, not up.

… and would publicize confirmed communications.

- No scientist is obligated by contractual terms to conceal such information or place it first at any government's disposal, at least here and in western Europe.
- The culture of science is such that correct results are *very* hard to conceal, and scientists are provided great incentive to be the first to reveal important results.
  - And to check each others results for correctness and completeness.

"But all those reports of UFOs can't be wrong!"



Just because a flying object is unidentified doesn't mean it comes from outer space and carries intelligent beings.

A cautionary tale:

- Before WW II, reports of mysterious flying objects were infrequent, and essentially always explicable in terms of natural phenomena.
  - Notably comets and meteors, which do come from outer space but are not carrying or concealing intelligent beings from outer space.

Comet 1P/Halley, in 1066 (top, Queen Mathilde) and 1986 (bottom, Giotto/ESA).

"But all those reports of UFOs can't be wrong!" (continued)

- During WW II, the number of aircraft and balloons in the air increased by many orders of magnitude. This led to greater notice of flying objects by people.
- As the jet age approached many different futuristic shapes and sizes of aircraft and rockets were tried out.
- Thus there was great confusion provoked by sightings of flying objects, either aircraft or natural phenomena confused with aircraft.
  - And a factor of 10-100 increase in reports of UFOs, mostly by normal people merely curious about what they saw,
  - and many fringey reports of aliens and abductions.

"But all those reports of UFOs can't be wrong!" (continued)

So the US Air Force conducted a study of the reports (Project Blue Book, 1948-1968) to see if there was credible evidence of visits by aliens, which would have been a security risk.

- In 21 years they investigated almost 13,000 reports, plausibly identifying all but about 700 as natural phenomena or known aircraft.
- The others involve shaky evidence, not mysteries.
- Thus the Air Force concluded that there was no evidence either of alien visits or a security risk.

This was not enough for the UFO zealots, who pestered the Air Force and Congress with tales of coverups and conspiracies.

"But all those reports of UFOs can't be wrong!" (continued)

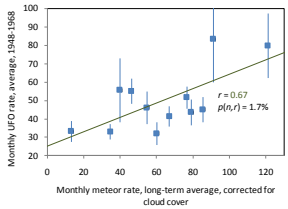
So the Air Force recommended, and Congress approved, an independent research-university study of Blue Book and other evidence. The lead was taken by E.U. Condon (U. Colorado), and the results go by the name of the Condon Report. Their results:

- ❑ No credible evidence of visits to Earth by extraterrestrials.
- ❑ Not even any reports sufficiently mysterious that there could be other scientific interest in their further study.
- ❑ In essentially all cases the sightings were of aircraft, human-deployed spacecraft, or natural phenomena.

This was not good enough for the zealots either, so the Condon Report was referred to the National Academy of Sciences for a review.

"But all those reports of UFOs can't be wrong!" (continued)

Lenticular clouds over Boulder, CO, 2002 (UCAR).



Correlation between UFO reports and meteor showers. UFO data from Blue Book, meteor shower data from the International Meteor Organization, cloud cover from U. Manitoba)

"But all those reports of UFOs can't be wrong!" (continued)

- ❑ The eleven member NAS panel reviewed the Condon Report – the study's methods and results – and found themselves in complete agreement with the report and its conclusions.

And this, predictably, was also not satisfactory to the zealots.

- ❑ UFO zealots continue to saturate the Web and the airwaves with conspiracy theories and ever more detailed sightings and abduction reports, and
- ❑ scientists have long since given up in impatience with trying to convert the zealots, focusing instead on teaching the value of evidence and critical thought.

Now do you believe that some UFOs represent visits to Earth by intelligent extraterrestrials?

A. Yes B. Not sure C. No

Mid-lecture Break

- Pre-Exam office hours today 1-3 PM in B&L 477
- Exam #3 tomorrow in any 75-minute window of your choosing between 10 AM and 6 PM

Kenneth Arnold, showing a drawing of the UFO he saw in 1947 which he describe as flying "like a saucer would if you skipped it across water."

Bad Astronomy

Close Encounters of the Third Kind (1977)
1 Million Years BC (1966)
Signs (2002)
Star Wars Episode I: Phantom Menace (1999)
Men In Black (1997)