

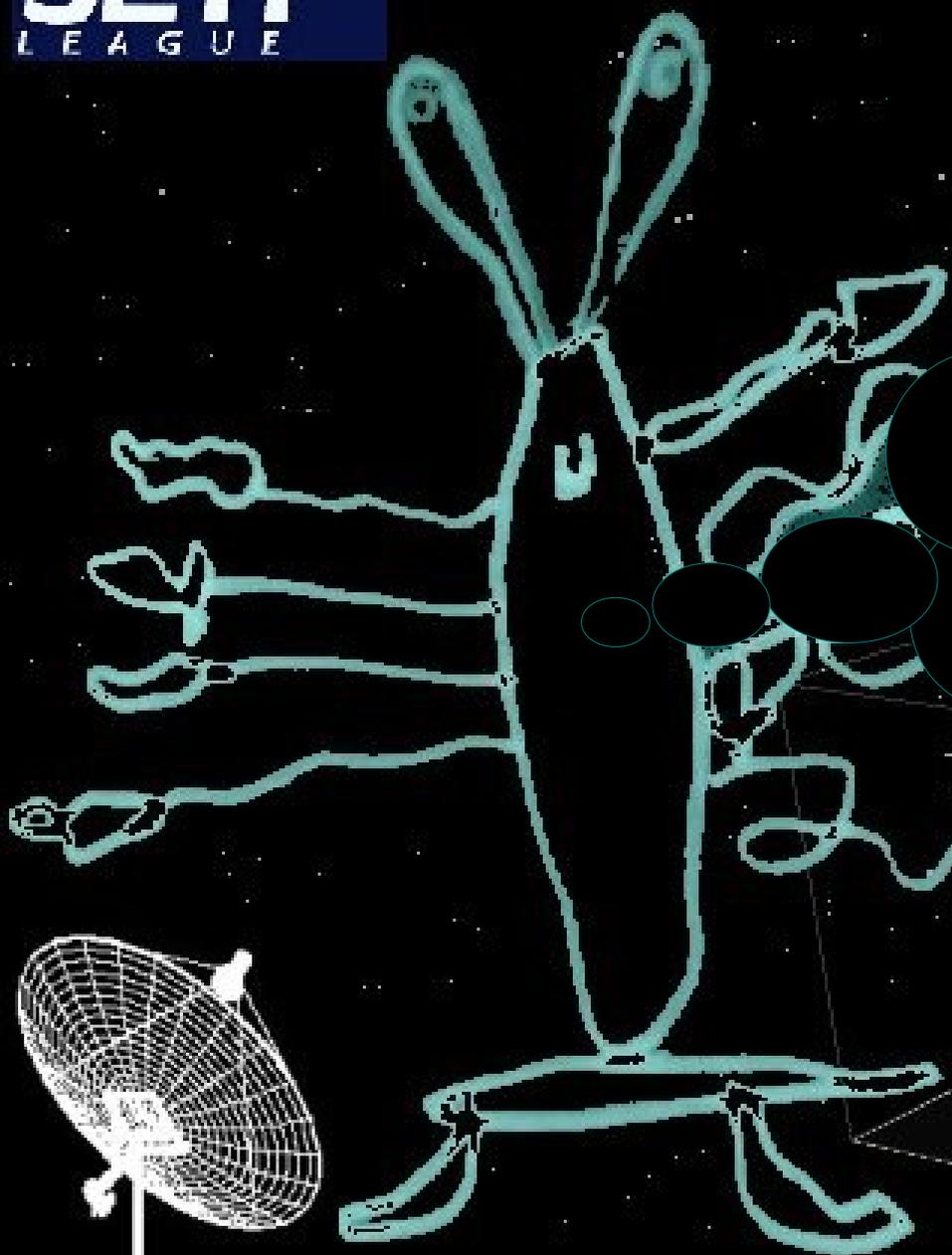
Elisabeth Piotelat



Data analysis

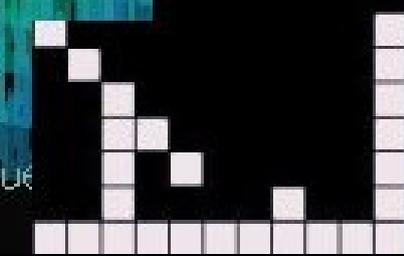
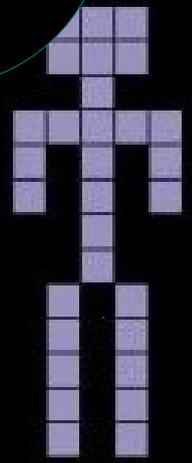
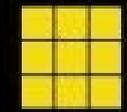
Searching for Gaussians
Doppler drift rate 8.5180 Hz/sec Resolution 0.596 Hz
New Gaussian power 106, fit -1.#10, score -1.#10

Où
sont-ils ?



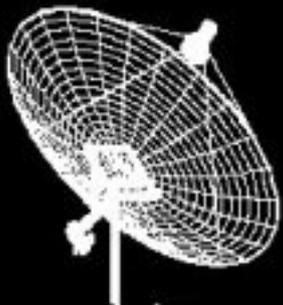
Time

Frequ



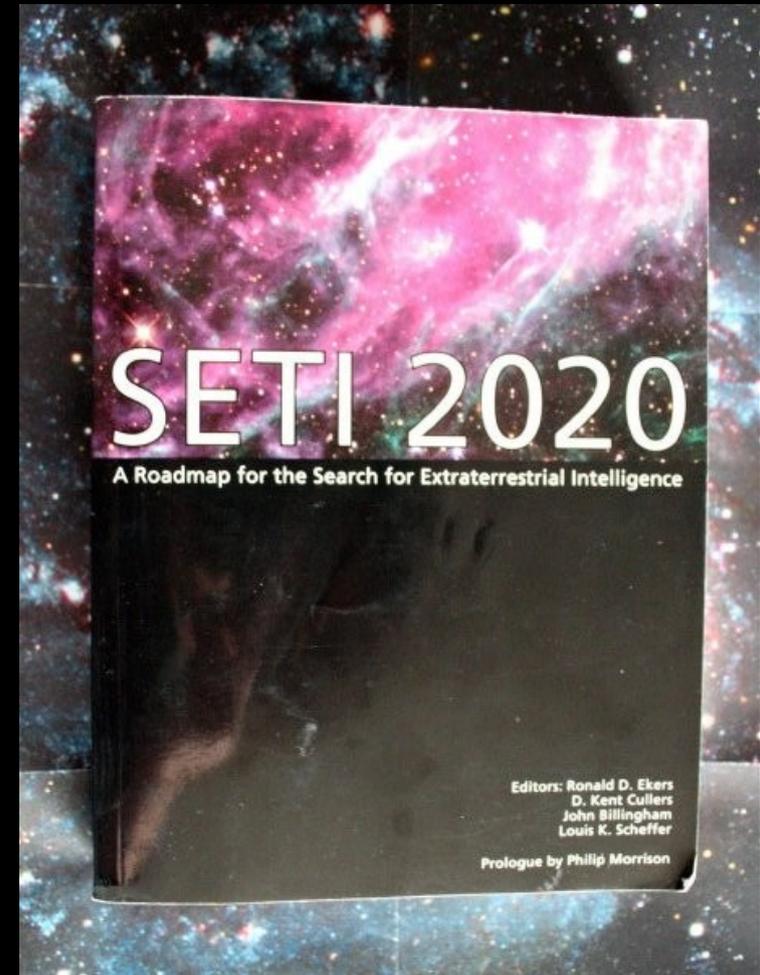
Sommes-nous seuls ?

- 50 ans de recherche
 - Drake et notre ignorance
 - 11s sur le calendrier cosmique
- Où sont-ils ?
 - Le paradoxe de Fermi
 - Quelques solutions
- SETI : Les techniques



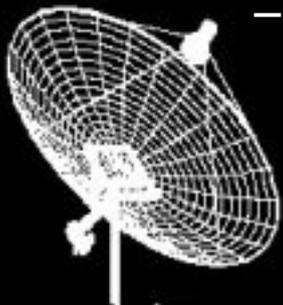
SETI : Depuis 1959

- Search for Extra Terrestrial Intelligence
- Premier projet : OZMA (F. Drake)
- Plus de 70 projets depuis...
- 2007 : ATA
 - SETI 24h/24
 - 42 antennes / 350



2010 : Dorothy

- Pour fêter les 50 ans d'OZMA
- Ecoutes partout dans le monde dont à Nançay
 - **Epsilon Eridani : 11 a.l.**
 - une planète de la taille de Jupiter
 - une autre planète n'a pas été confirmée.
 - **HD 69830 : 41 a.l.**
 - au moins trois planètes (1 dans la zone habitable)
 - **Gl 581 : 20 a.l.,**
 - l'une des 6 planètes serait dans la zone habitable.



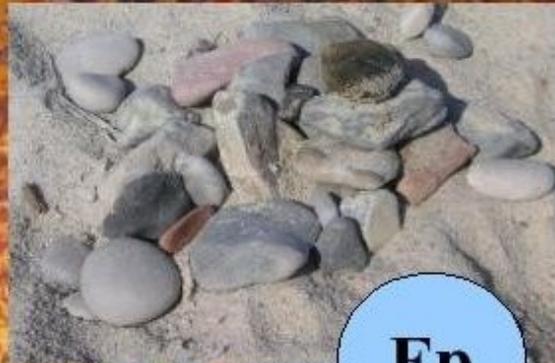
1961 : Quantifier notre ignorance

L'équation de Drake

$N =$



R^*



F_p

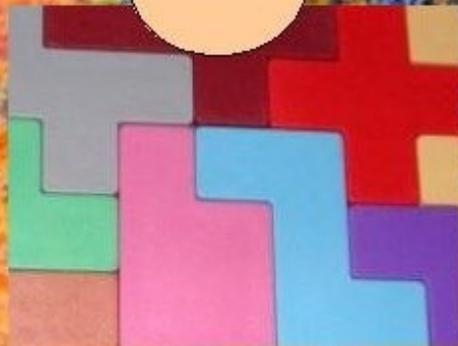


N_e

F_l



F_i



F_c



L



Que sait-on ?

- 200 milliards d'étoiles dans la galaxie
- 13 milliards d'années
 - Il se forme 10 étoiles par an
 - 14% sont de type G, 19% F, 31% K
 - $R^*=1,4$ ou $6,4$
- F_p ?
 - Atelier au CNES
 - 21 / 22 novembre 2011



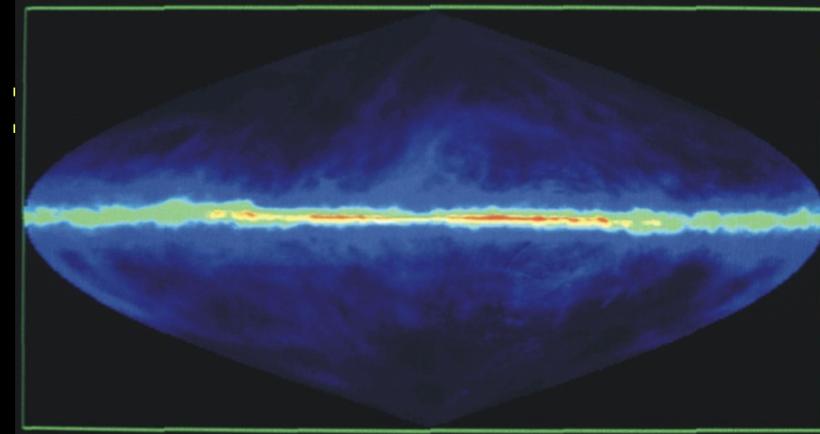
Le calendrier Cosmique

1er janvier

- 13,6-13,8 milliards d'années : notre univers

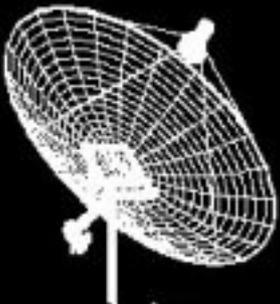
Février

- 13 milliards d'années plus vieilles étoiles de notre galaxie



14 septembre

- 4,5 milliards d'années : naissance du soleil



Le calendrier cosmique

1er décembre

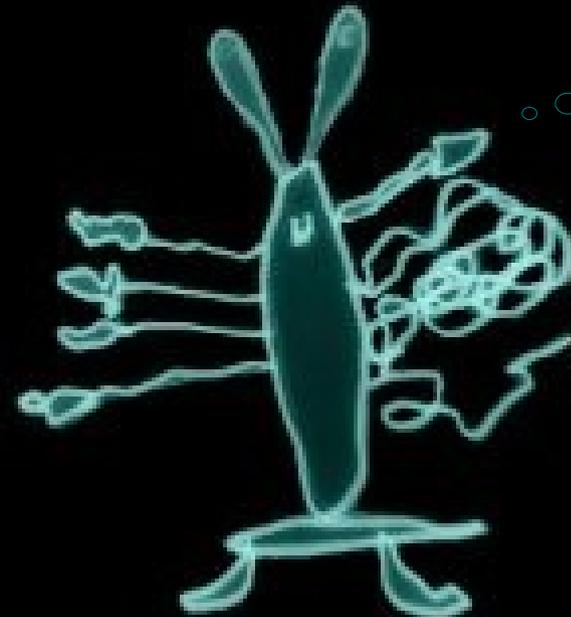
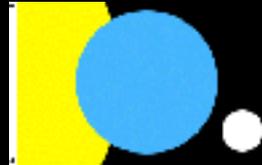
- Oxygène sur la Terre

31 décembre
22h30

- Homo Sapiens (100 000 ans)

23:59:50

- SETI



Où ?



La voie lactée

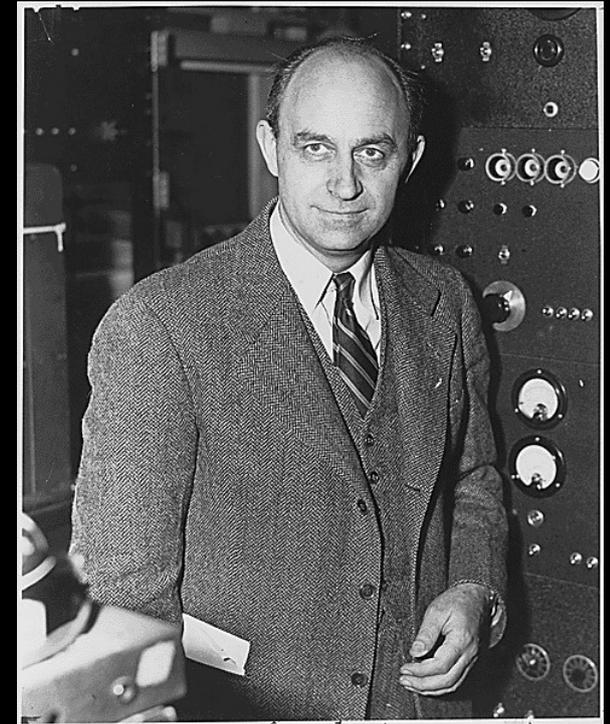
- 100 000 années-lumière de diamètre
- Entre 200 et 400 milliards d'étoiles
- ½ journée pour la coloniser d'après Fermi



Fermi

- Enrico Fermi (1901 – 1954)
 - Prix Nobel de physique en 1938
 - En 1950 : Mais où sont-ils ?
- **Le paradoxe : où sont-ils ?**
- **50 solutions...**

Je mens
toujours !

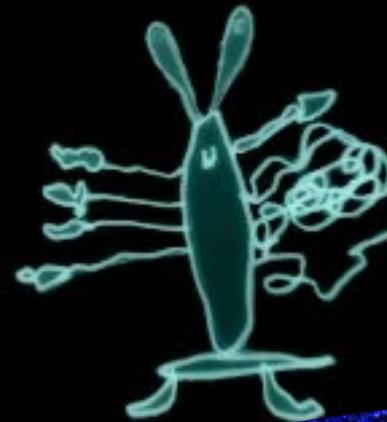


Le paradoxe

- 1% de la vitesse de la lumière
- La plus proche étoile : 5 a.l. : 500 ans
- Restent 500 ans

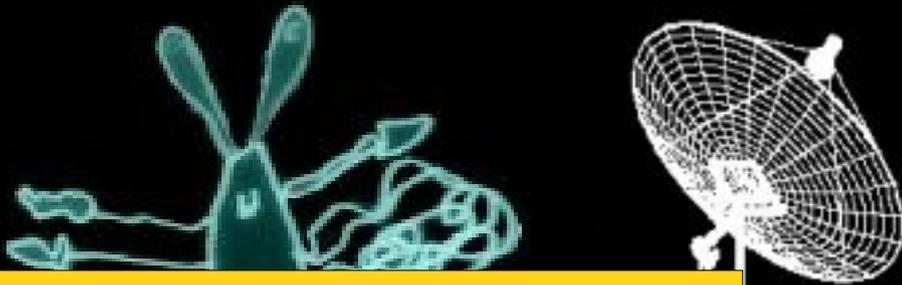


- 1000 ans : 5 a.l.
- 20 millions : 100 000 a.l.



Quelques solutions

- Ils sont là !
- Ils nous observent !



A postulat
extraordinaire,

Preuve
extraordinaire...



Rendez-vous raté ?



24 -28 décembre



Toulouse - 23 mars 2011

Ils émettent

- 1933 : Découverte de la radioastronomie
- 1959 : Article de Cocconi Morrison
- 1960 : Premier flash LASER
- 1961 : Article de Shalov et Townes

SEARCHING FOR INTERSTELLAR COMMUNICATIONS

By GIUSEPPE COCCONI* and PHILIP MORRISON†

Cornell University, Ithaca, New York

NO theories yet exist which enable a reliable estimate of the probabilities of (1) planet formation; (2) origin of life; (3) evolution of societies possessing advanced scientific capabilities. In the absence of such theories, our environment suggests that stars of the main sequence with a lifetime of many billions of years can possess planets, that of a small set of such planets two (Earth and very probably Mars) support life, that life on one such planet includes a society recently capable of considerable scientific investigation. The lifetime of such societies is not known; but it seems unwarranted to deny that among such societies some might maintain themselves for times very long compared to the time of human history, perhaps for times comparable with geological time. It follows, then, that near some star rather like the Sun there are civilizations with scientific interests and with technical possibilities much greater than those now available to us.

* Now on leave at CERN, Geneva.

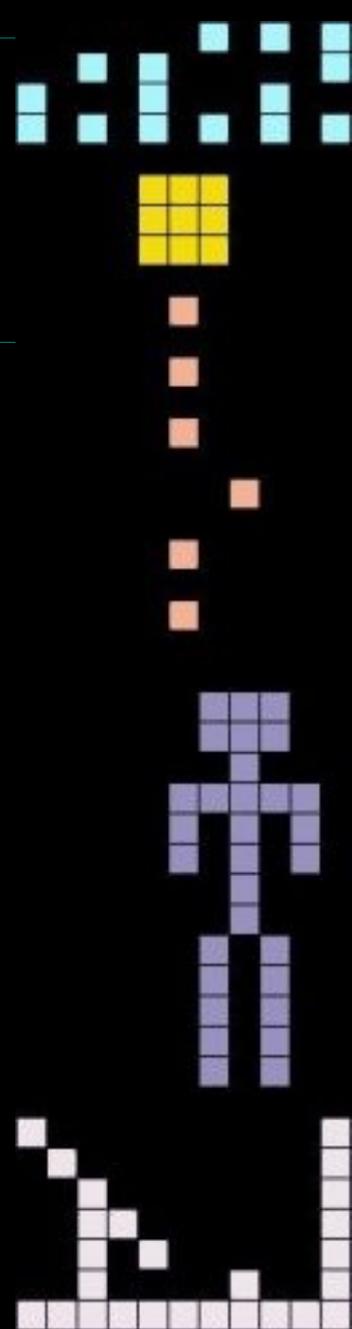
† Now on leave at the Imperial College of Science and Technology, London, S.W.7.

To the beings of such a society, our Sun must appear as a likely site for the evolution of a new society. It is highly probable that for a long time they will have been expecting the development of science near the Sun. We shall assume that long ago they established a channel of communication that would one day become known to us, and that they look forward patiently to the answering signals from the Sun which would make known to them that a new society has entered the community of intelligences. What sort of a channel would it be?

The Optimum Channel

Interstellar communication across the galactic plasma without dispersion in direction and flight-time is practical, so far as we know, only with electromagnetic waves.

Since the object of those who operate the source is to find a newly evolved society, we may presume that the channel used will be one that places a minimum burden of frequency and angular discrimi-



Ils écoutent

- Faut-il envoyer des messages ?
- **Oui !**
 - Active SETI
 - METI : Al Zaitsev
- **Non !**
 - Prudence / Prix : Billingham
 - Danger : Hawking (2010)

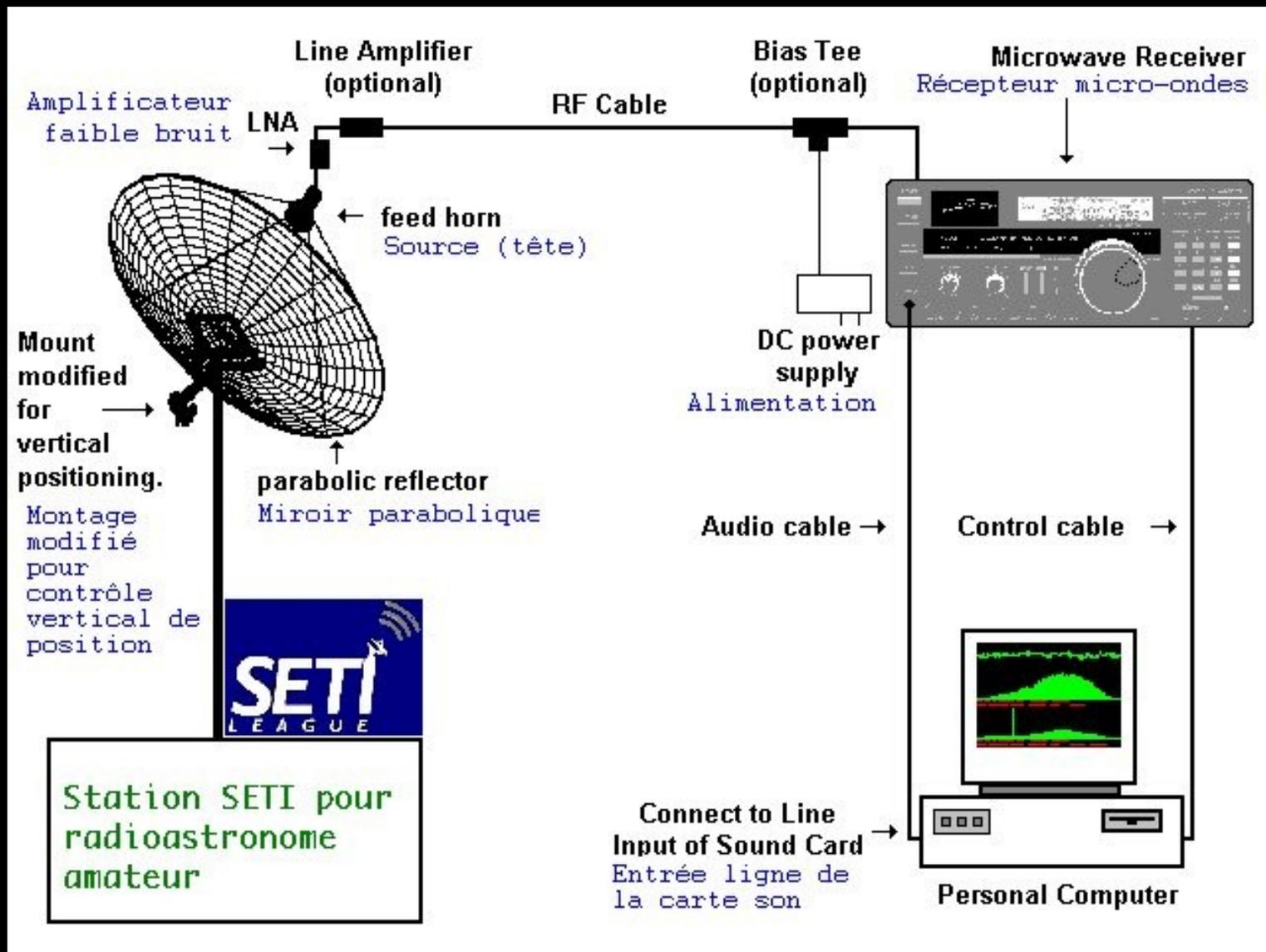


Un radiotélescope ?



Toulouse - 23 mars 2011

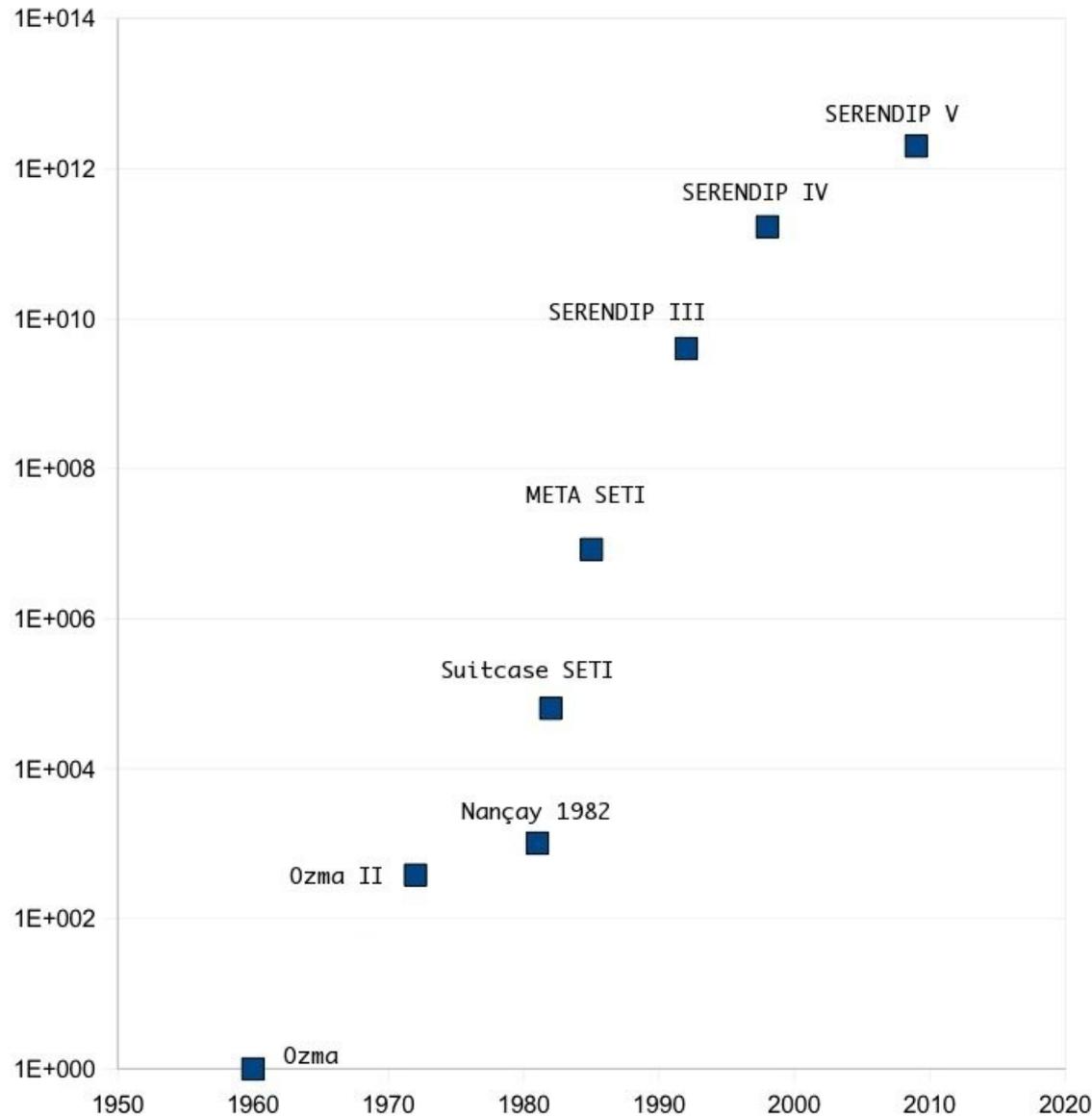
Un principe...



D'autres antennes



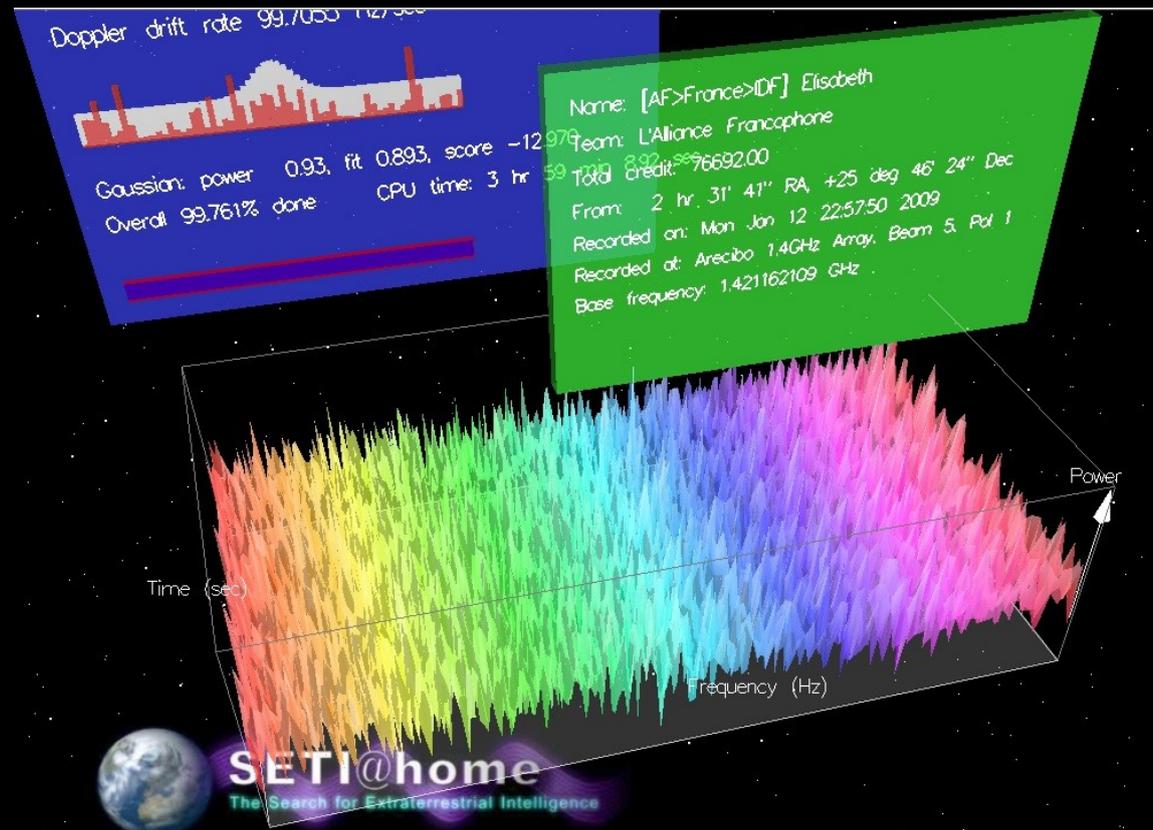
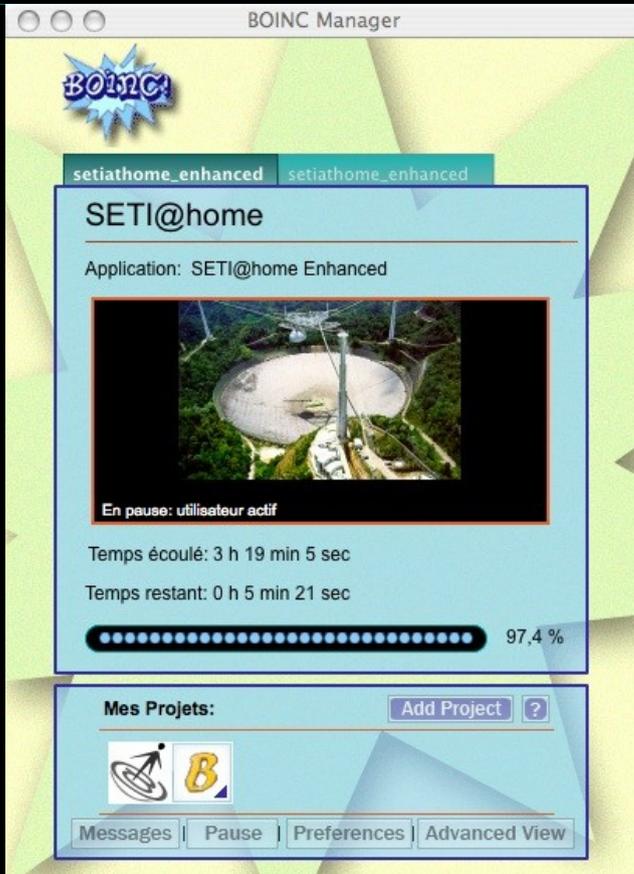
Loi de Moore



- 1960 :
 - Ozma
 - 2 canaux
- 2009 :
 - Serendip V
 - 2G canaux

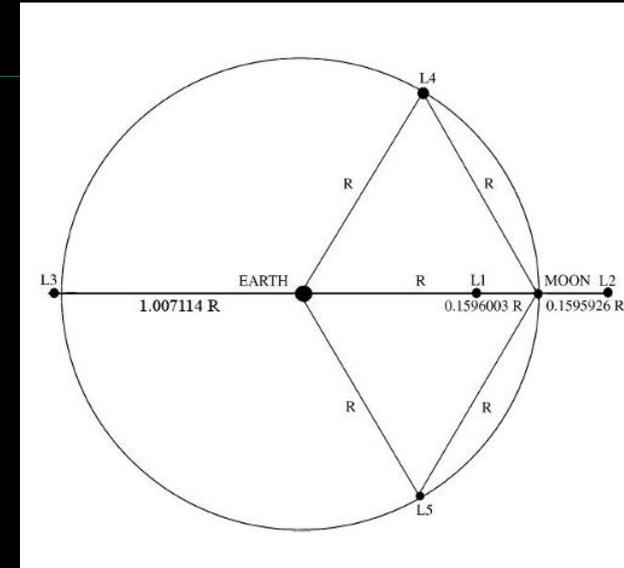
BOINC

- Cinq millions de participants
- 200 TeraFlops/s



Ecoute depuis la Lune

- De plus en plus de pollution radio sur la Terre...
- Projet d'observatoire sur la Lune
 - Jean Heidmann (Saha)
 - Claudio Maccone (Deadalus)



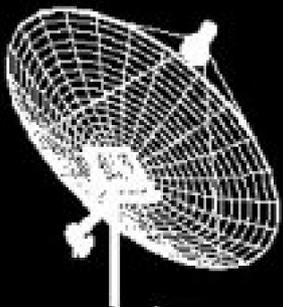
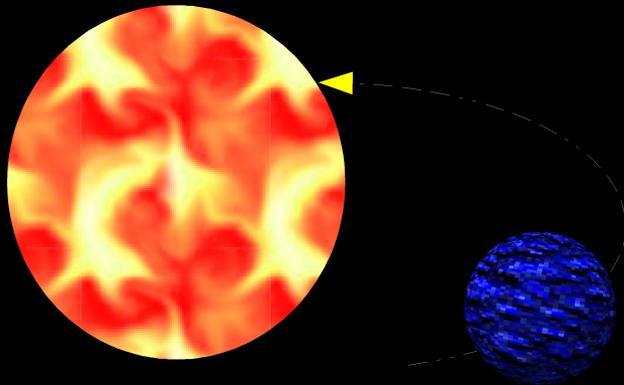
Où cherchez-vous ?

- Recherches ciblées
 - Etoiles proches (Ozma)
 - Etoiles habitables (17000)
 - Exoplanètes (538 le 11/3)
- Balayage du ciel
 - SETI Parasite (SERENDIP)
 - Couverture complète (Argus)

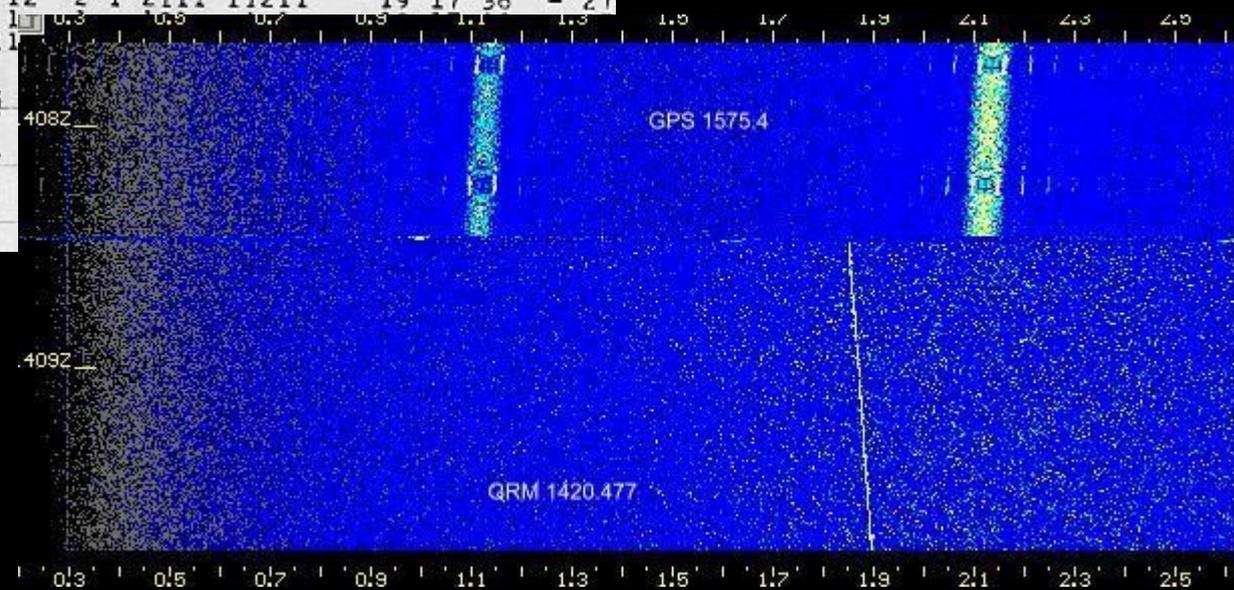
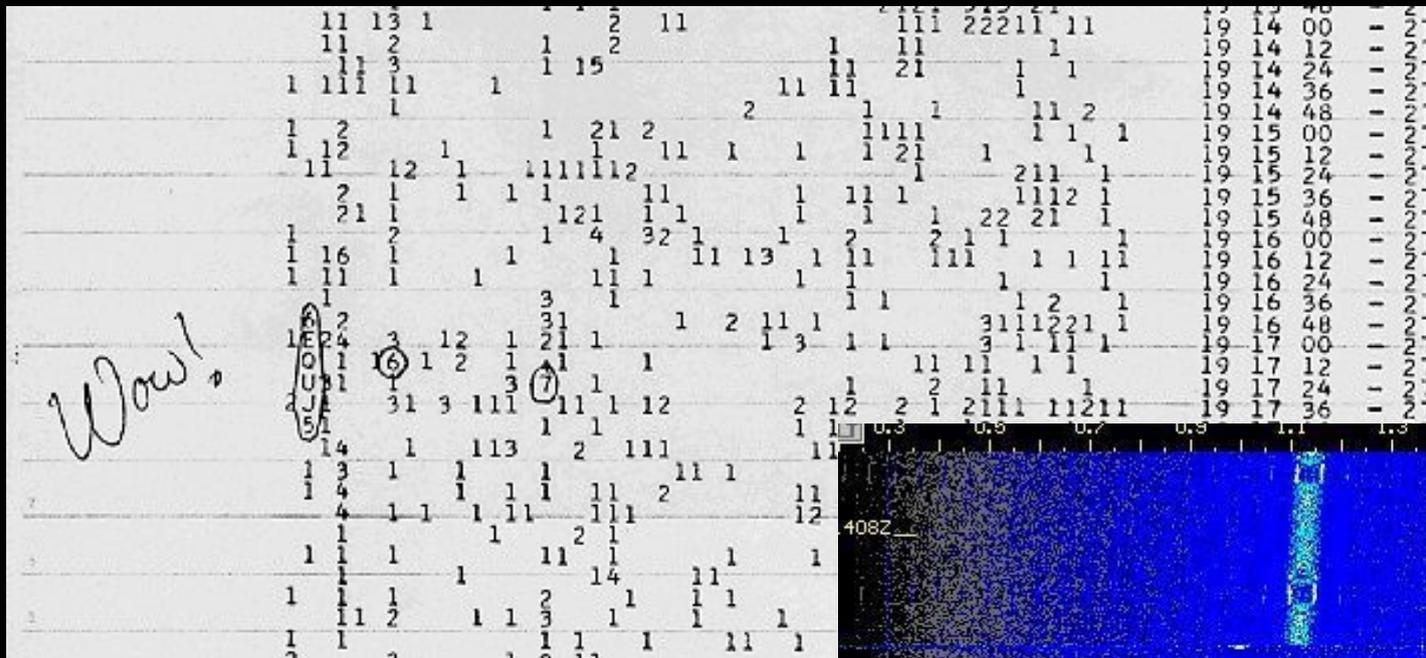


Que cherchez-vous ?

- Un signal artificiel
 - Continu (radio)
 - Pulsé (radio, optique)
- D'origine cosmique



Que des candidats...



Toulouse - 23 mars 2011

Bilan

- Ecouter apporte des connaissances
- Multiples applications de BOINC (palu)
- La vie en question à chaque découverte de Corot ou Kepler
- <http://setileague.free.fr>

