



Alt det vi IKKE ved

FRA
BIG BANG
TIL
MODERNE MENNESKE

Universets historie

Første atomer
379.000 år

Udviklingen af galakser, planeter, etc.

Big Bang

Første stjerner omkring
200 millioner år

Big Bang udvidelsen

13.8 milliarder år

Hubble-
teleskopet

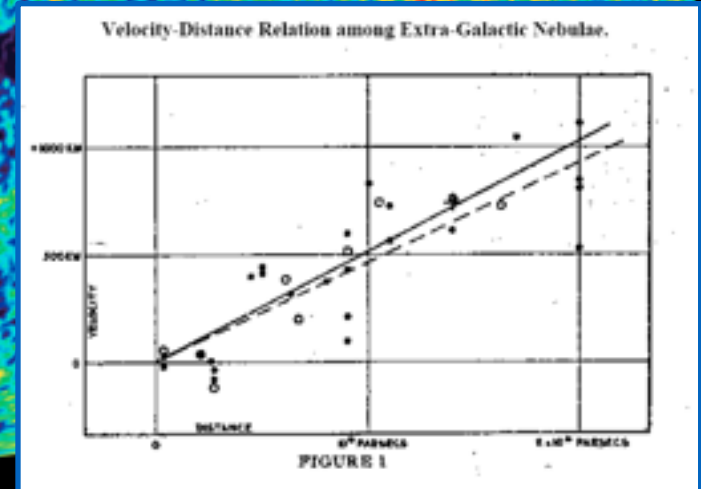
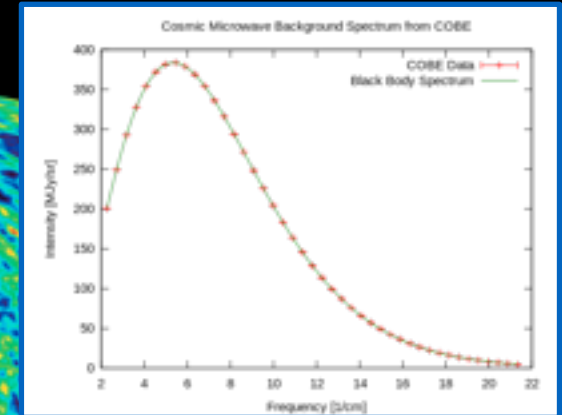
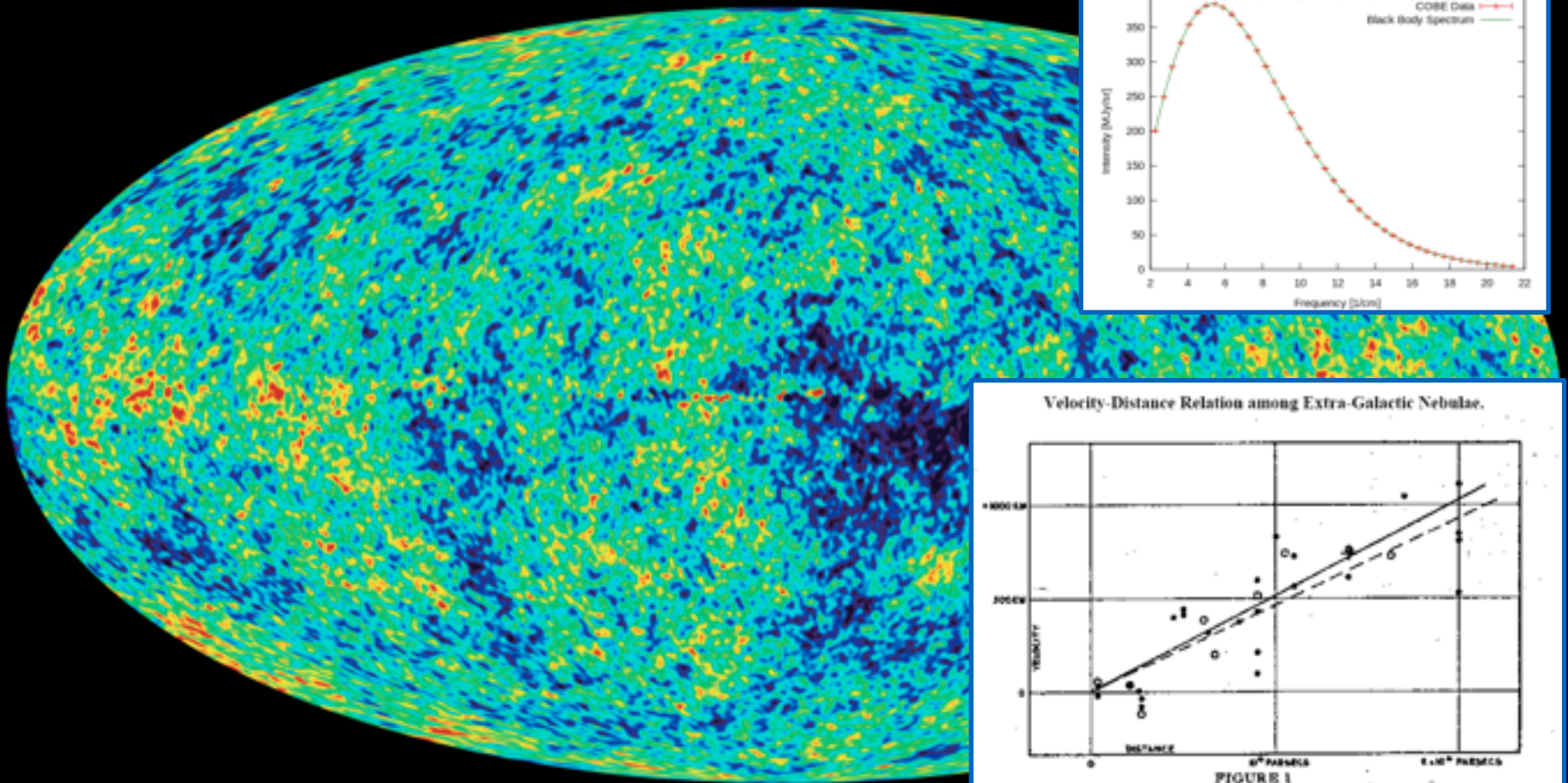


Det tidlige univers

The background features a complex, abstract pattern of glowing lines and circles. The lines are primarily blue and yellow, creating a sense of depth and movement. The circles are also glowing, with some appearing as thin outlines and others as more solid, bright rings. The overall effect is reminiscent of a cosmic or digital landscape, with a central point of convergence where the lines and circles seem to meet.

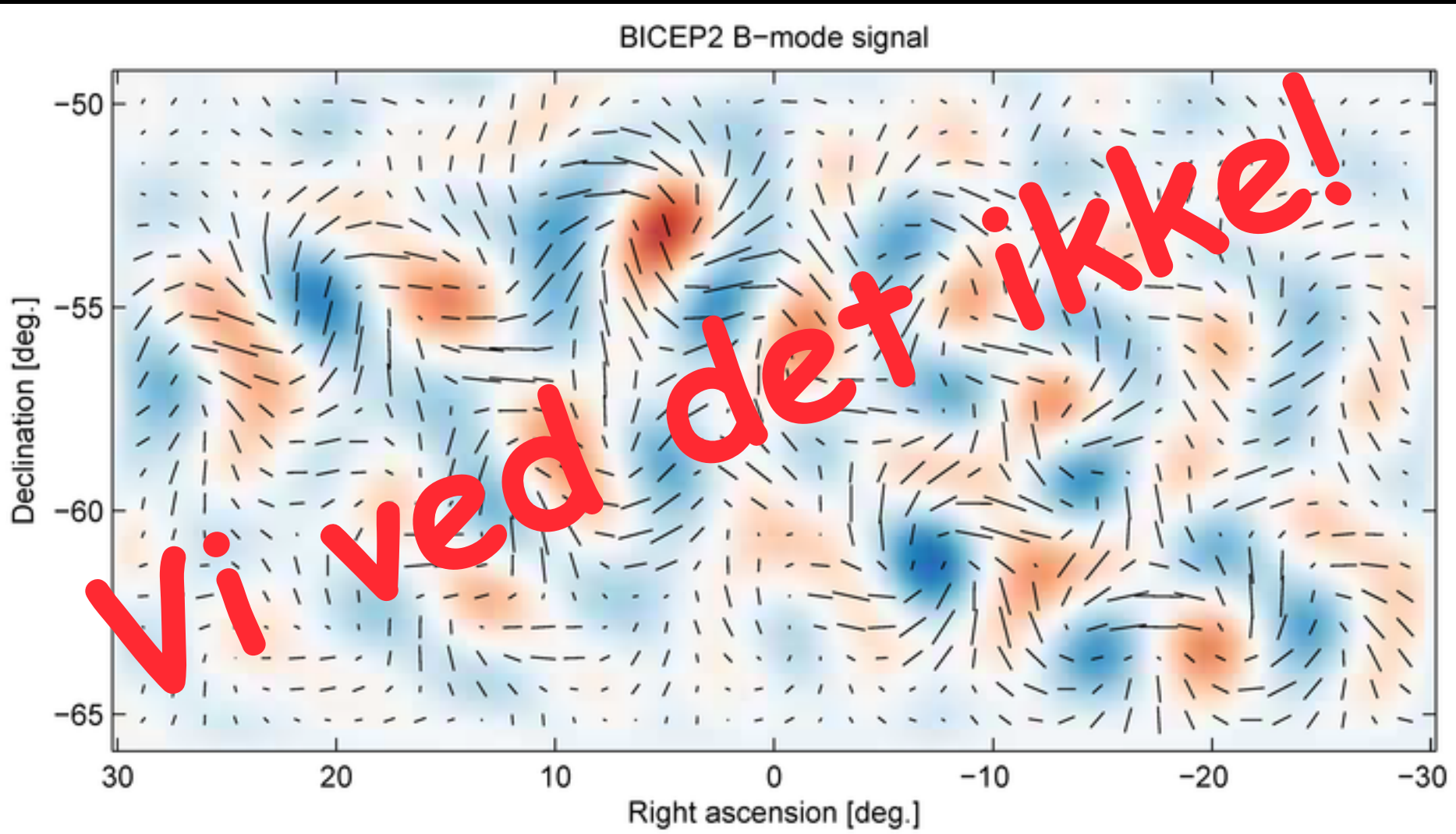
Første billede af Universet

(snapshot af universet, 379.000 år gammelt)



Hvordan så det ud før?

Det tidligste univers



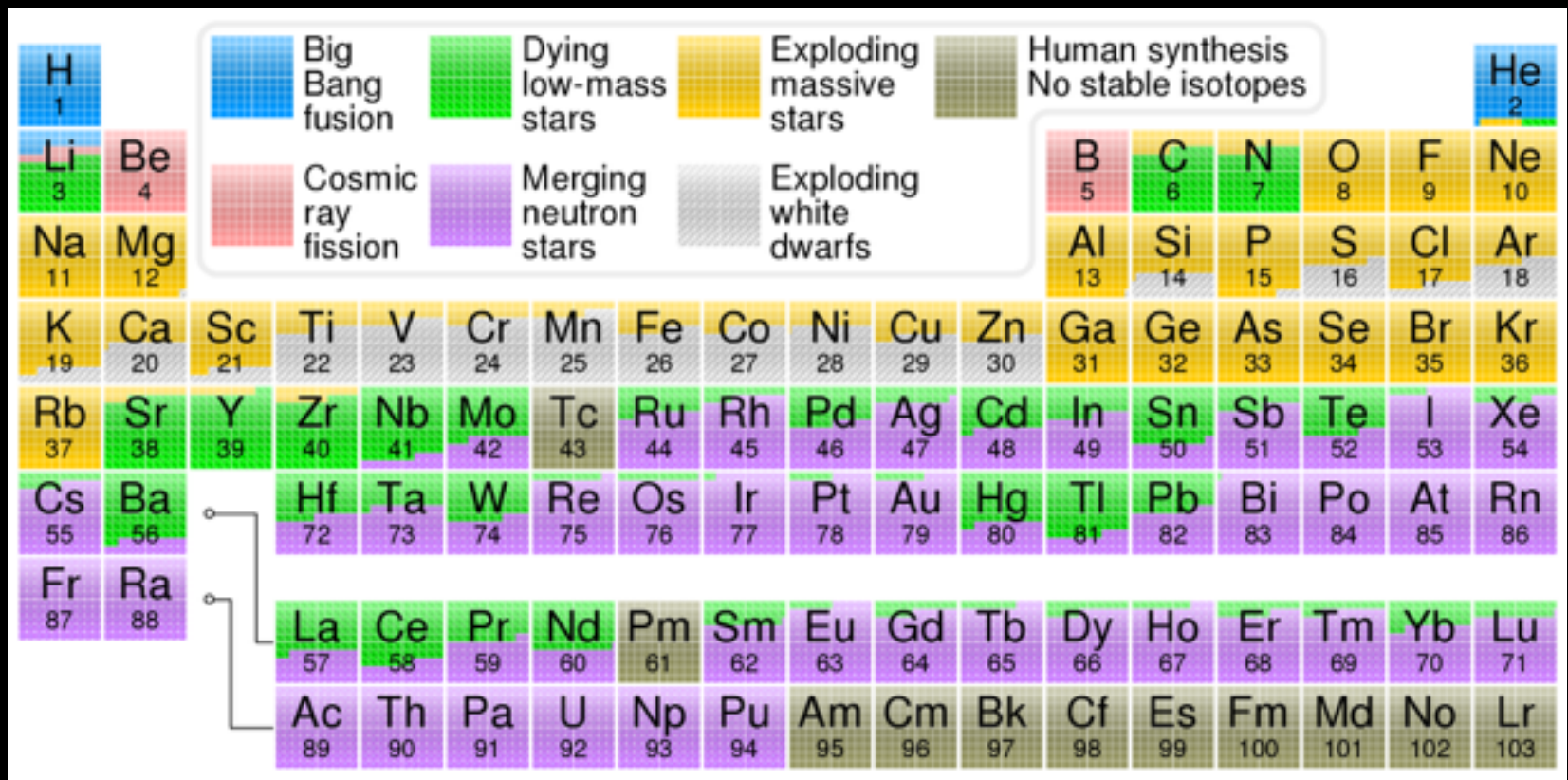
Universets bestanddele

The background features a complex, abstract pattern of glowing lines and circles. The lines are primarily blue and yellow, creating a sense of depth and movement. The circles are also glowing, with some appearing as concentric rings. The overall effect is reminiscent of a digital or scientific visualization, possibly representing data or a complex system.

Elementernes oprindelse

(august 2017 version)

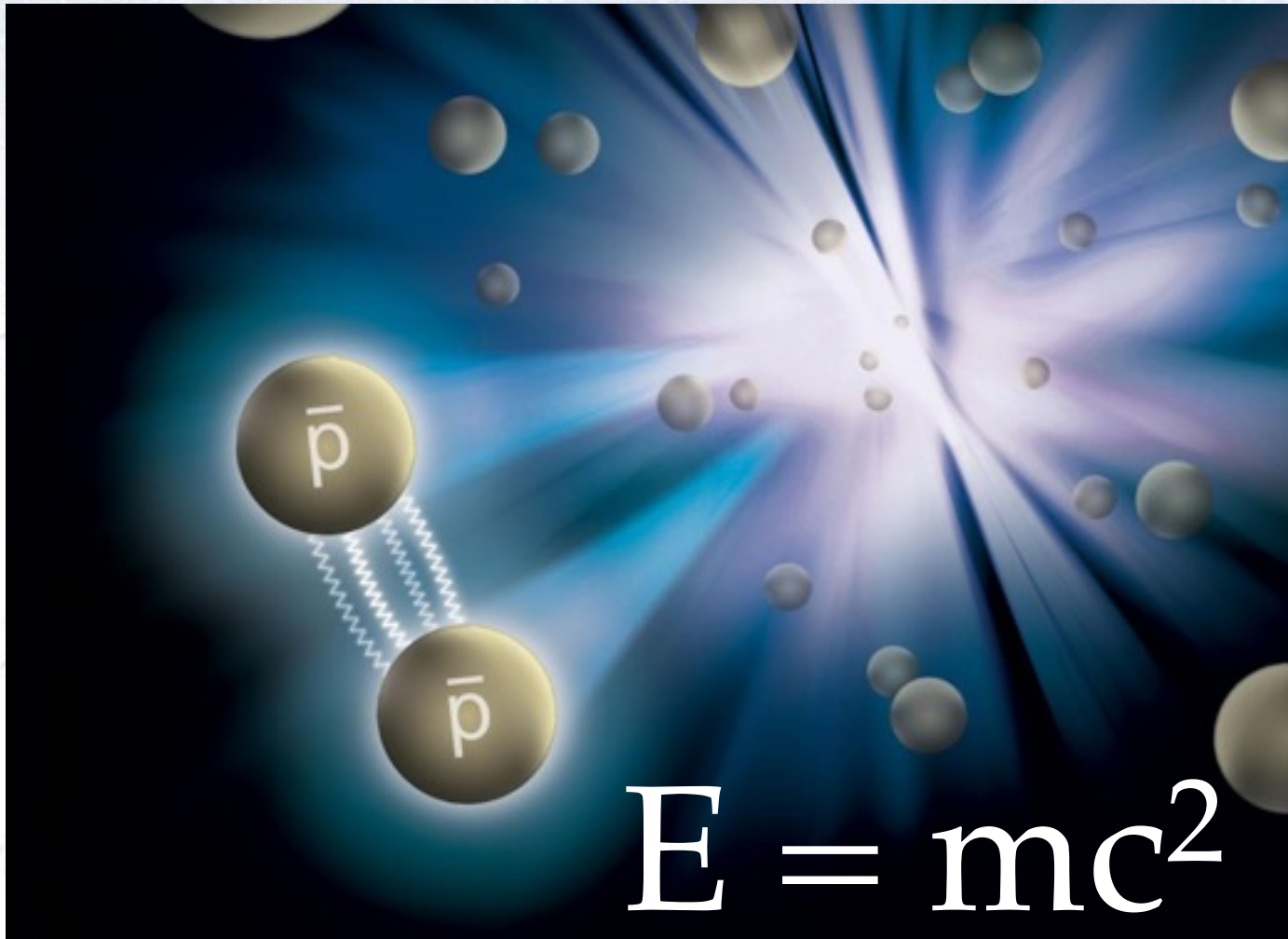
Der er også mange ting, som vi godt ved noget om, men hvor vores viden er begrænset og / eller med fejlagtige detaljer.



Historien om grundstoffernes oprindelse er et godt eksempel.

Stof vs. Antistof

Fra energi blev der i starten af Universet skabt lige store mængder stof og antistof, men af en eller anden grund "vandt" stoffet.

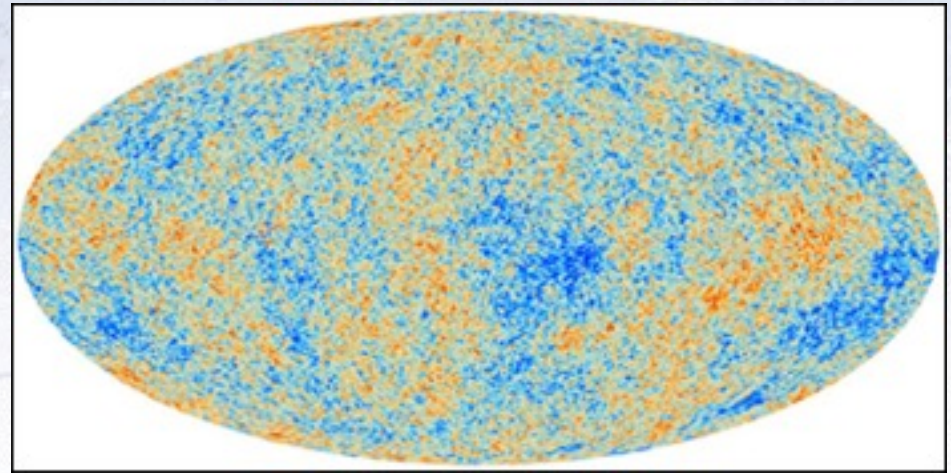


Ingredienser til stof i Universet

Hvad ved vi:

For hver **1 proton** var der omkring **1.000.000.000 fotoner!**

Disse fotoner ser vi i den kosmiske mikrobølge baggrundsstråling, som skabtes ved annihilationen mellem stof og antistof i det tidlige Univers.



Cosmic Microwave Background as measured by Planck.

Hvilke ingredienser kræves der for at få den krævede stof-antistof asymmetri?

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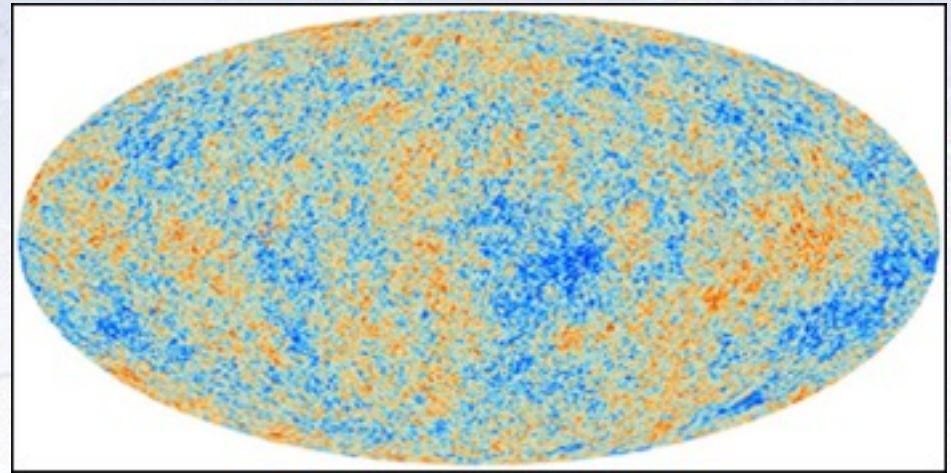
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- C- og CP-symmetribrud.
- 1. ordens faseovergang.

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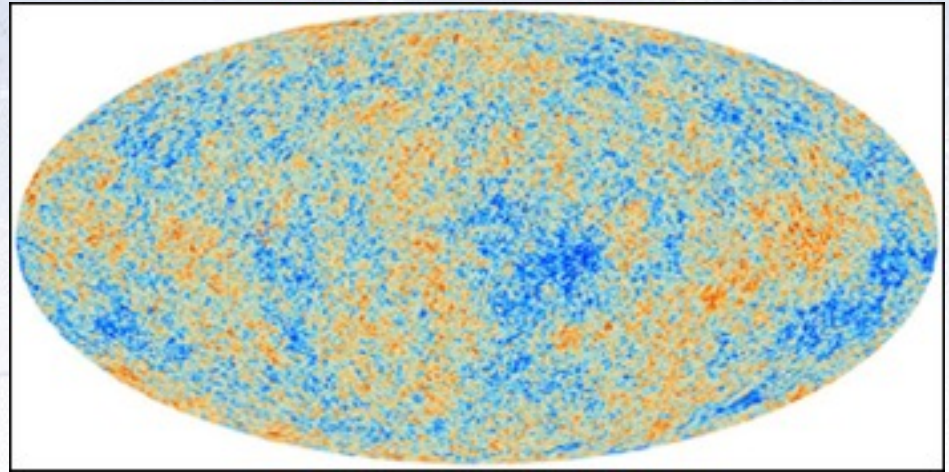
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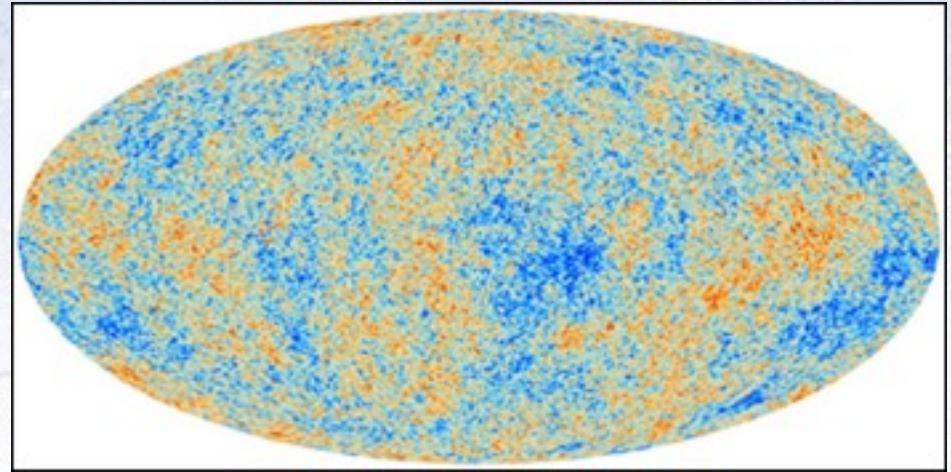
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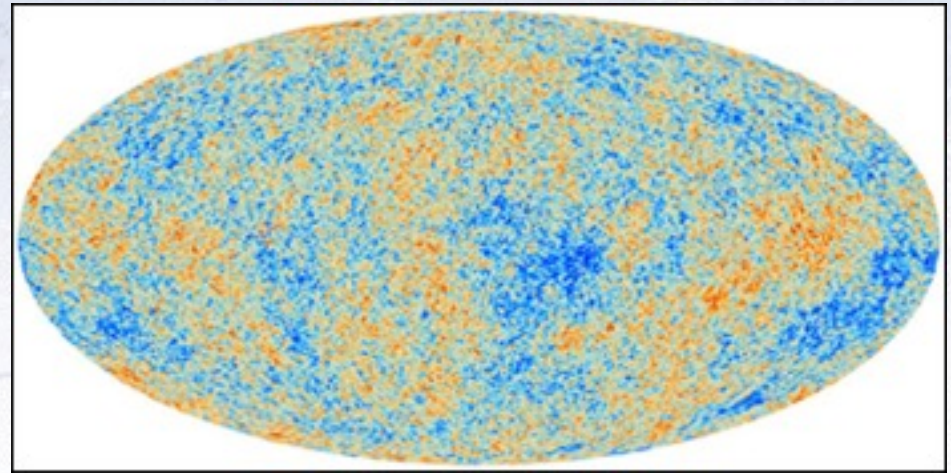
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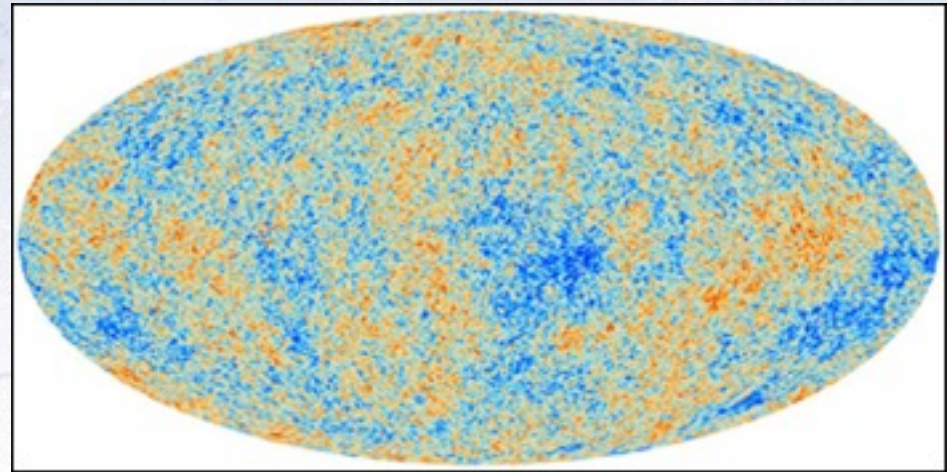
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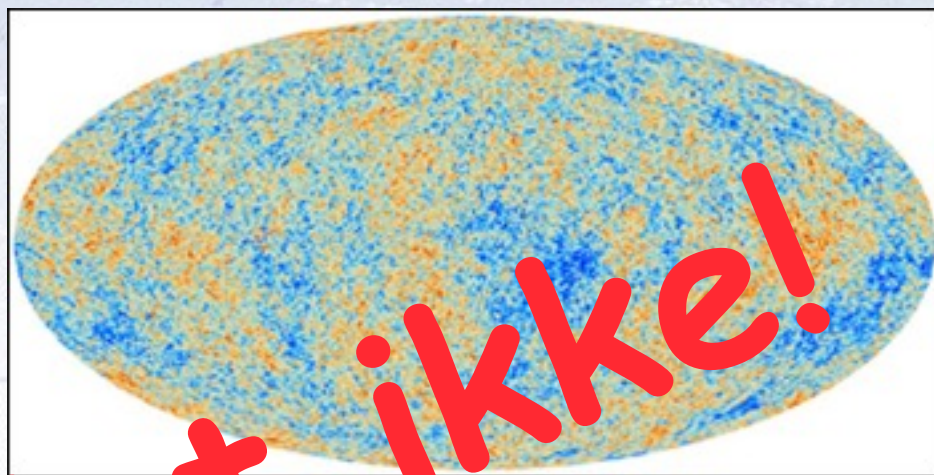
Faktisk IKKE!...

Ingredienser til stof i Universet

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Faktisk IKKE!...

men interessant!

... vi rammer en faktor 10.000.000 ved siden af

Galaxers rotation



Fritz Zwicky, 1898-1974

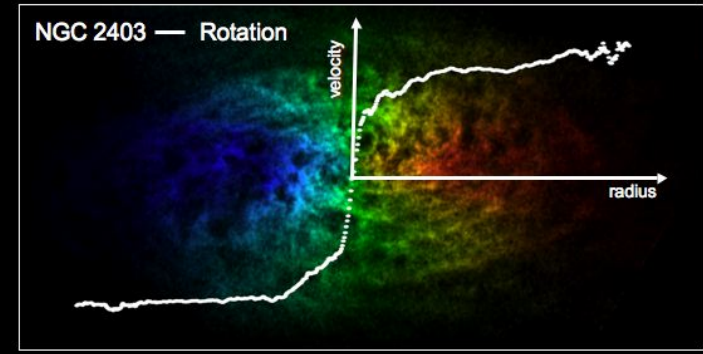
Vera Rubin, 1928-2016



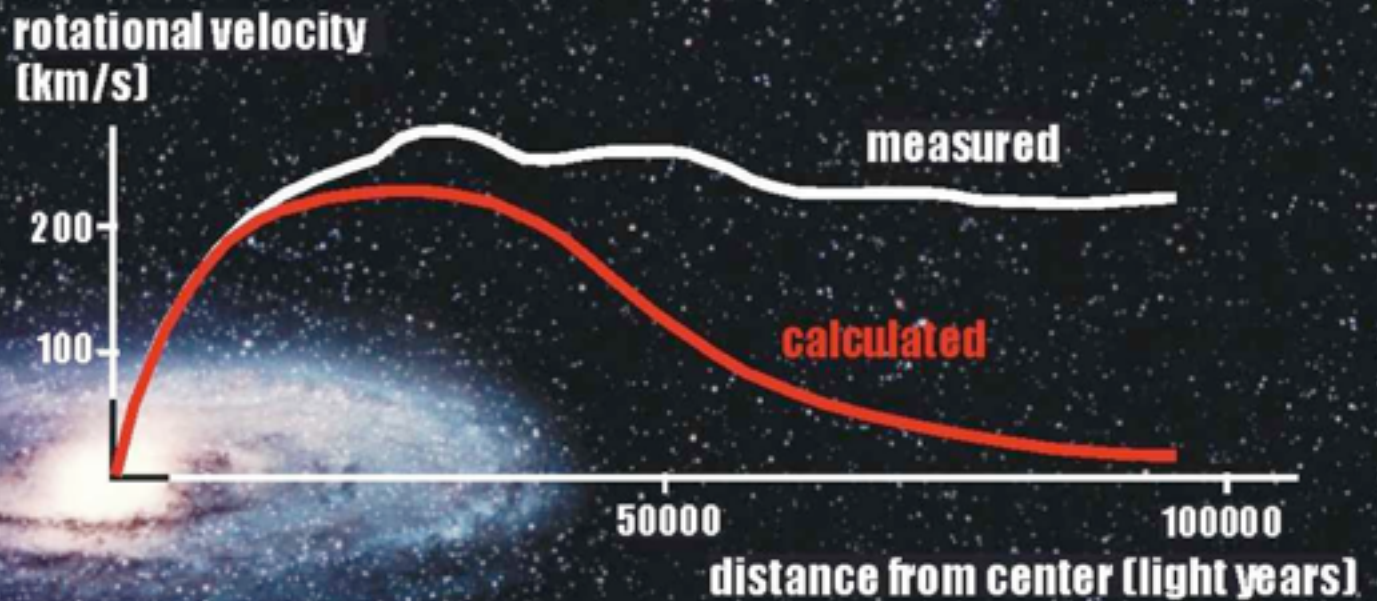
NGC 2403 — Gas and Stars



NGC 2403 — Rotation



Galaxers rotation



Galakters rotation

Mørkt stof får galakser til at rotere hurtigere, end man ville fra blot at betragte alt det "normale" lysende materiale i galaksen.

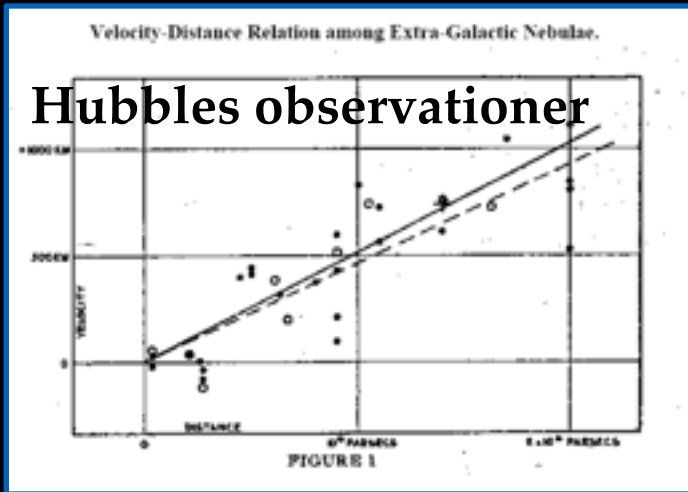
With Dark Matter



Without Dark Matter



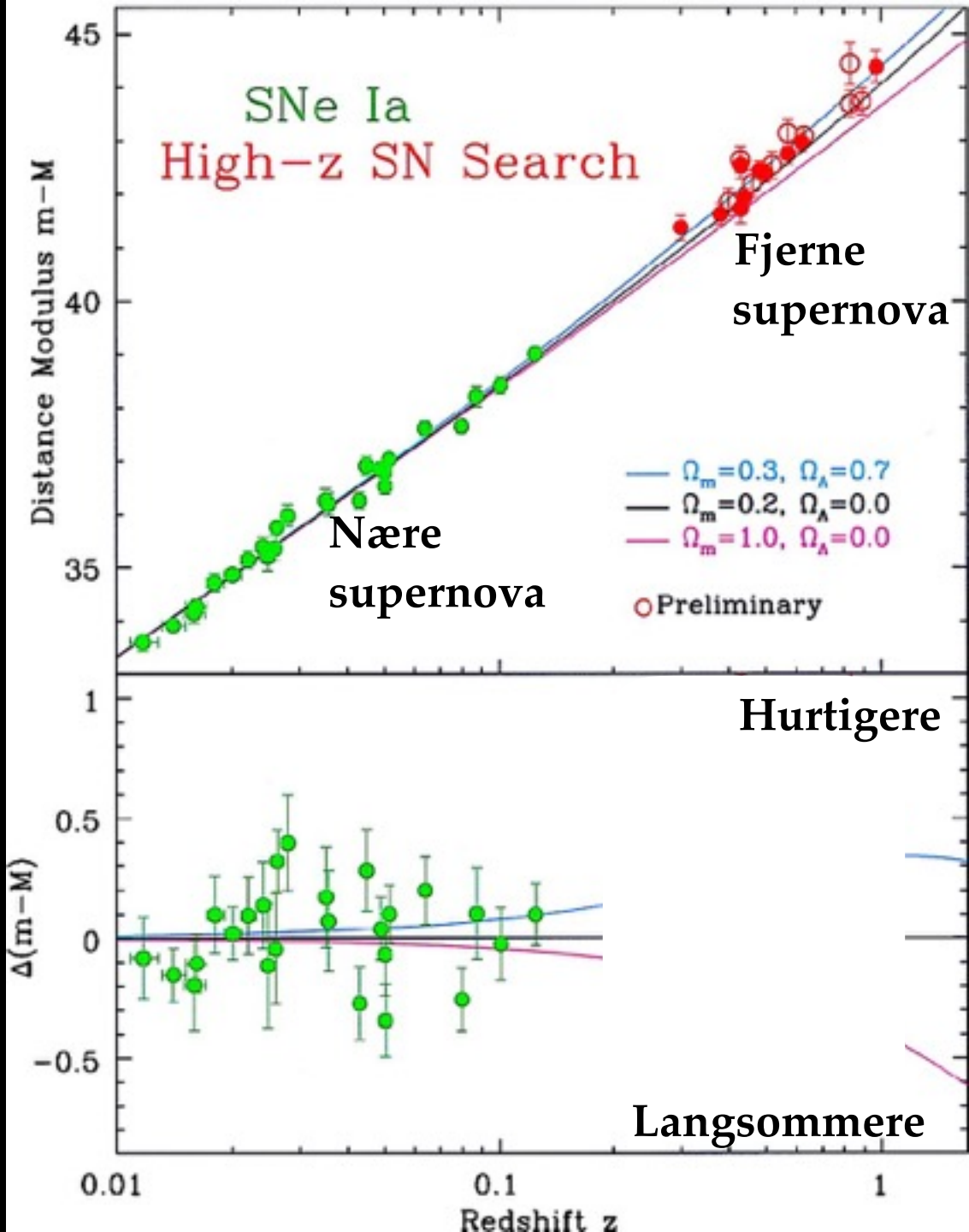
Universets Udvidelse



Har det ændret sig over tid?

Ja, men ikke som vi forventede!!!

Inkluderes i Einstein GR, kvantebeskrivelse: faktor 10^{120} forkert!



Hvad består Universet af?

(...og hvordan ved vi det?)

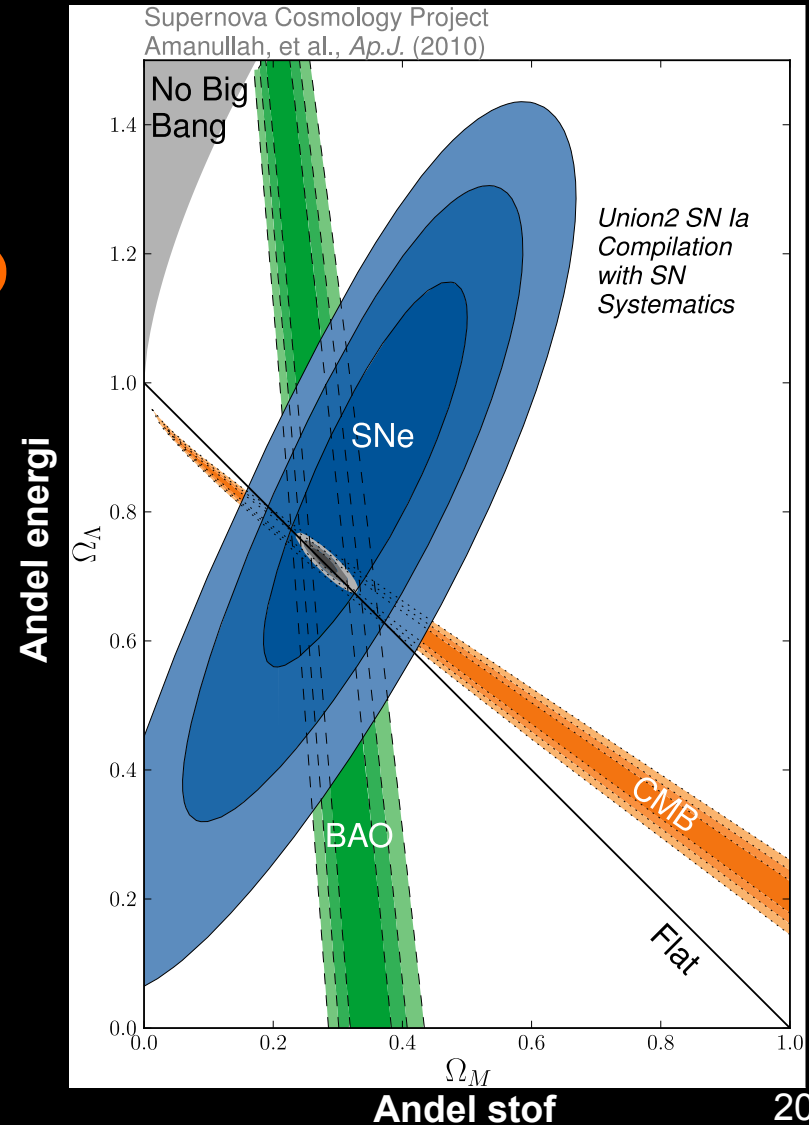
Tre forskningsfelter observerer
Universet på hver deres måde:

- **Kosmisk mikrobølgebagrund (CMB)**
- **Fjerne supernovae (SNe)**
- **Galakseformation (BAO)**

Hver af felterne forsøgte at måle:

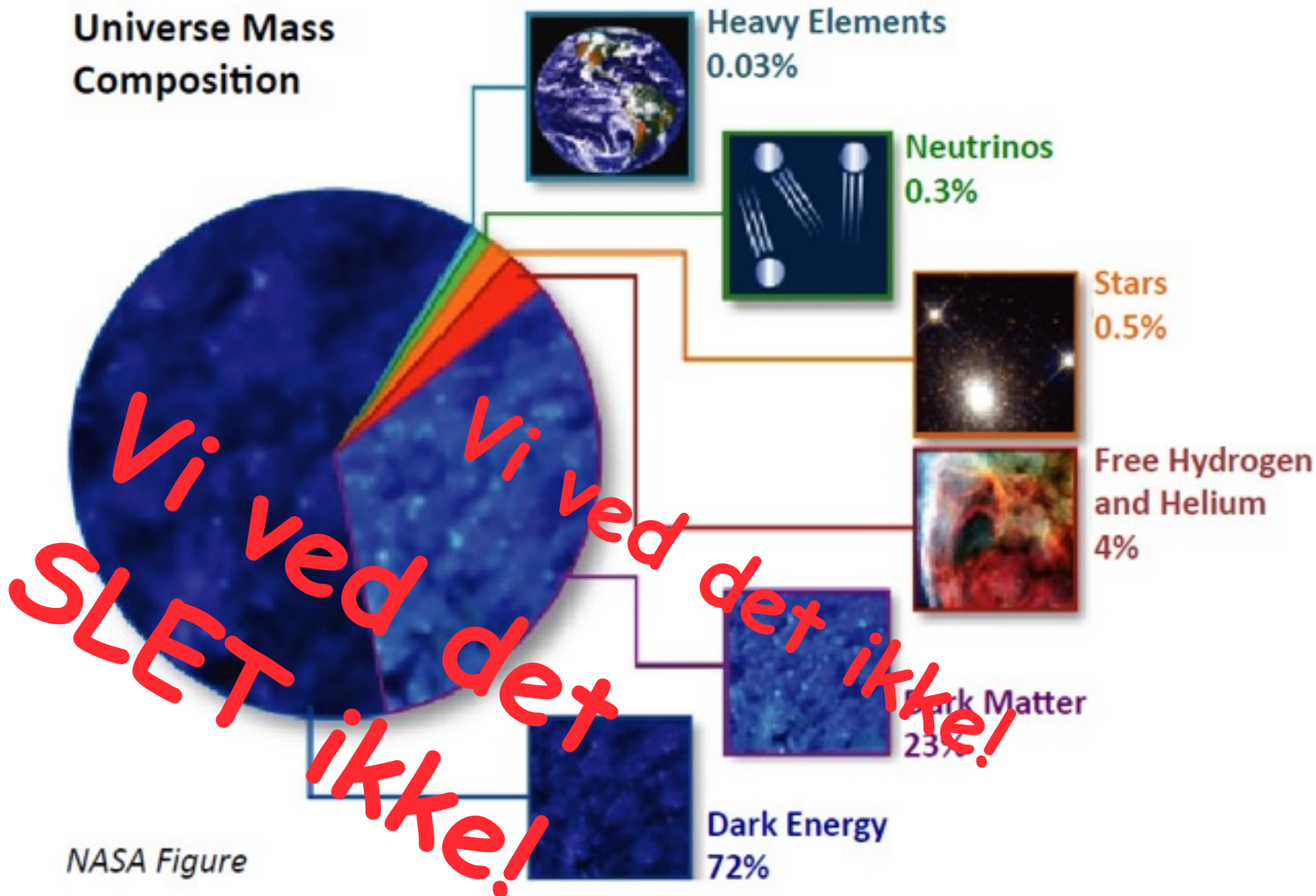
- x) Andelen af **stof** i Universet
- y) Andelen af **energy** i Universet

...og de er enige!!!



Universets bestanddele

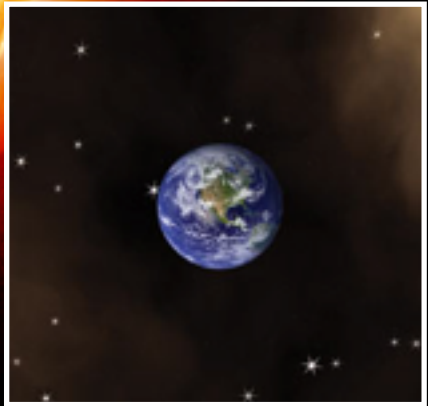
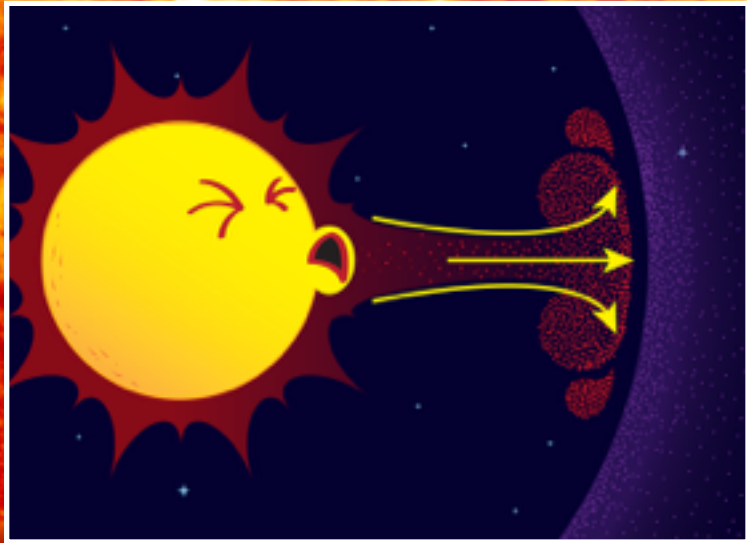
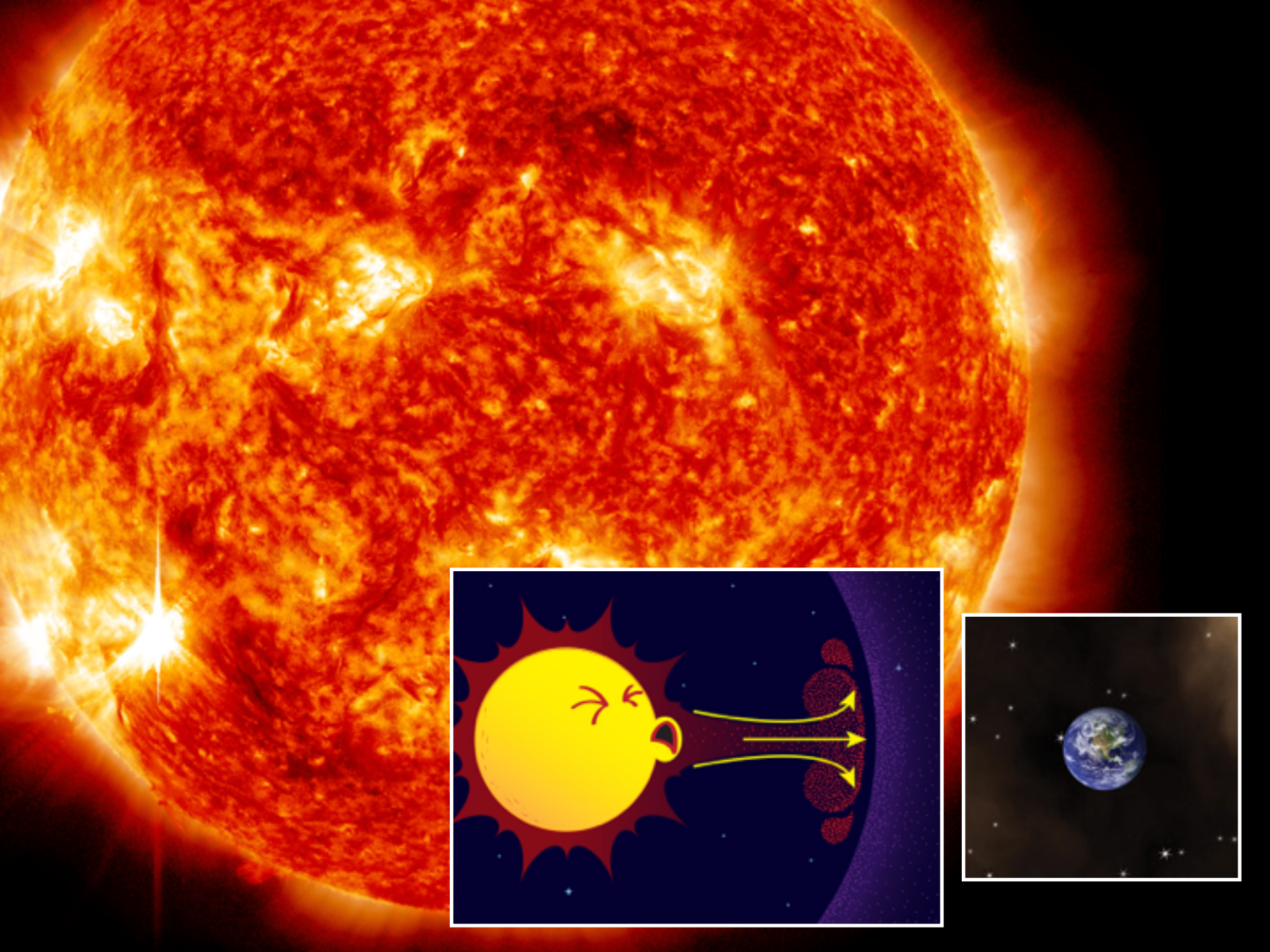
Universe Mass
Composition

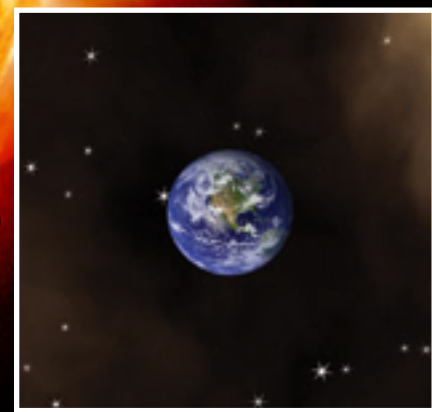
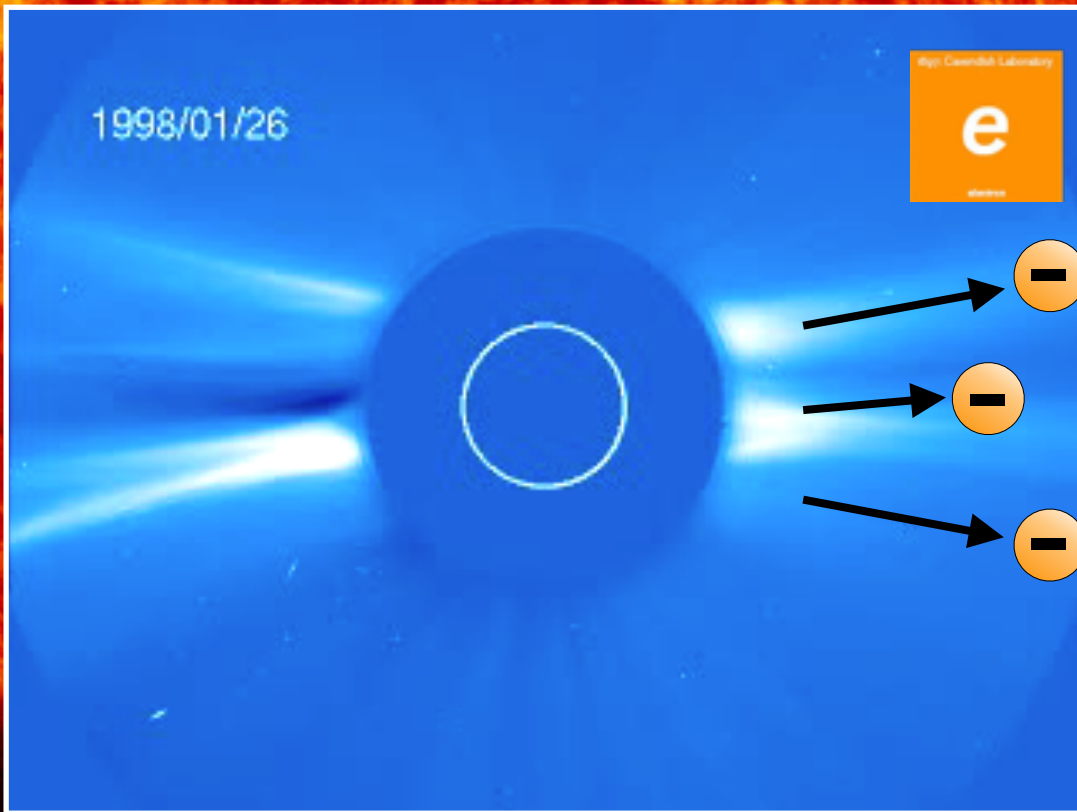
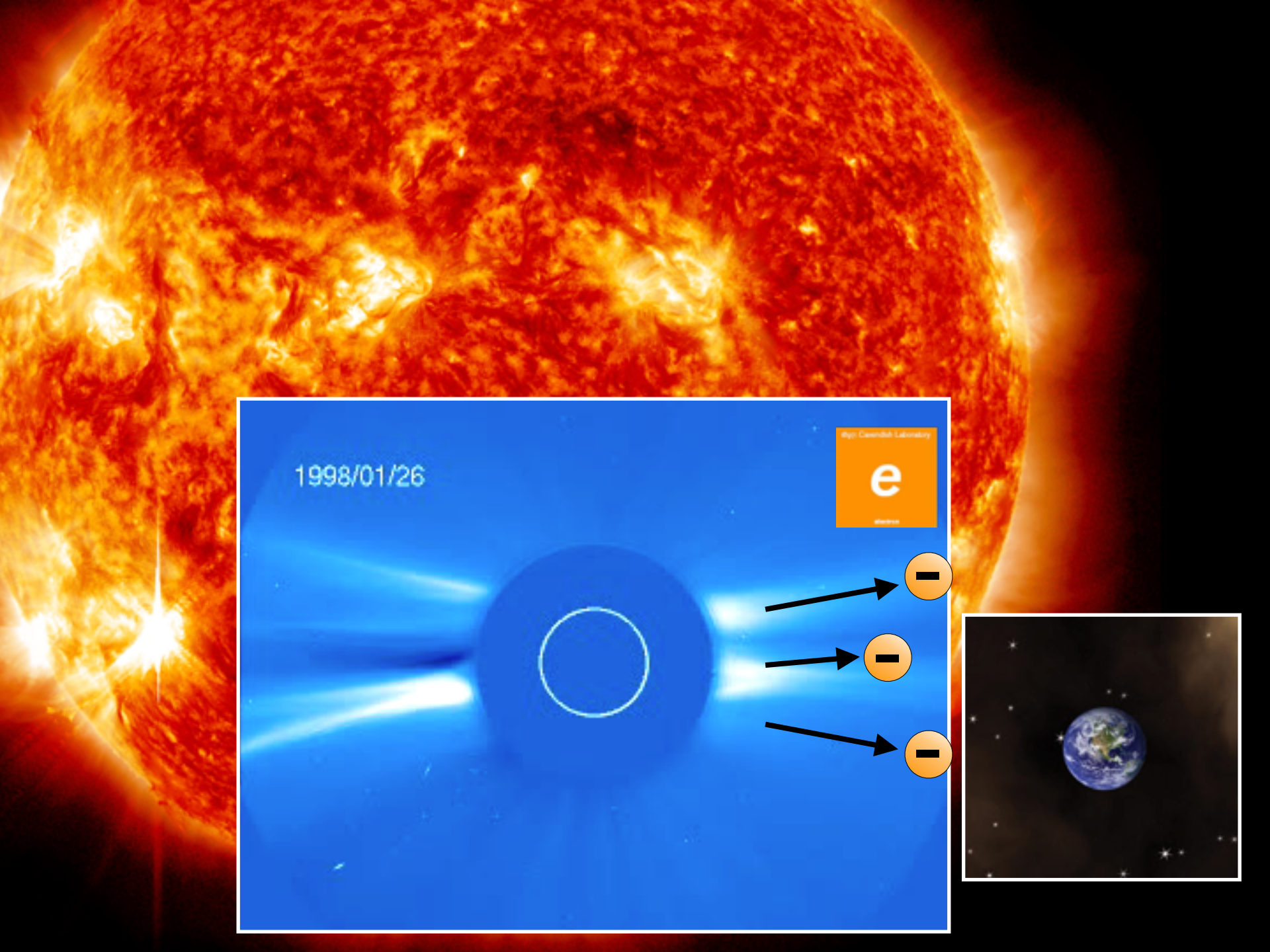


NASA Figure

Universets maskiner

The background features a complex, abstract pattern of glowing lines in shades of blue and yellow. These lines form a series of overlapping, concentric circles and spirals, creating a sense of depth and movement. The overall effect is reminiscent of a futuristic or scientific visualization, possibly representing the structure of the universe or a complex data set.







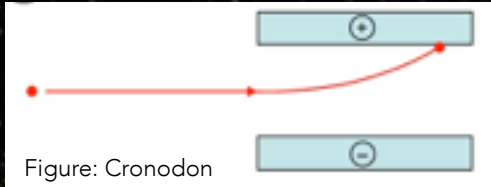


Figure: Cronodon

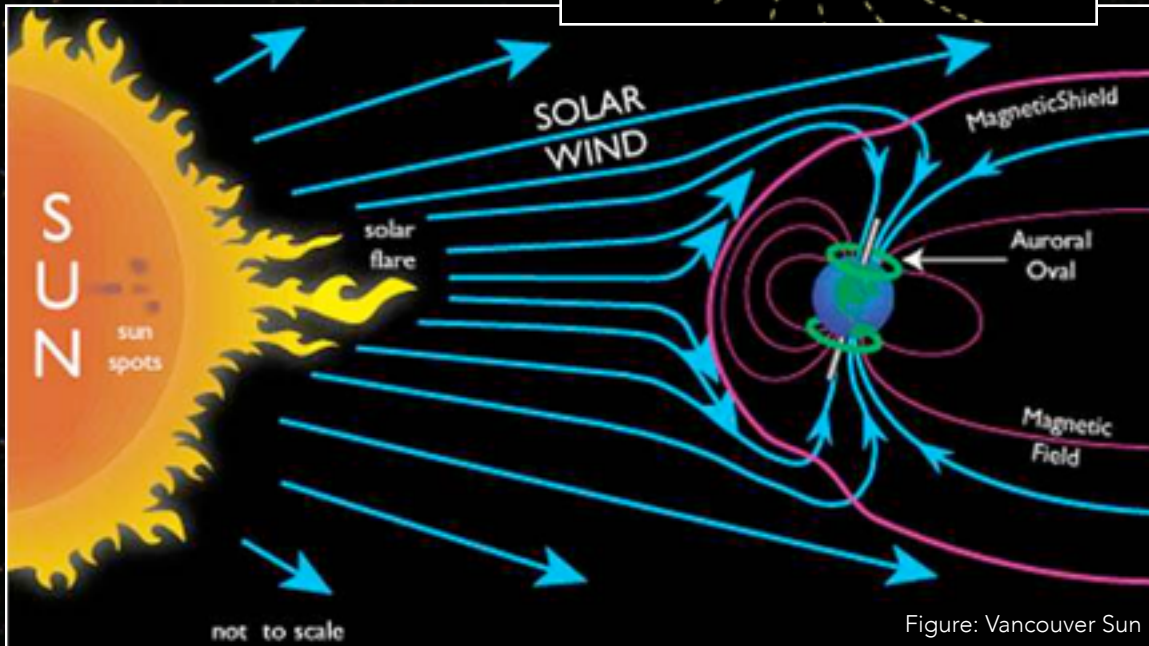
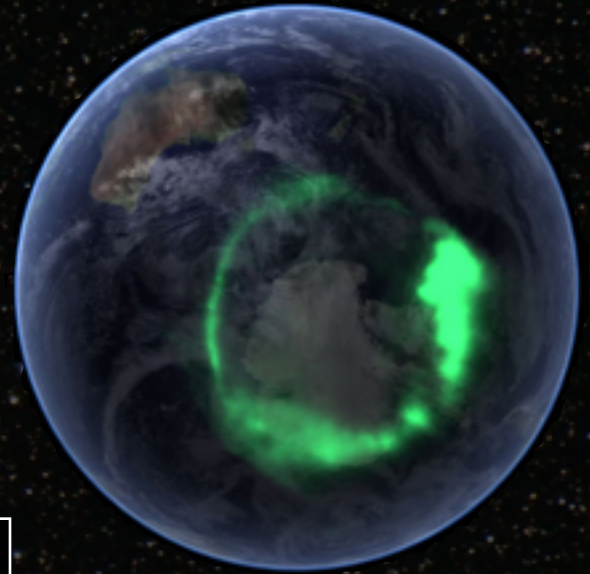
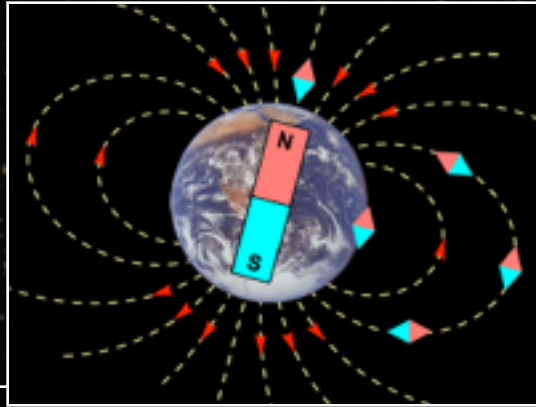
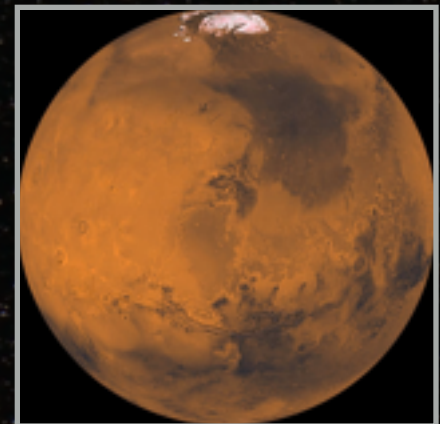
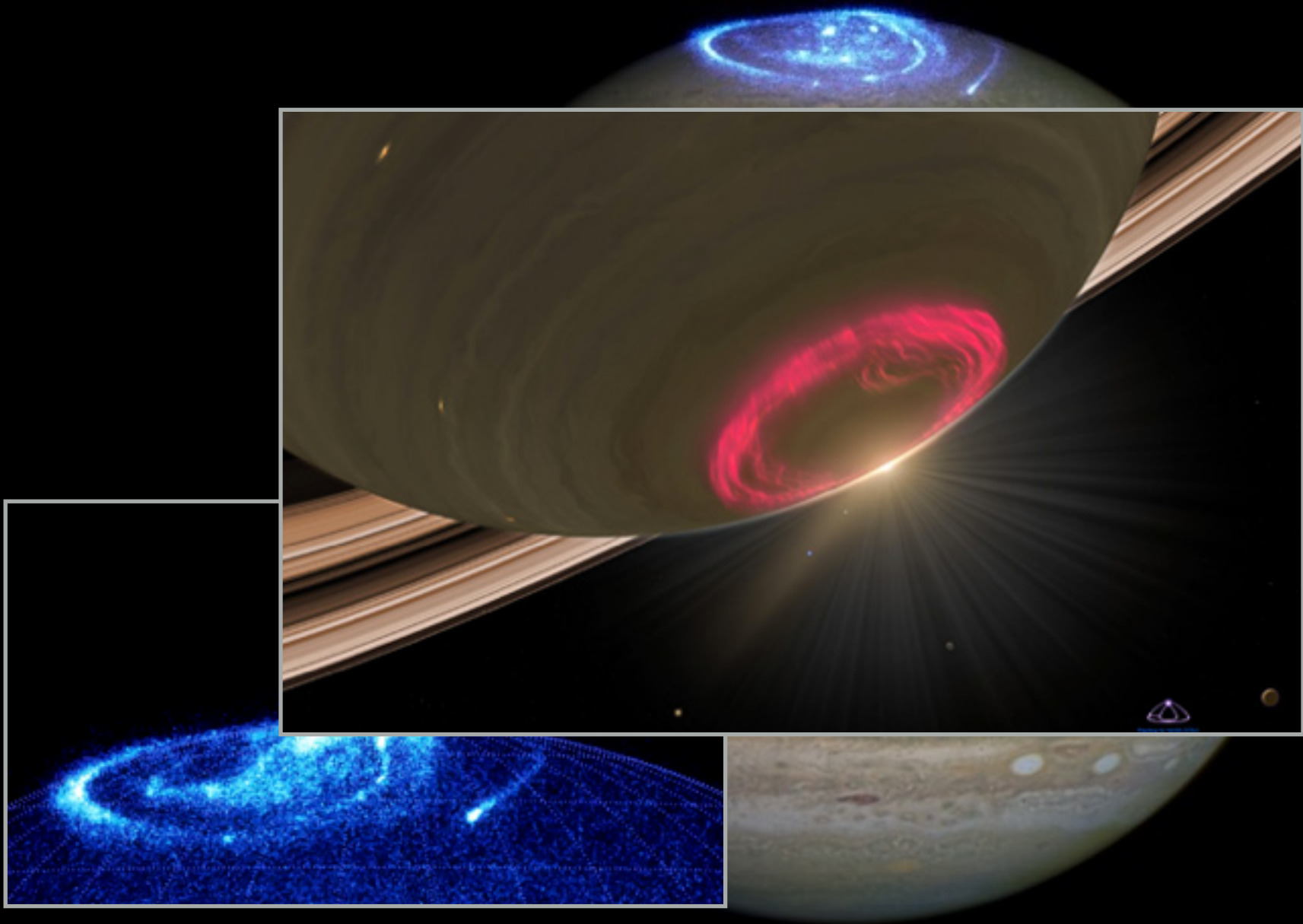
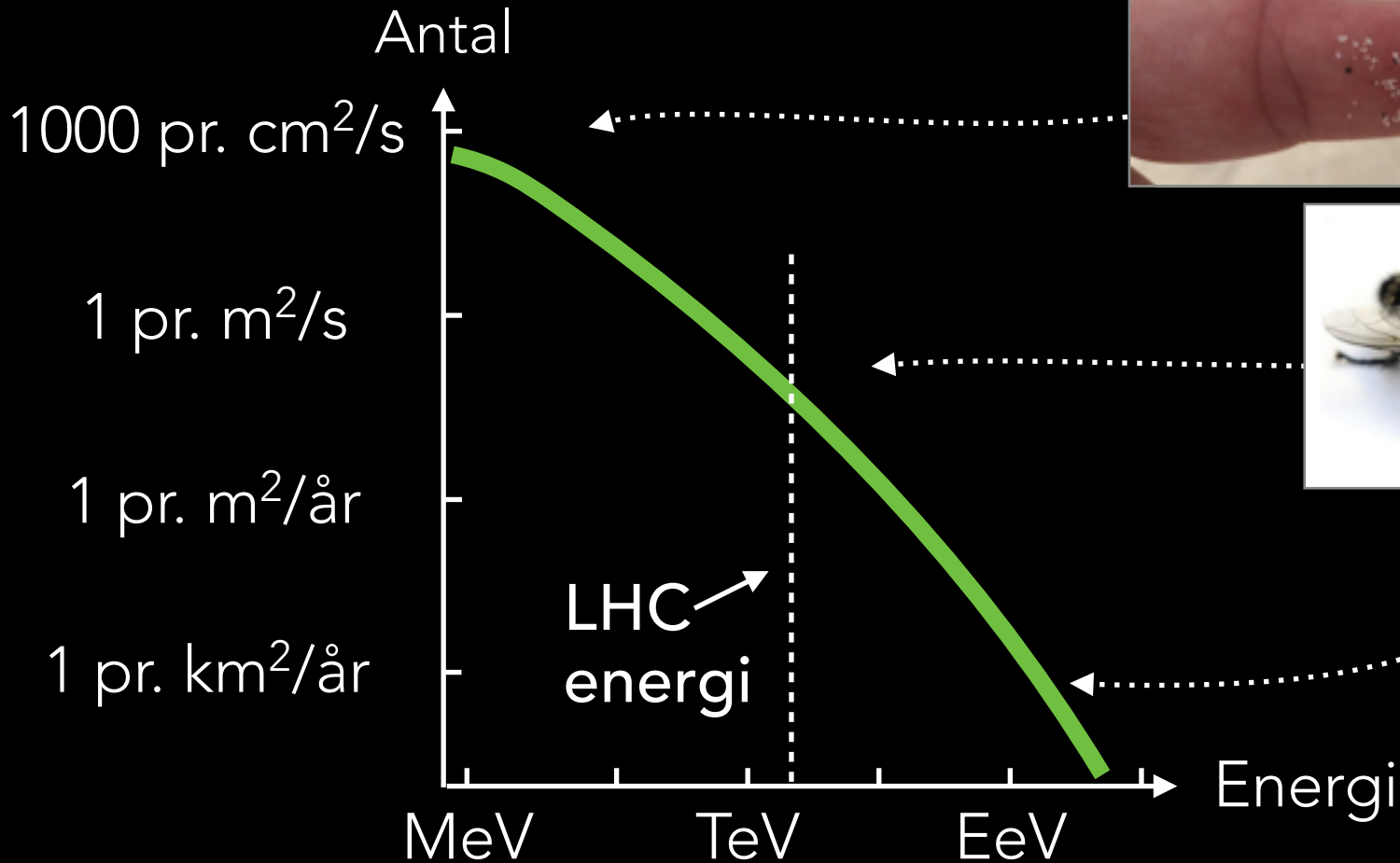


Figure: Vancouver Sun

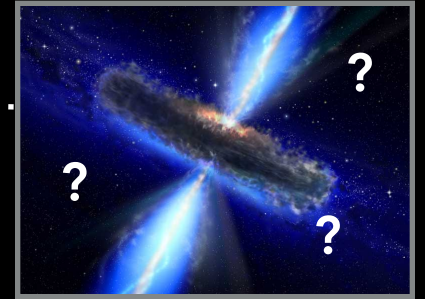
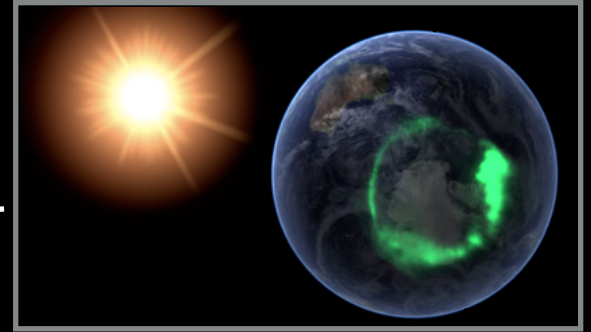
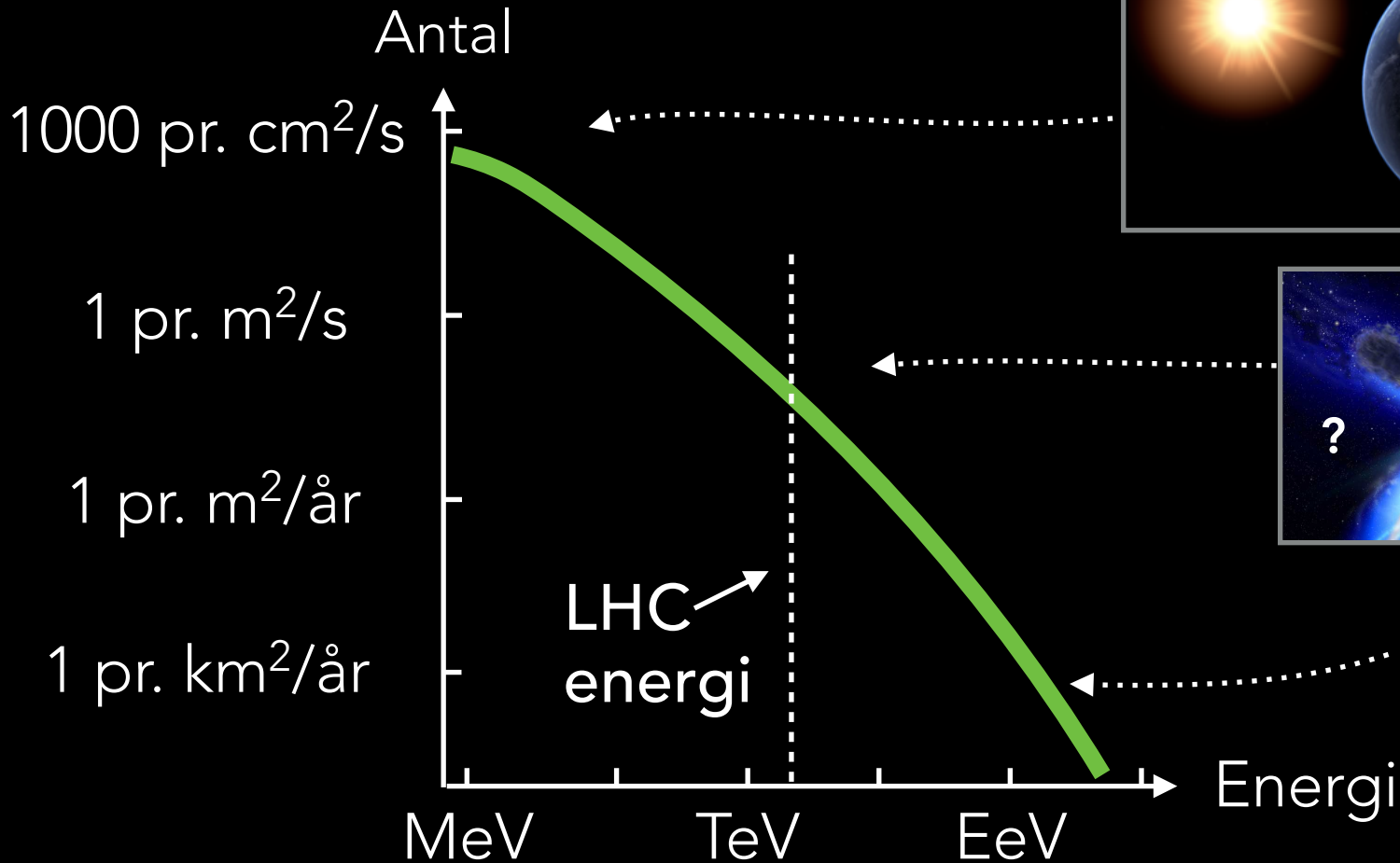




Enorme energier

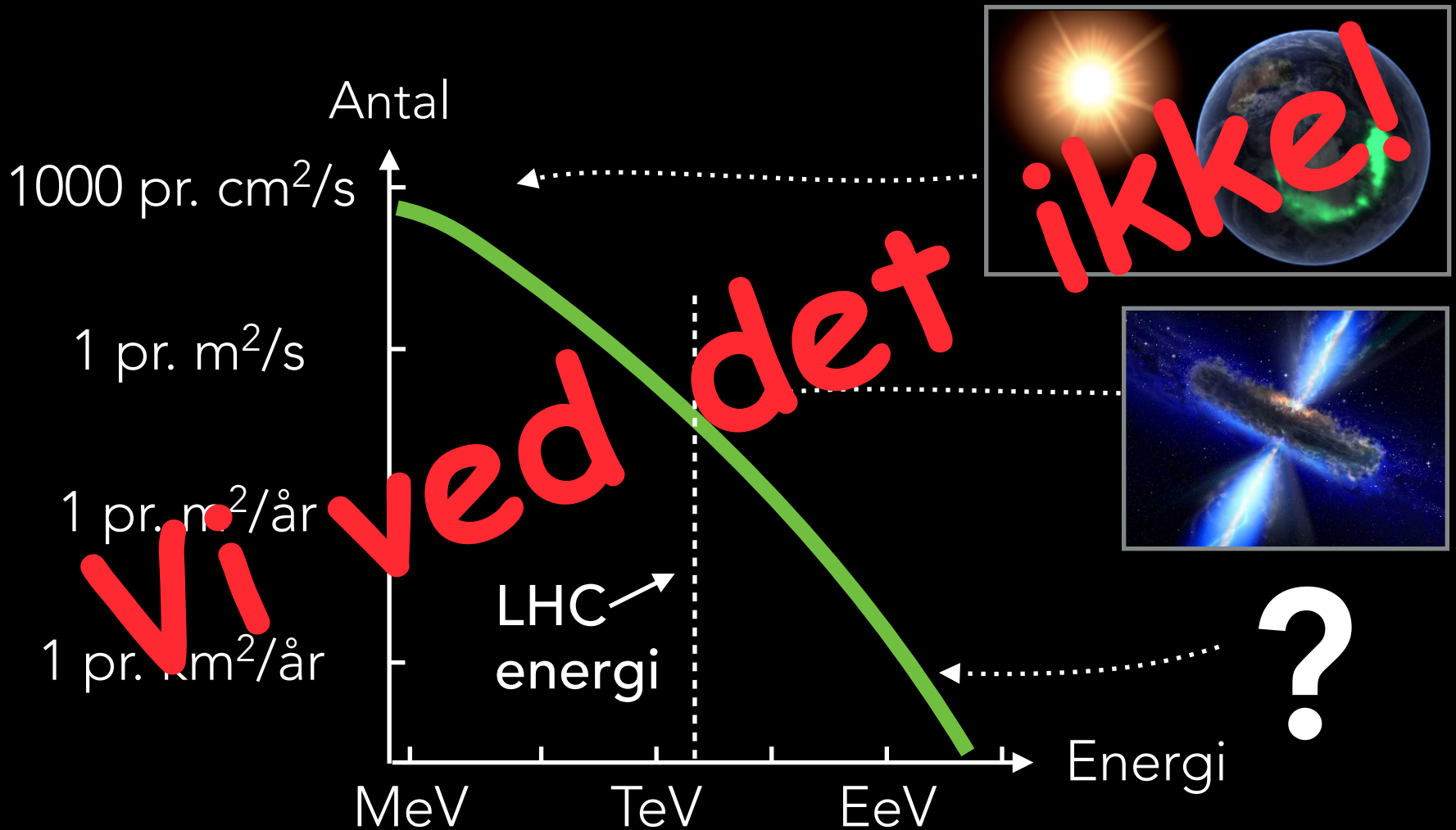


Enorme energier



?

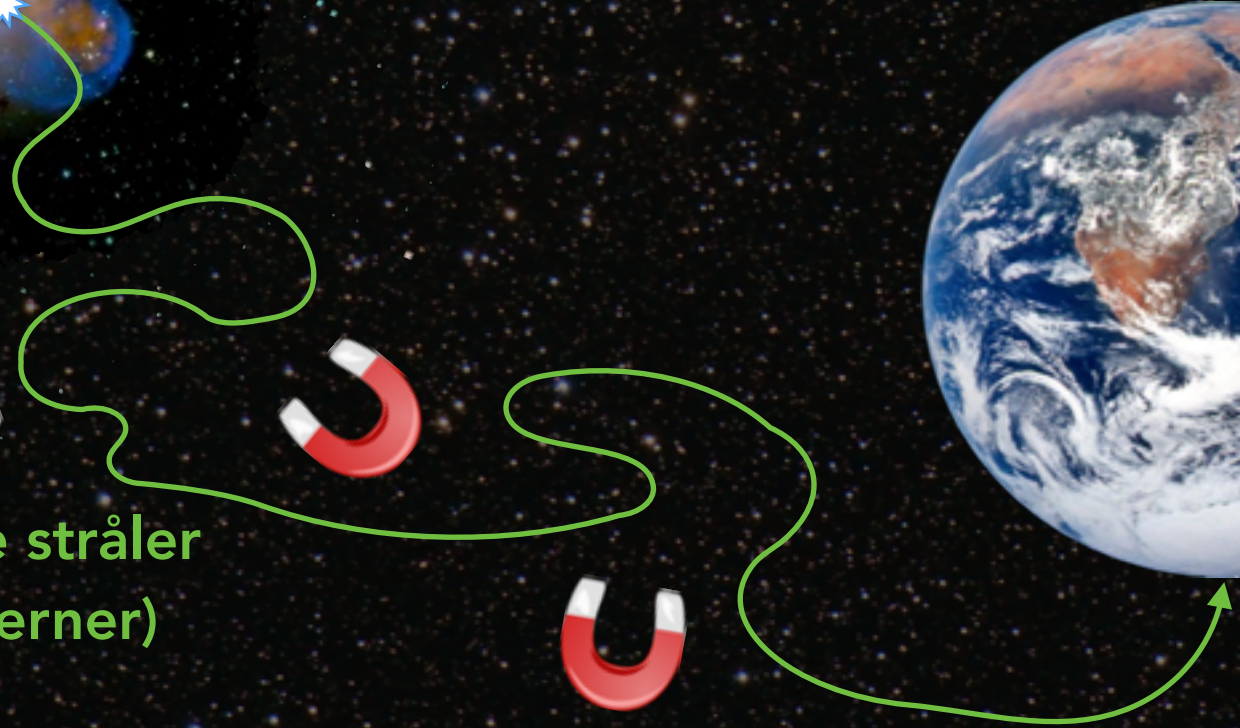
Enorme energier



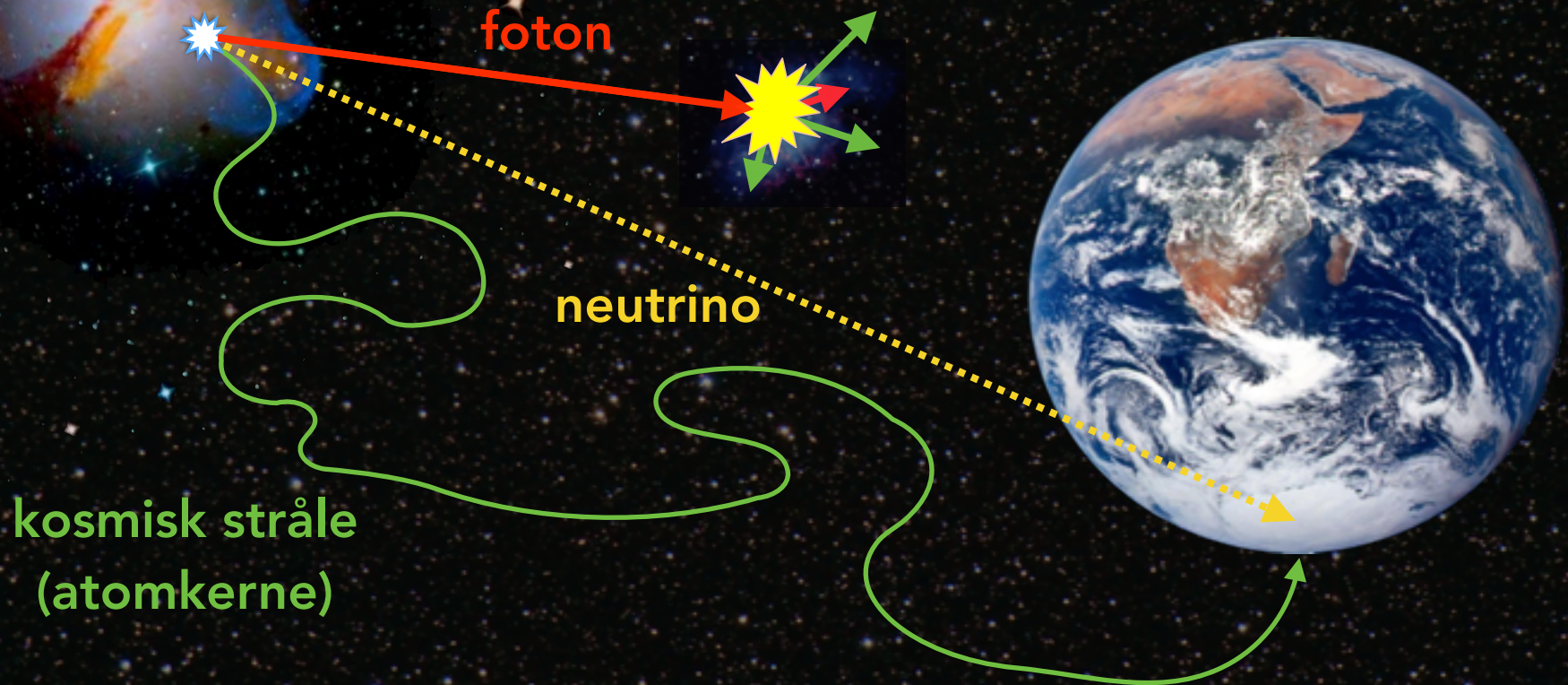
Oprindelsen



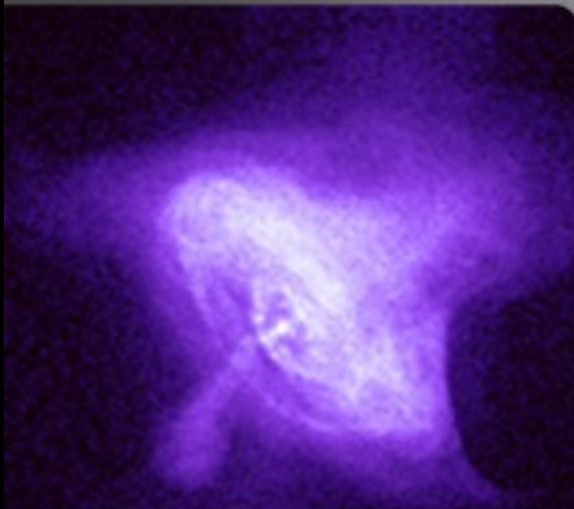
kosmiske stråler
(atomkerner)



Oprindelsen



Nye budbringere?

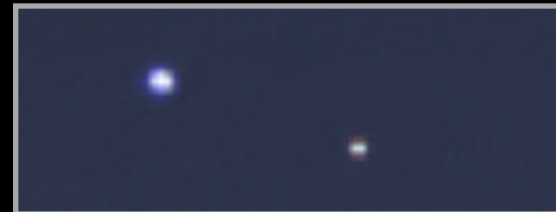


Neutrinoer?

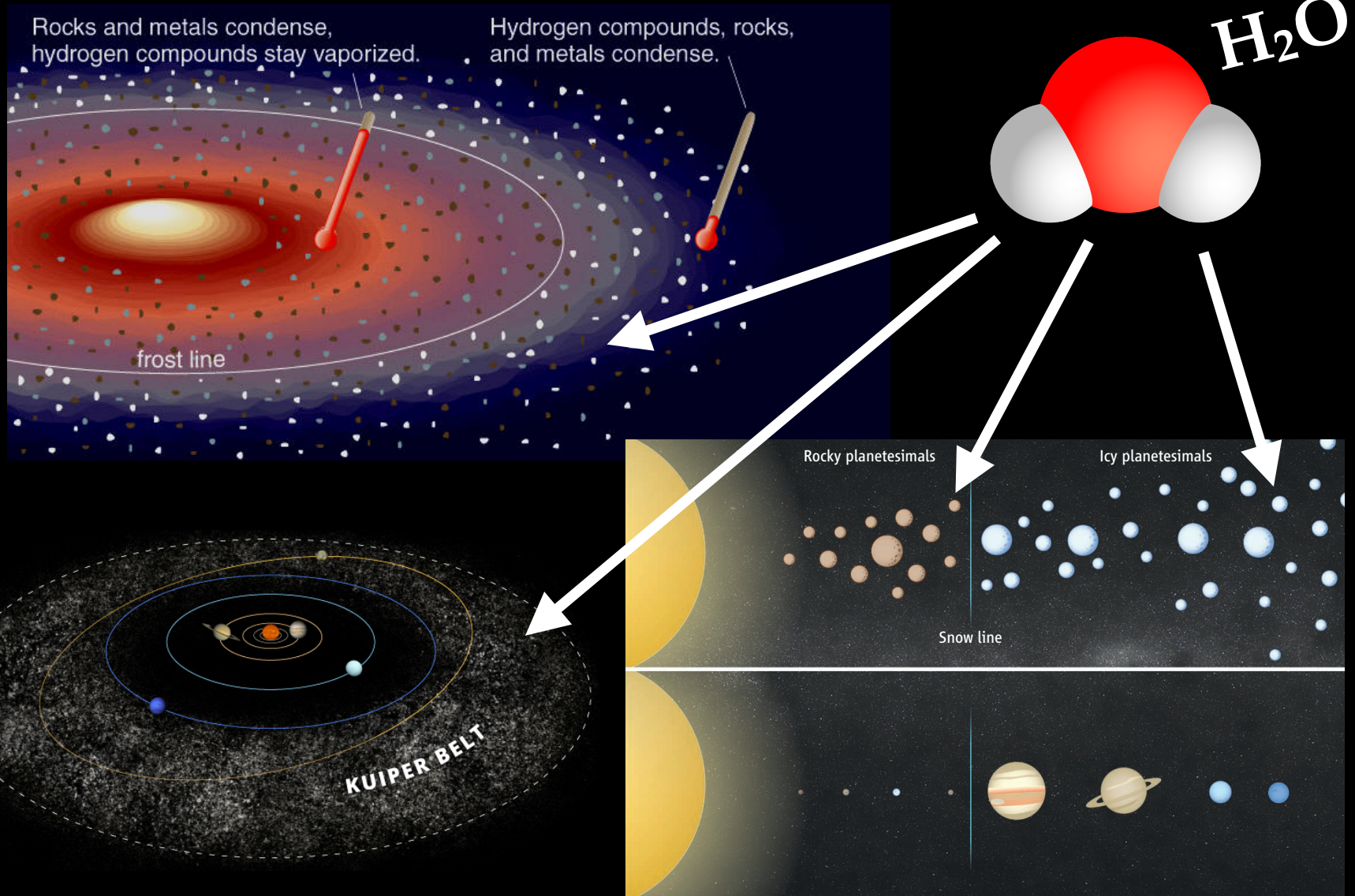
Jorden og vandet

The background features a complex, abstract pattern of glowing lines. A central point from which numerous lines radiate outwards, some forming concentric circles and others spiraling. The lines are primarily light blue and pale yellow, creating a sense of depth and movement against the dark, almost black background. The overall effect is reminiscent of a digital or scientific visualization, possibly representing data flow or a complex system.

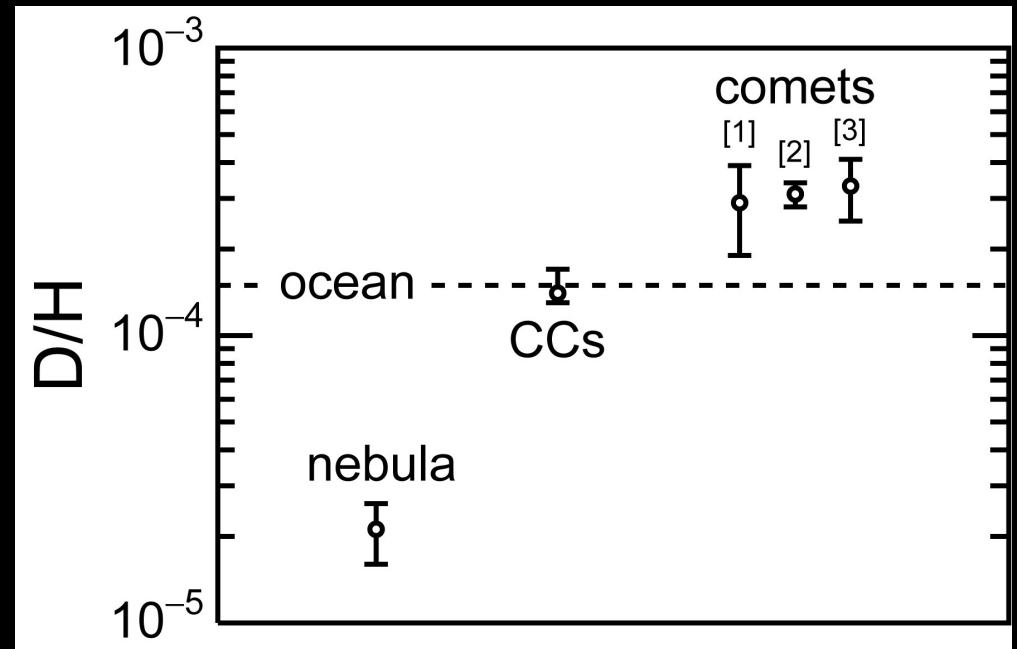
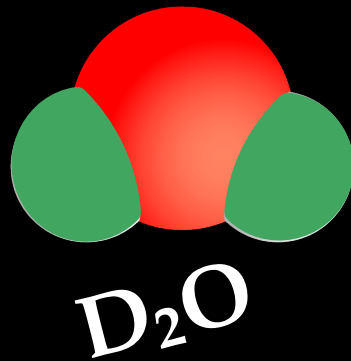
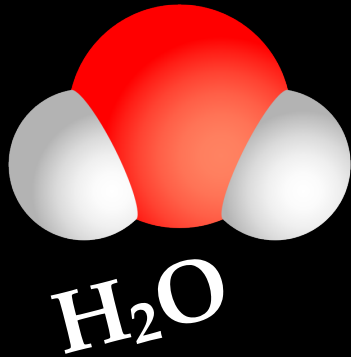
Den blå planet



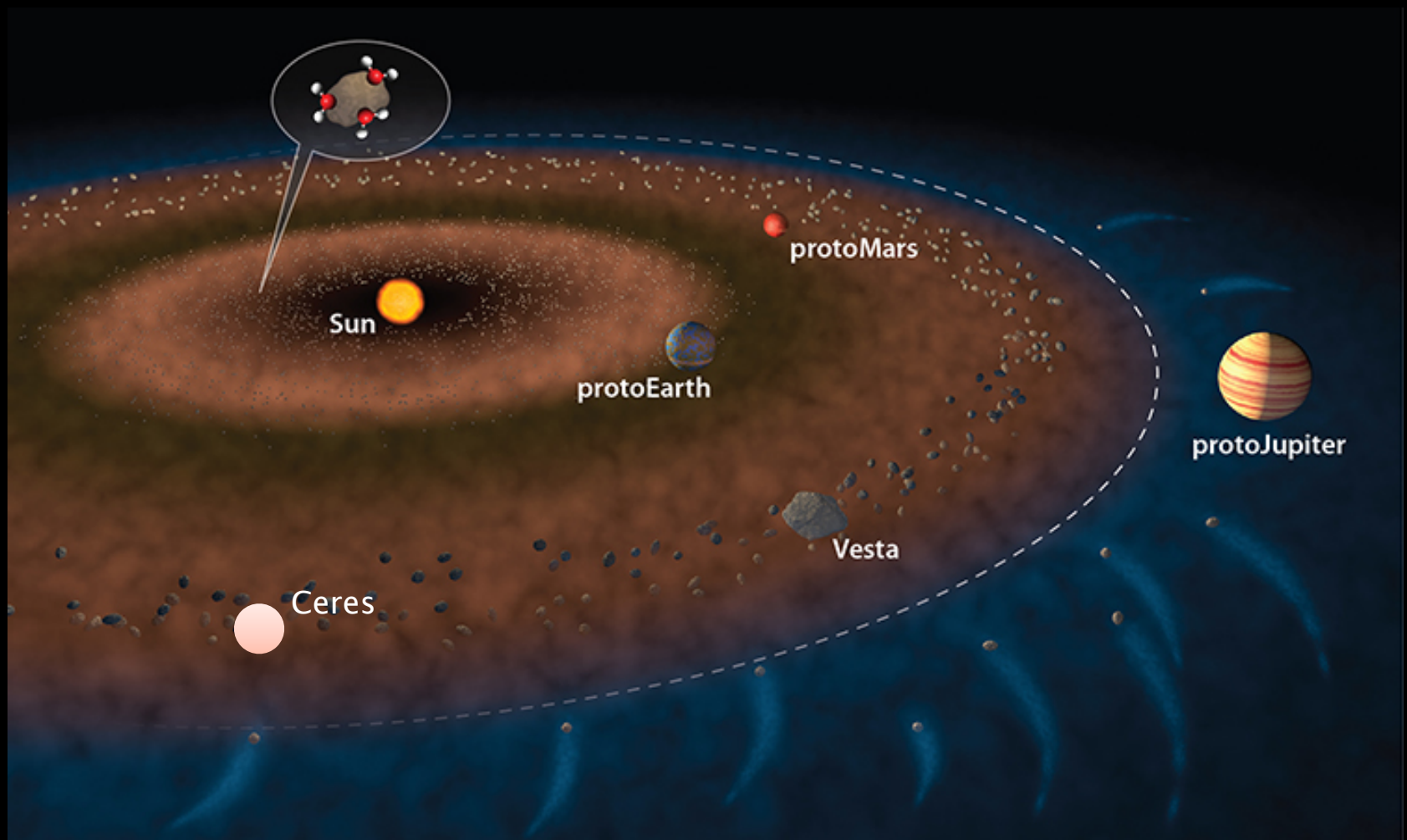
Vandets oprindelse



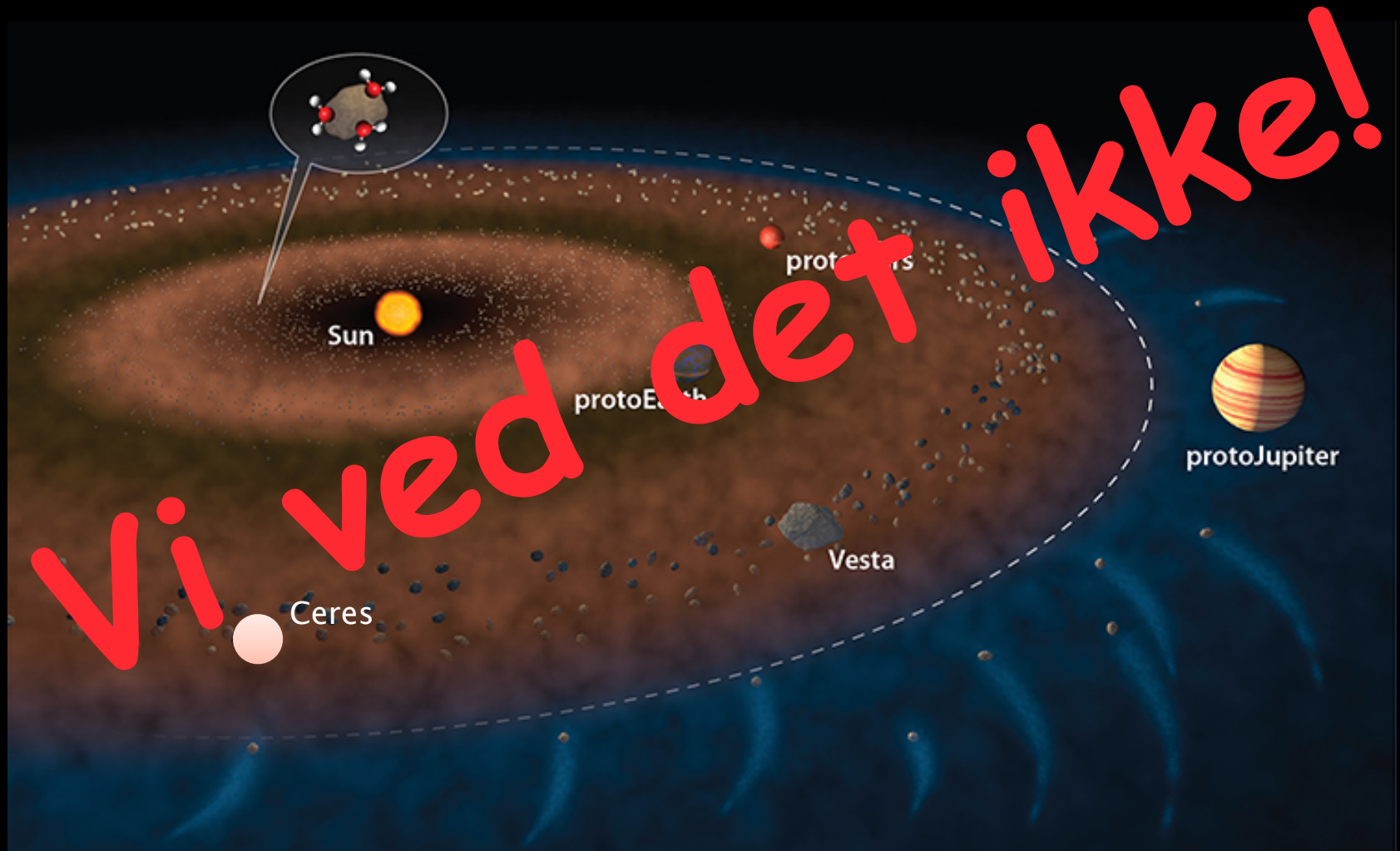
Vandets oprindelse



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Liv på Jorden og evolution

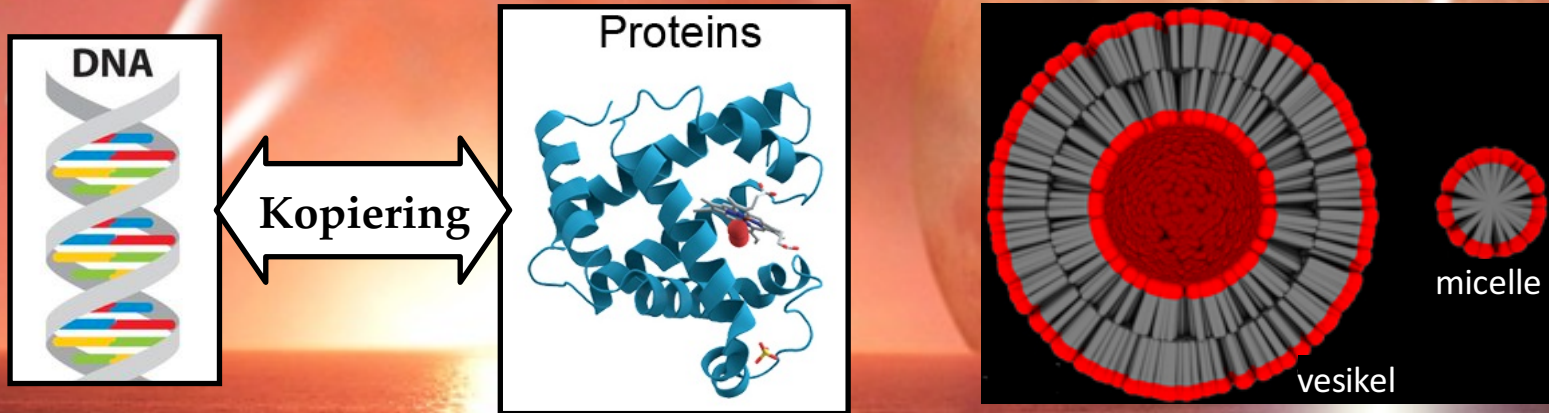
Livet opståen på Jorden



Al liv vi kender

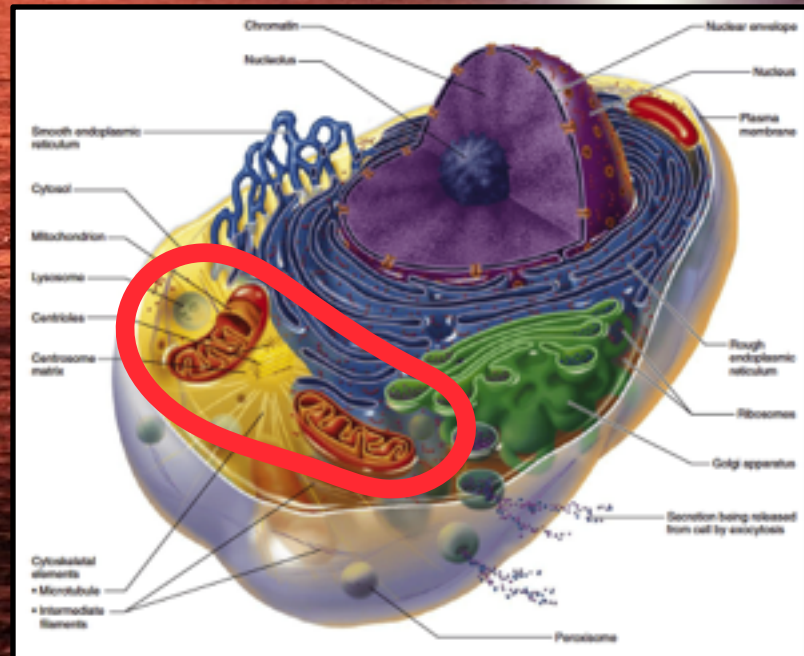
- **kopierer** sig selv
- **befinder** sig i en **celle**
- **forbruger energi**

Livet opståen på Jorden

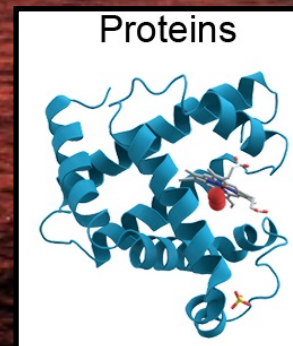


Al liv vi kender

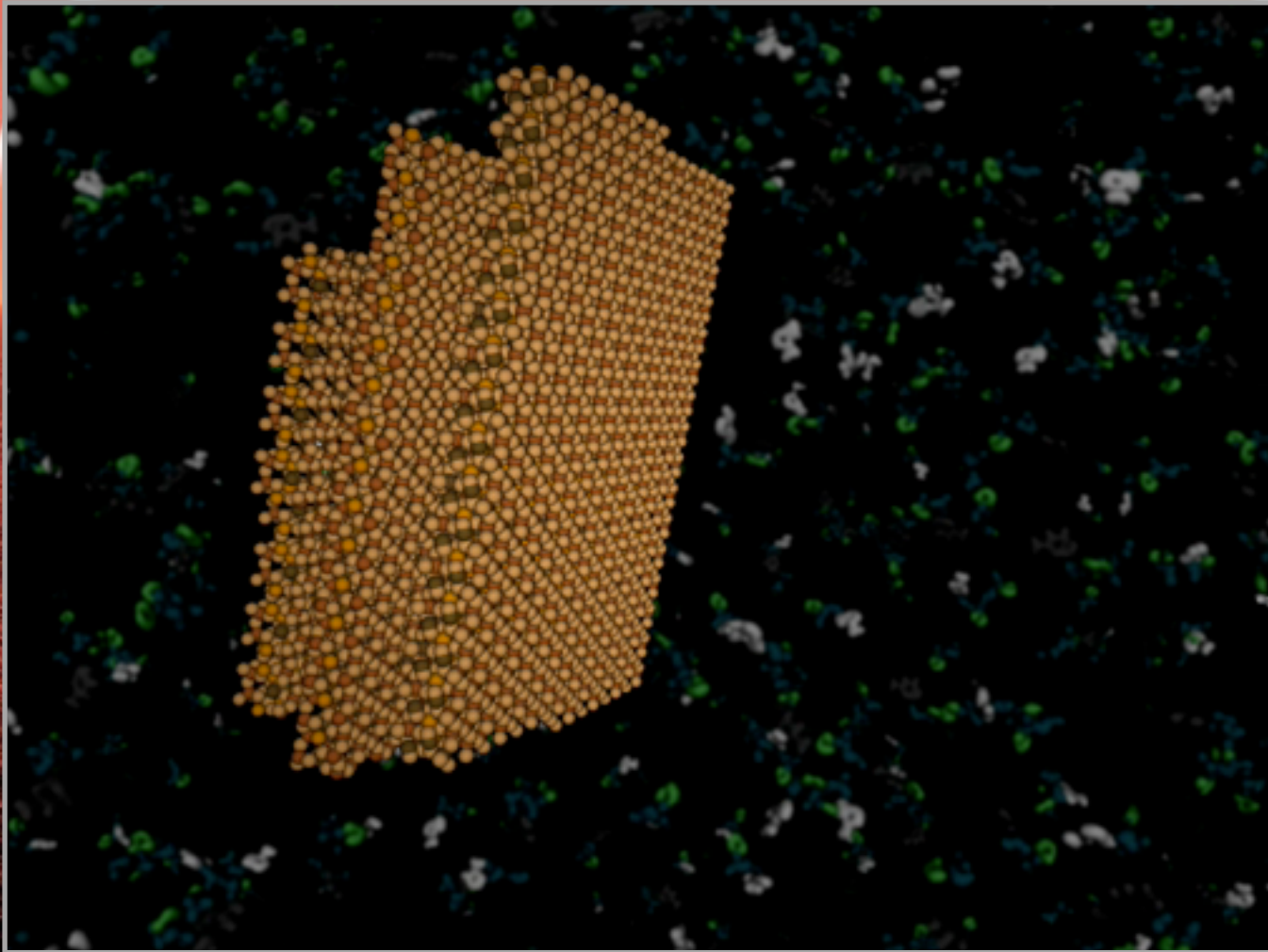
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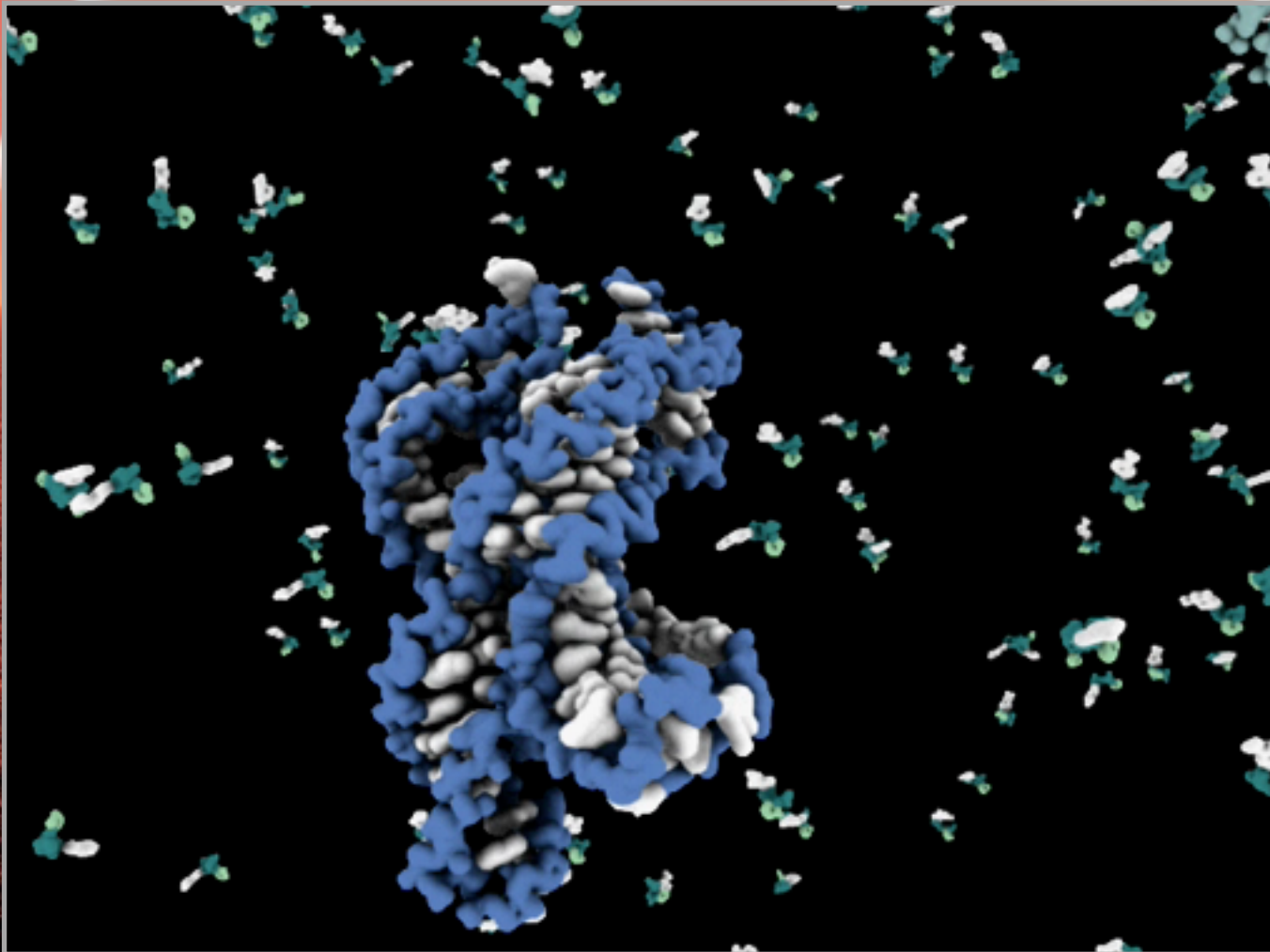
Livet opståen på Jorden



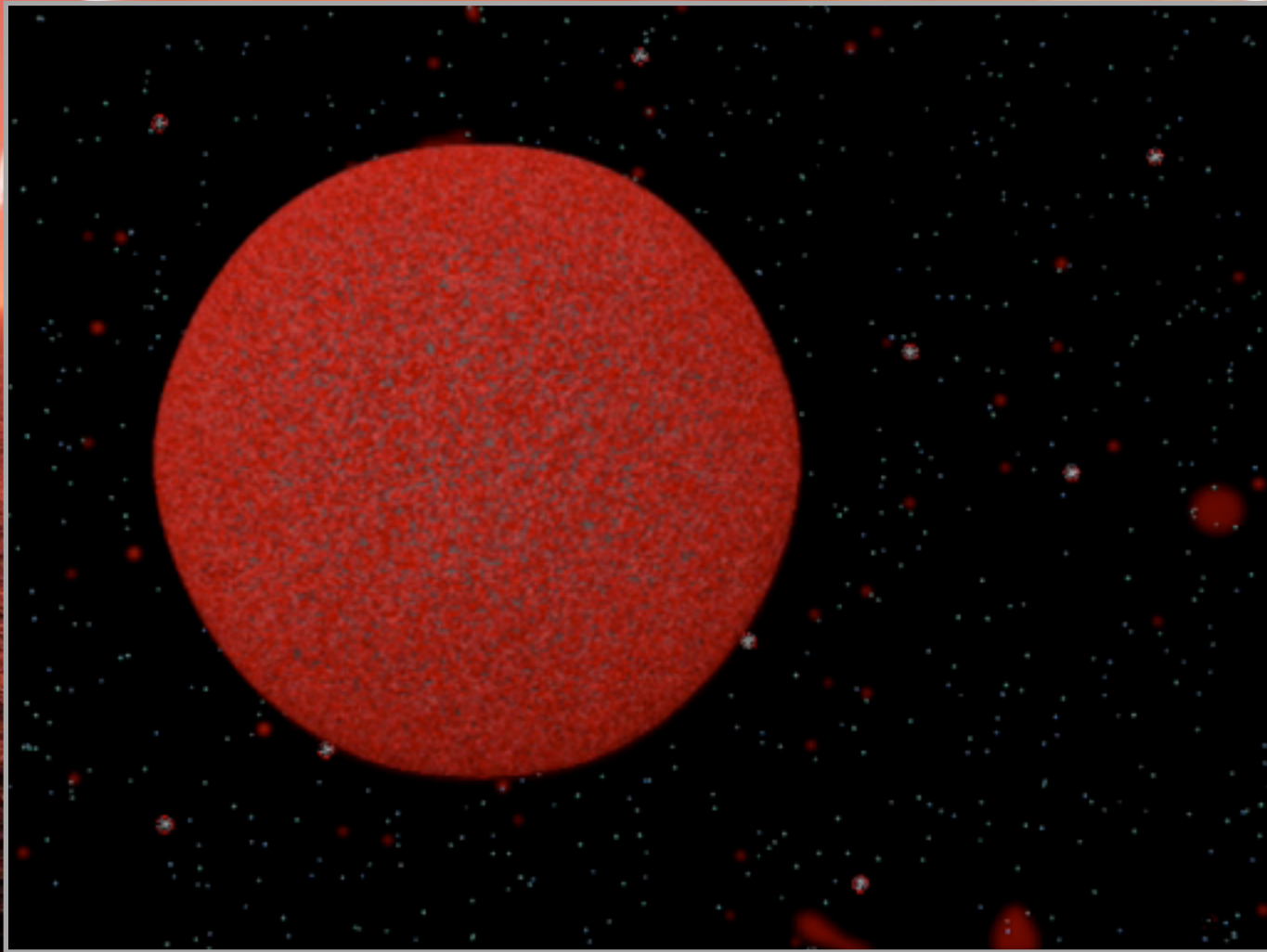
Livet opståen på Jorden



Livet opståen på Jorden



Livet opståen på Jorden



Livet opståen på Jorden

Ursupper med
aminosyrer og
nukleotider

RNA verden

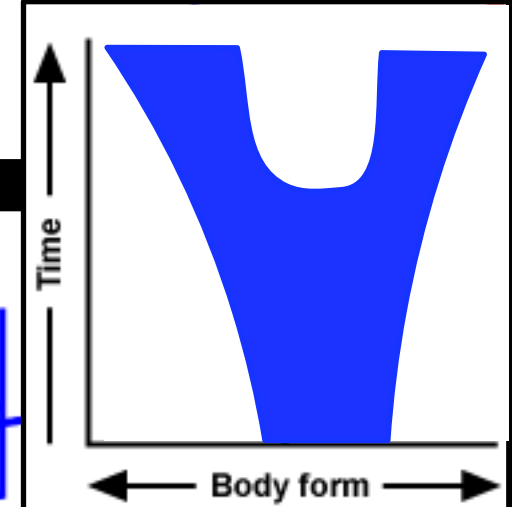
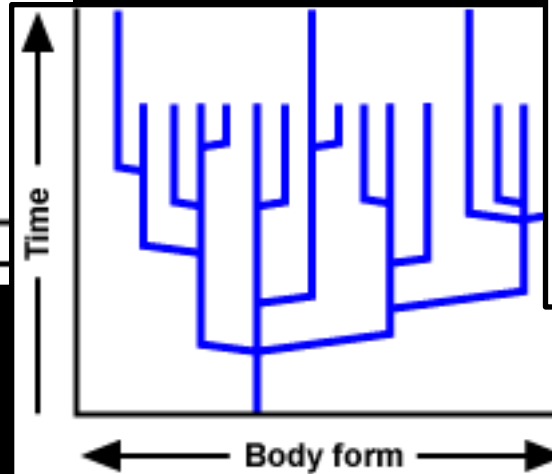
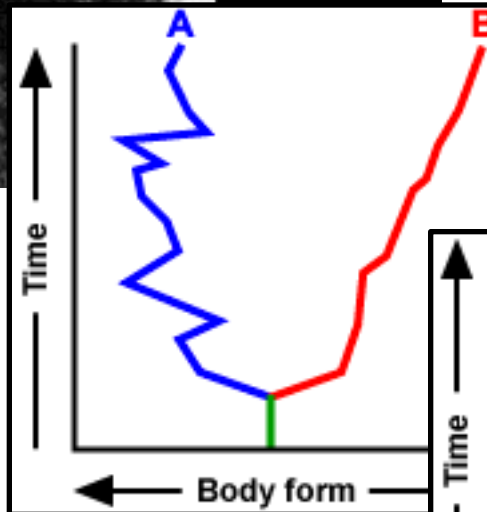
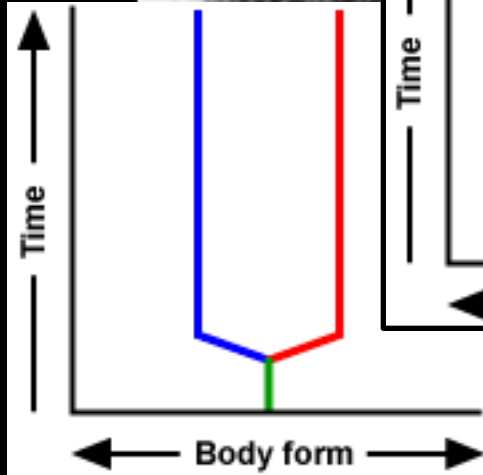
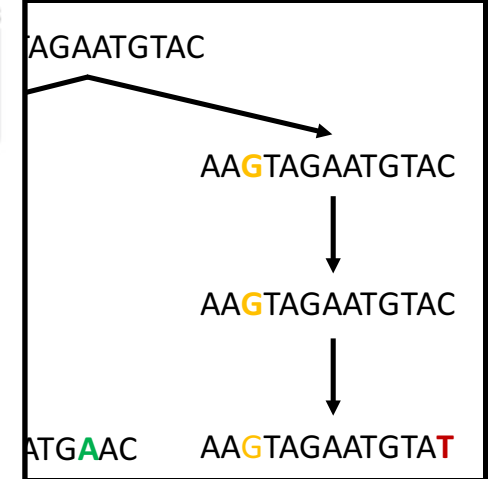
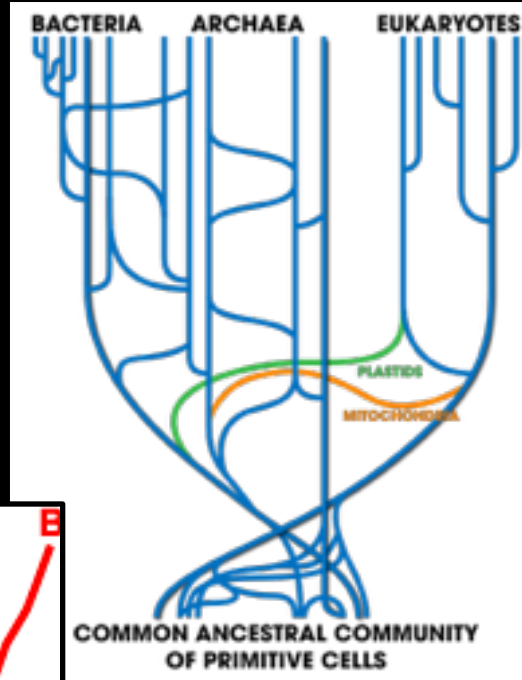
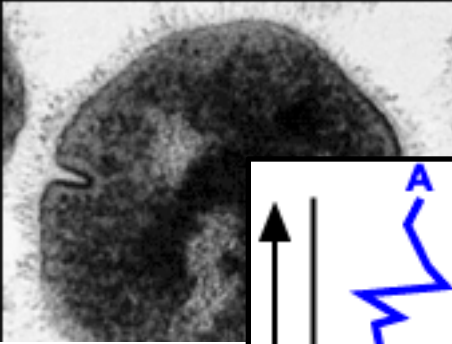
DNA og proteiner

(Mulige) Ingredienser:

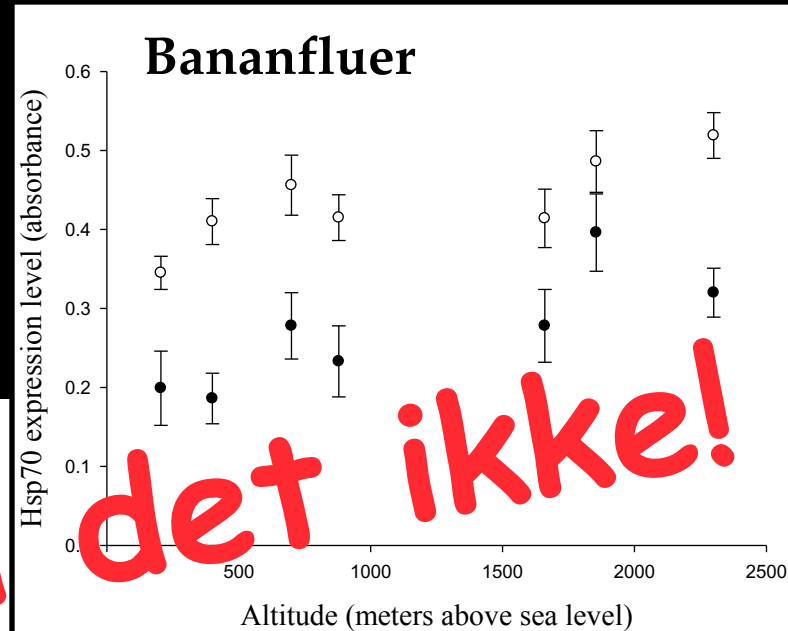
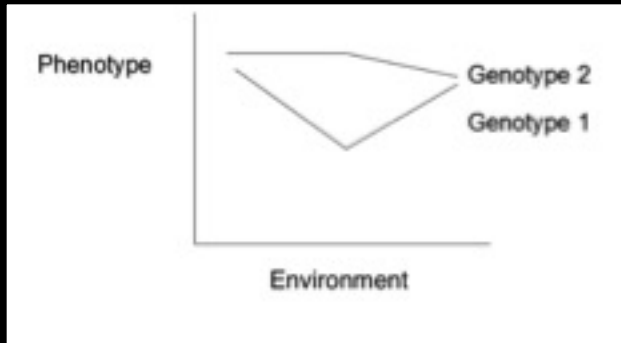
- Der skabes aminosyrer i solsystemet.
- Passende atmosfære og flydende vand.
- Rigtig temperatur og overskud af energi.
- Relativ stabilitet men også dynamikker.

Vi ved det ikke!

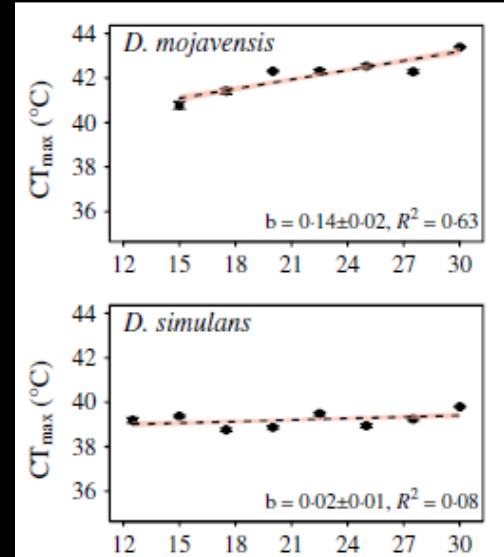
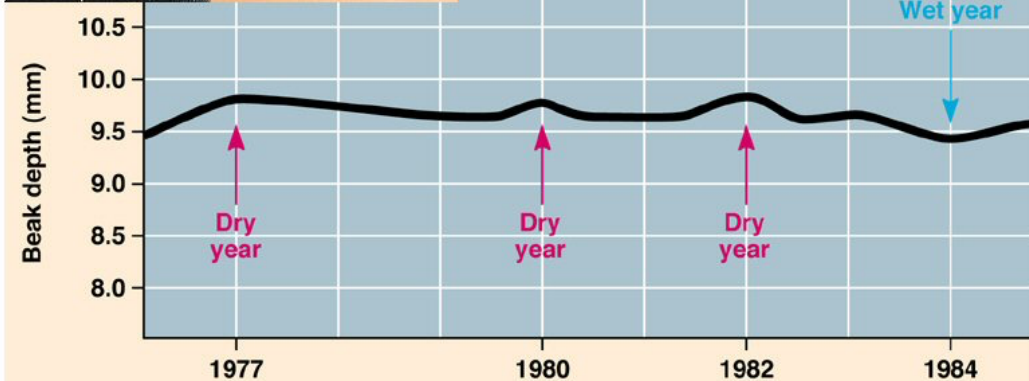
Arter og artsdannelse



Evolution og miljø



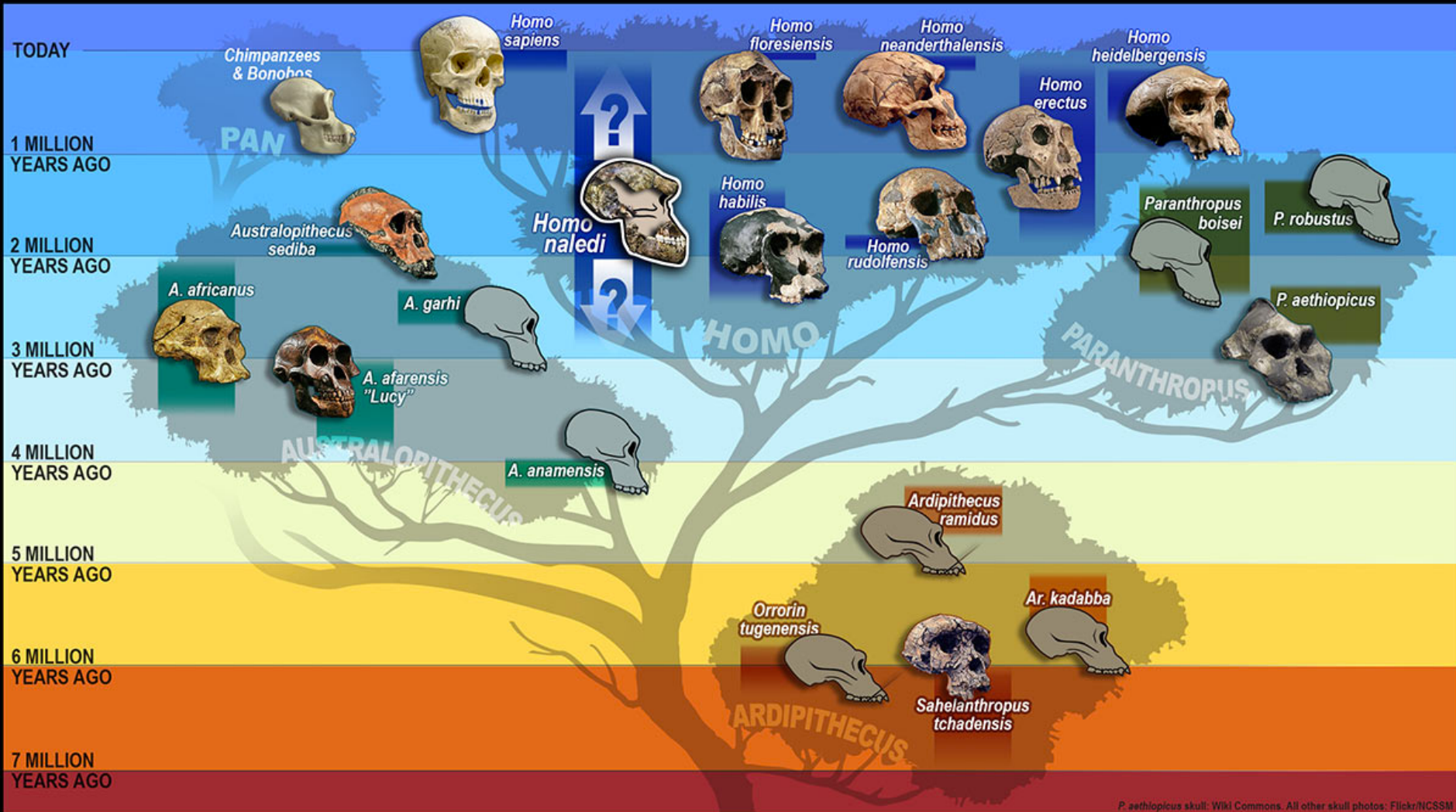
vi ved det ikke!





Mennesket og vores forfædre

Vores forfædre



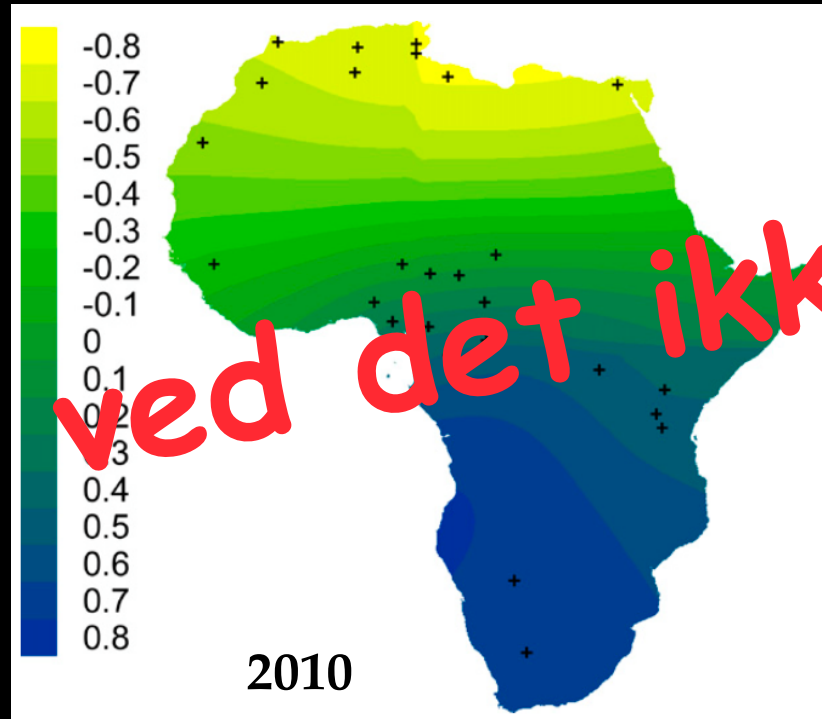
P. aethiopicus skull: Wiki Commons. All other skull photos: Flickr/NCSSM

Hvor opstod Homo sapiens?

Tidligere: Rift Valley (Etiopien)

Bedre bud: Sydlige Afrika

Vi ved det ikke!

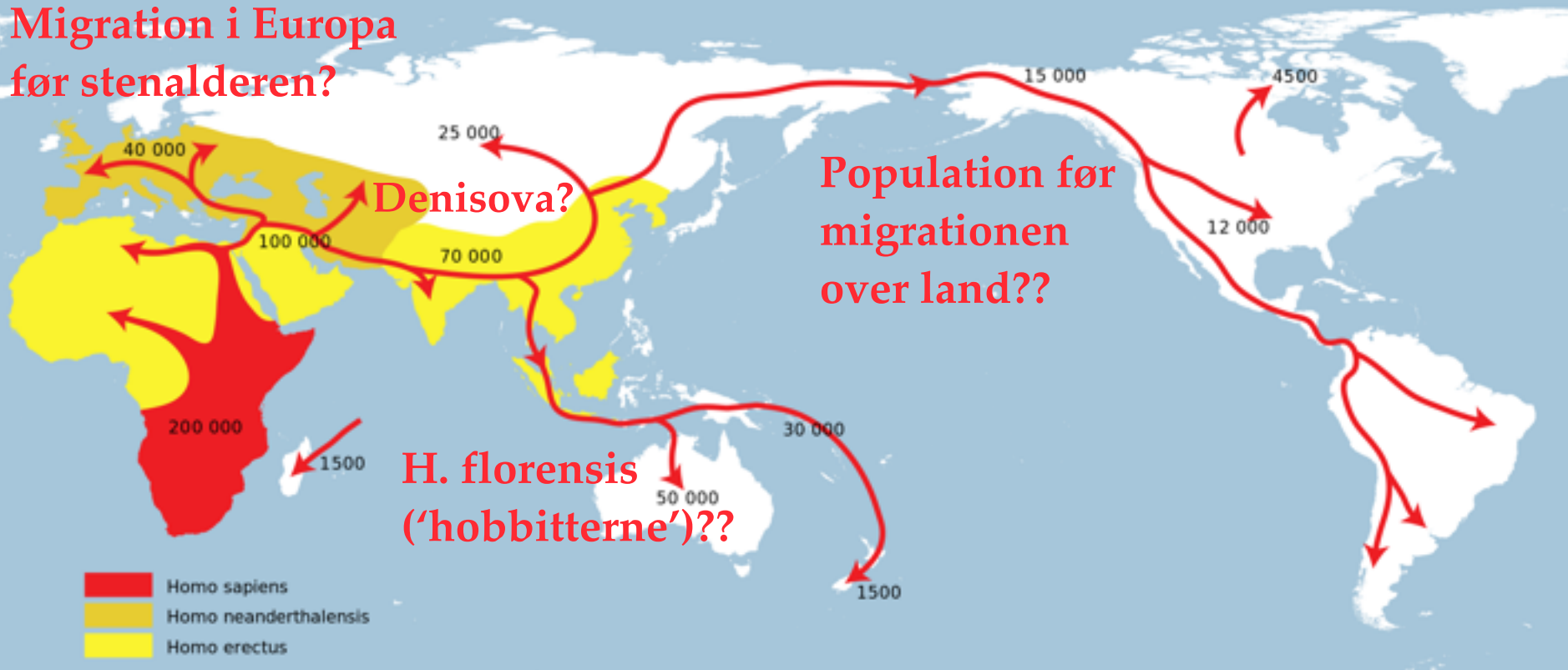


300.000 år gammel H. sapiens fundet i Marokko

175.000 år gammel H. sapiens fundet i hule i Israel

Moderne menneskes udbredelse

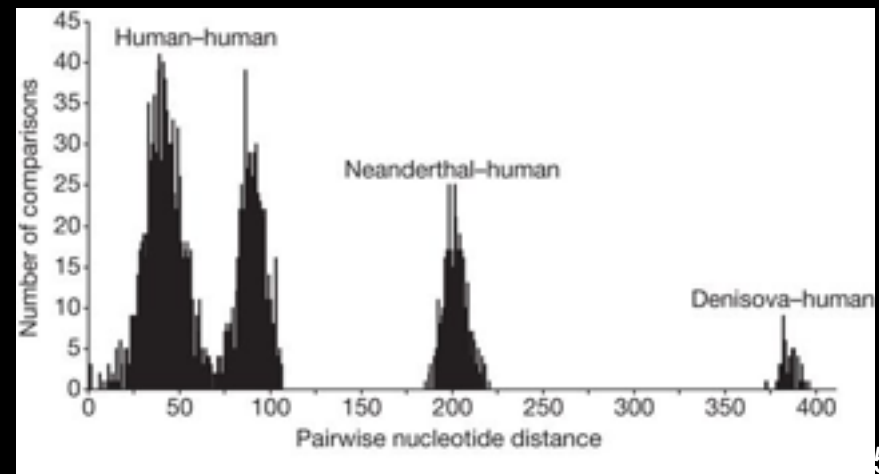
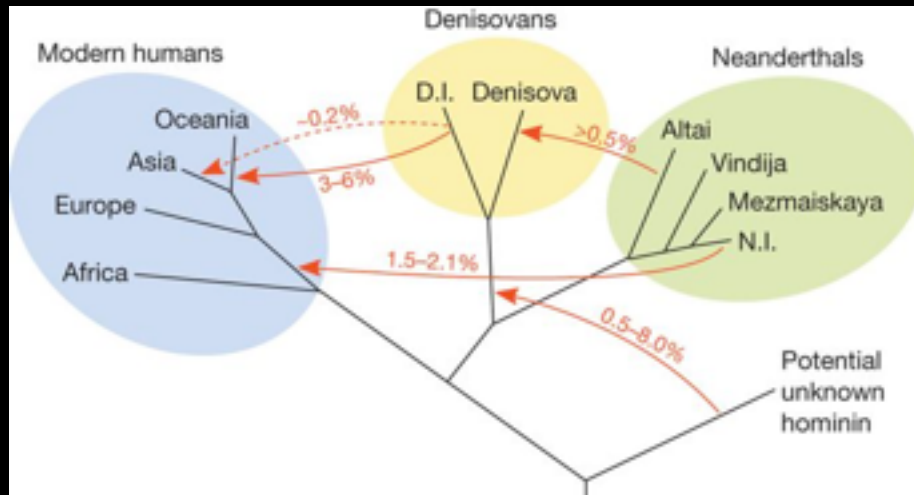
Migration i Europa
før stenalderen?



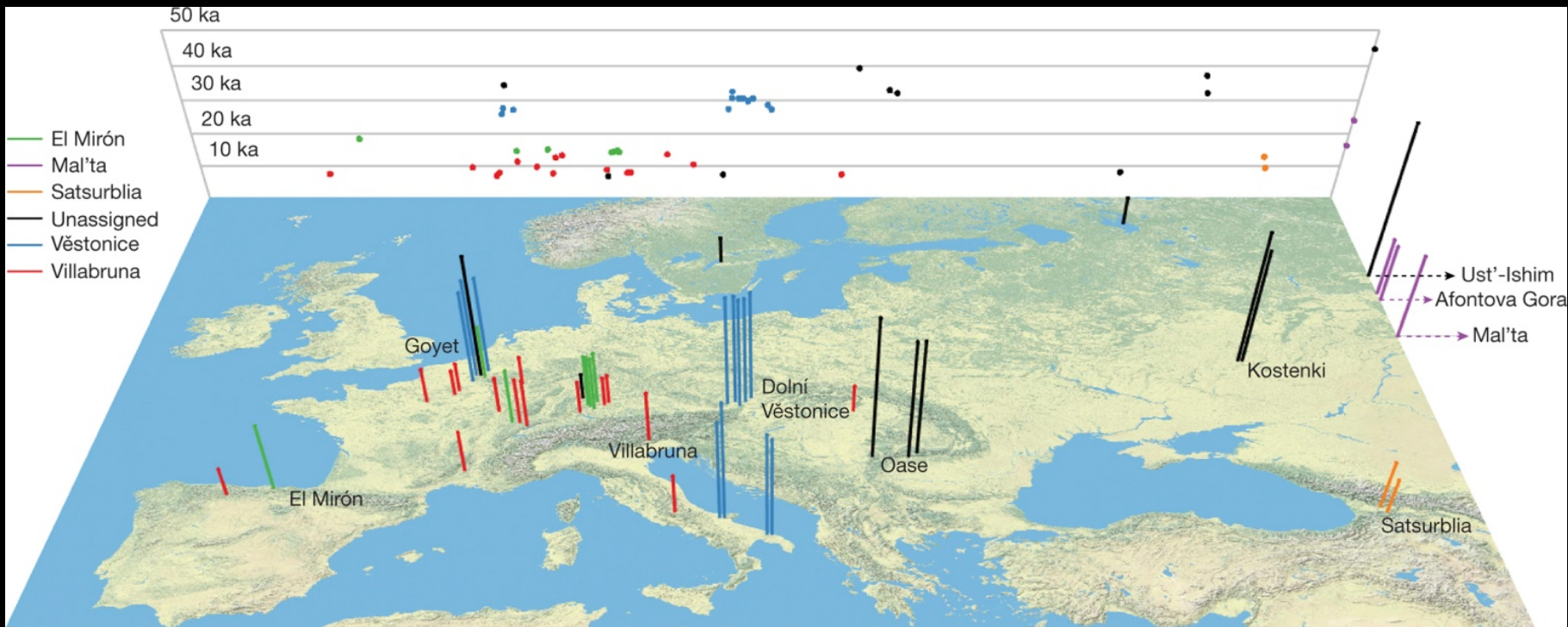
Denisova: Neandertalerens kusine?

41.000 år gammel
fingerknogle

Hvem er de??



Moderne menneske i Europa



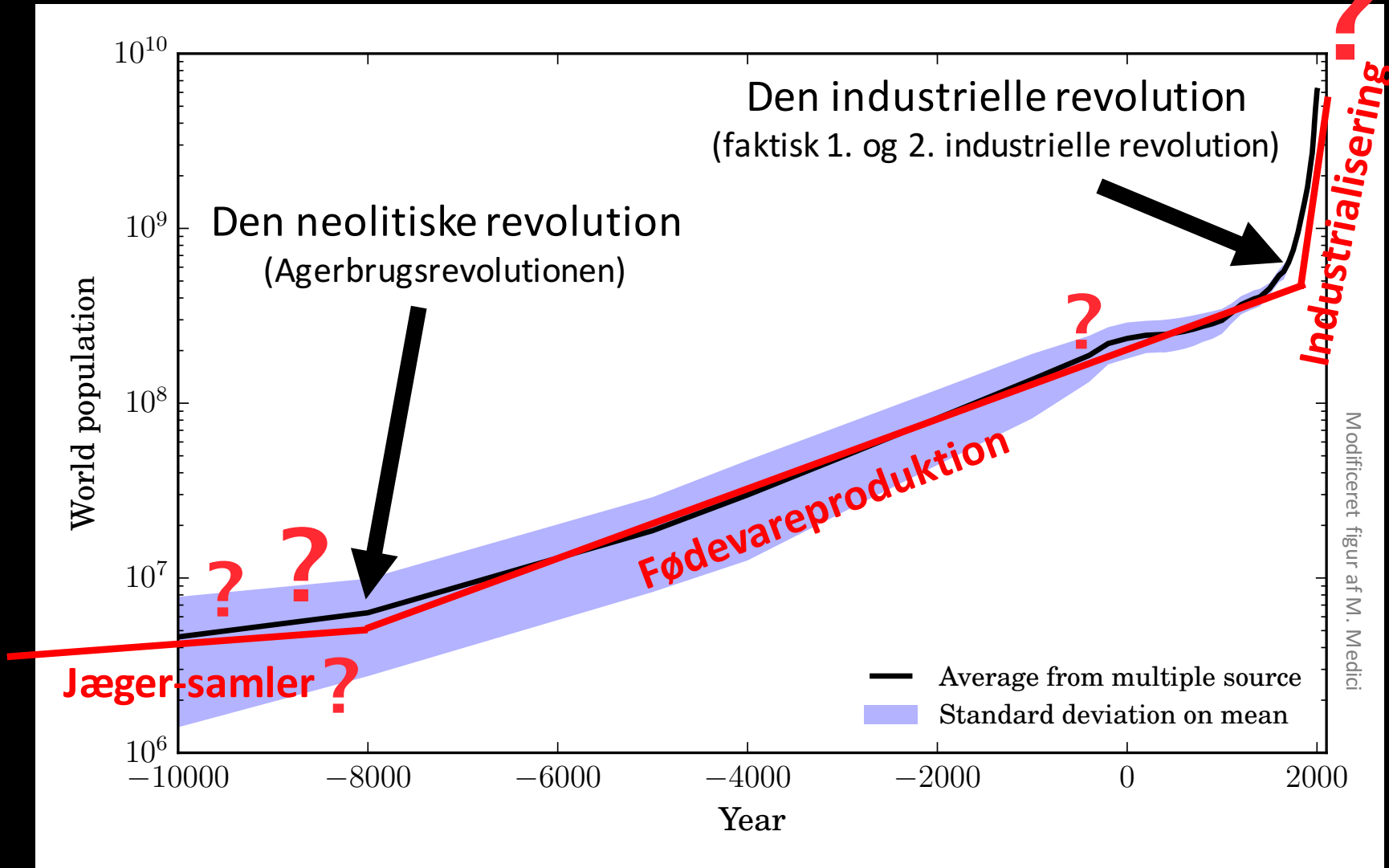
For nylig (10.000 år - nu):

- Jæger samlere
- Landbrugsfolk
- Steppefolket (Yamnaya)

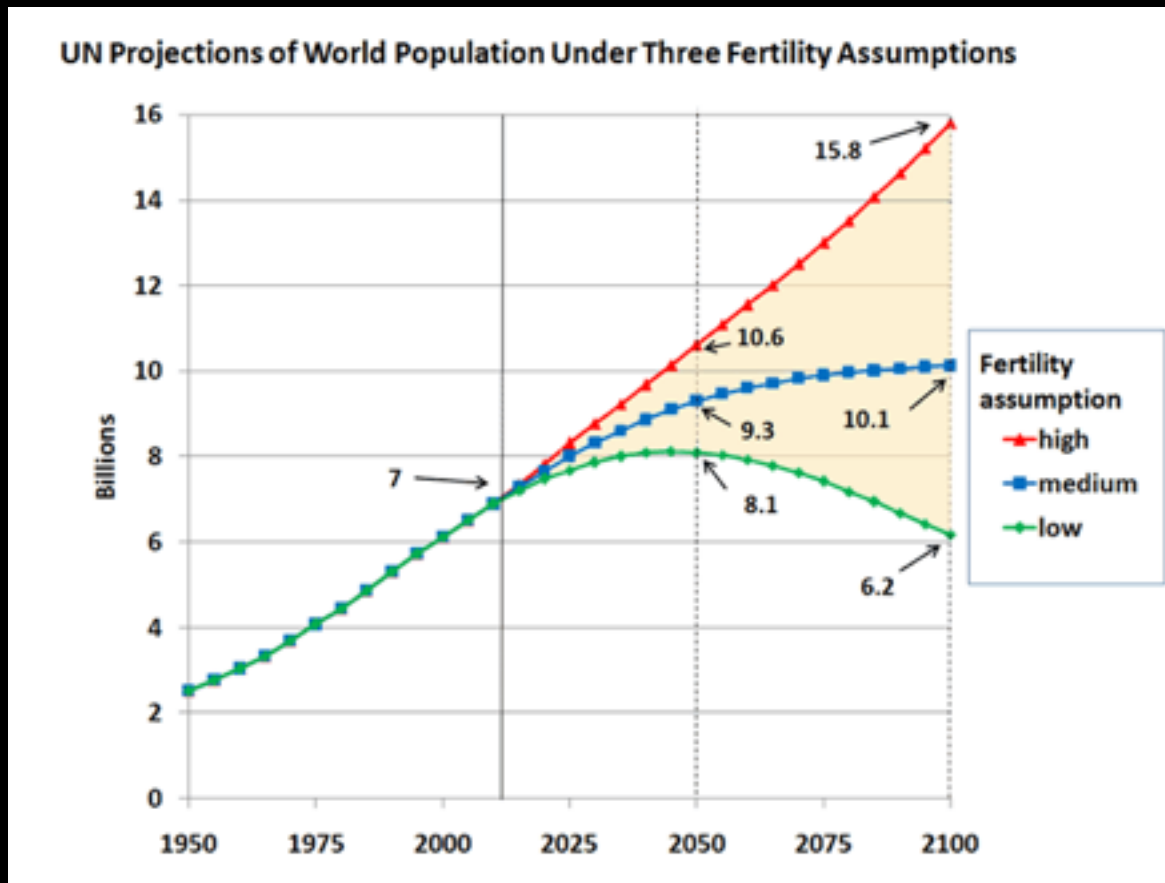
Tiden før mesolitikum:

Vi ved det ikke!

Jordens befolkning



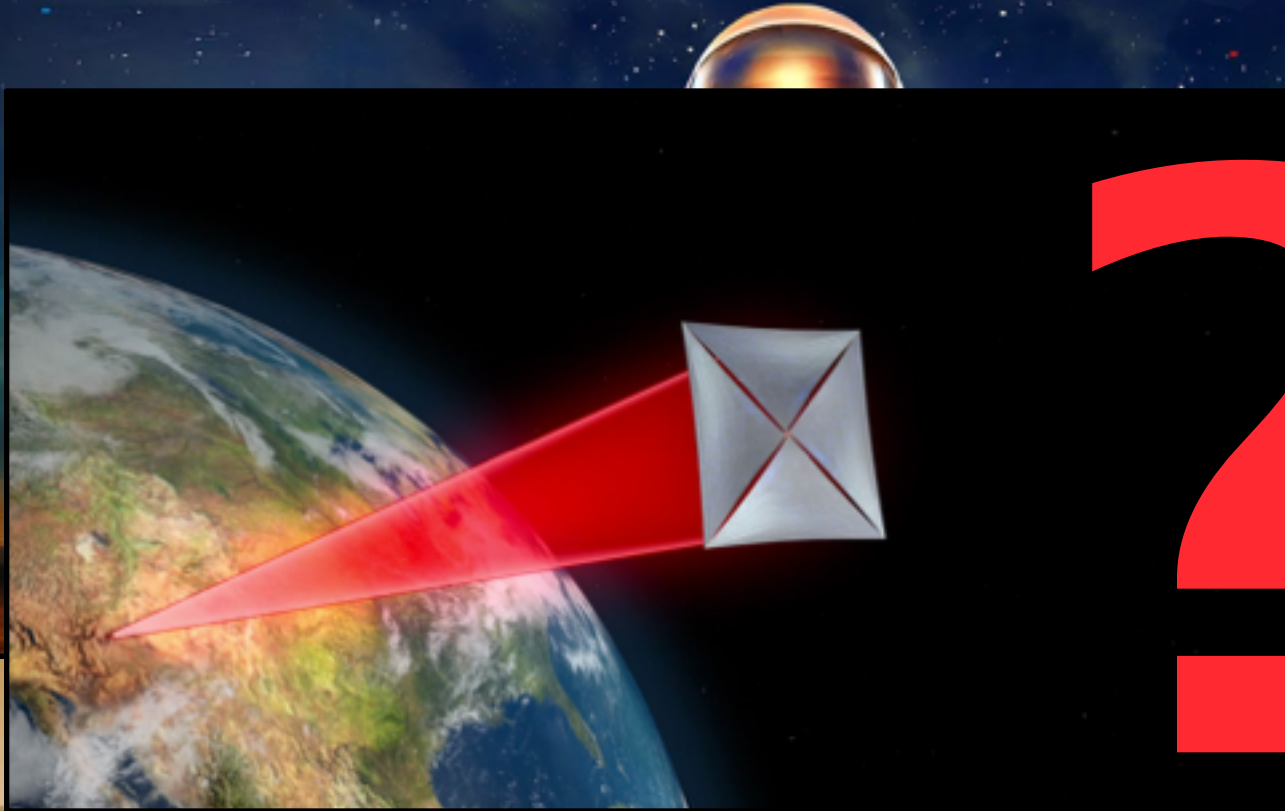
Jordens fremtidige befolkning



Vores bedste gæt er 10 mia...

.... men vi ved det reelt ikke...

Interplanetarisk civilisation??



The background features a complex, abstract pattern of glowing lines and circles. The lines are primarily blue and yellow, creating a sense of depth and movement. The circles are also glowing, with some appearing as concentric rings. The overall effect is reminiscent of a futuristic or scientific visualization, possibly representing data or a complex system.

Fremtidens svar?

Universets historie

Første atomer
379.000 år

Udviklingen af galakser, planeter, liv, mennesker, etc....

Big Bang

Første stjerner omkring
200 millioner år

Big Bang udvidelsen

13.8 milliarder år

Hubble-
teleskopet



Universets spørgsmål...

Første atomer
379.000 år

Udviklingen af galakser, planeter, liv, mennesker, etc....

Big Bang

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The background features a complex, abstract pattern of glowing lines and circles. The lines are primarily blue and yellow, creating a sense of depth and movement. The circles are also glowing, with some appearing as concentric rings. The overall effect is reminiscent of a digital or scientific visualization, such as a network diagram or a data visualization. The text is centered in the upper half of the image.

Tak for denne gang!

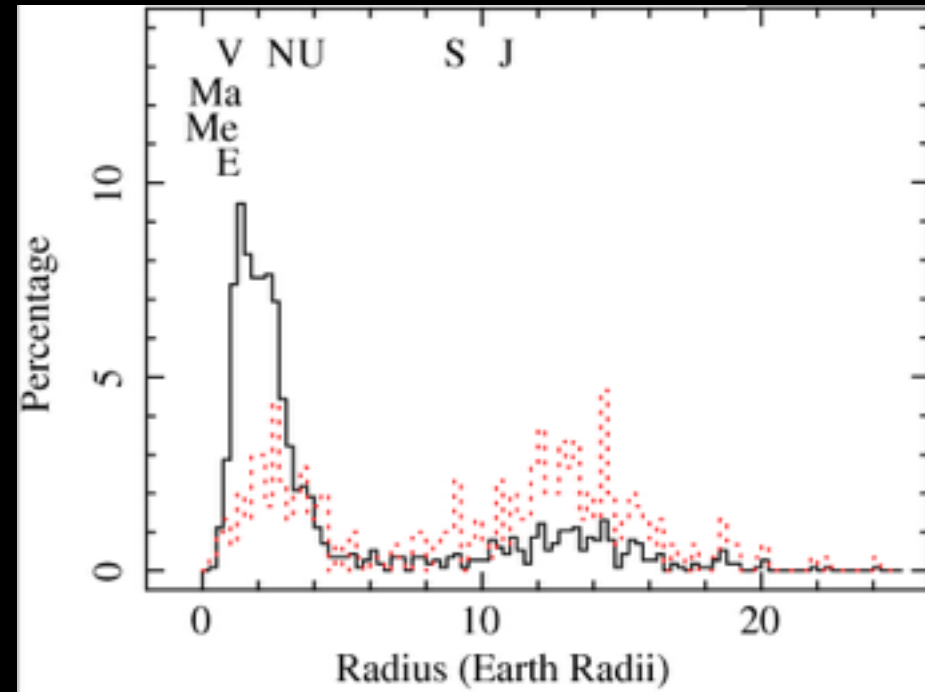
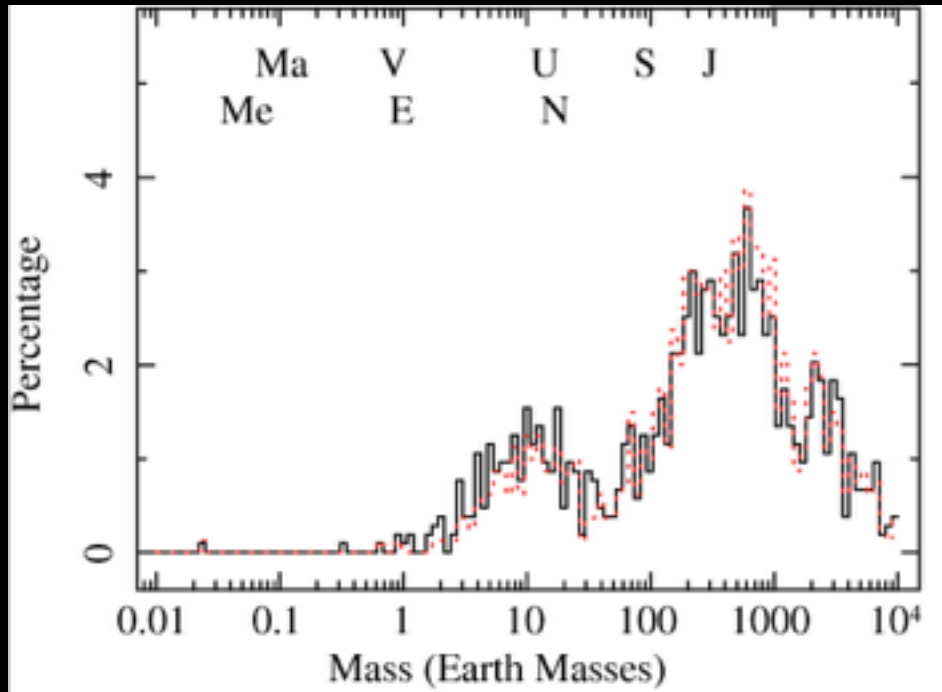
The background features a complex, abstract pattern of glowing lines and circles. The lines are primarily blue and yellow, creating a sense of depth and movement. The circles are also glowing, with some appearing as thin outlines and others as more solid, bright rings. The overall effect is reminiscent of a digital or scientific visualization, possibly representing data or a complex system.

Bonus: Exoplaneter

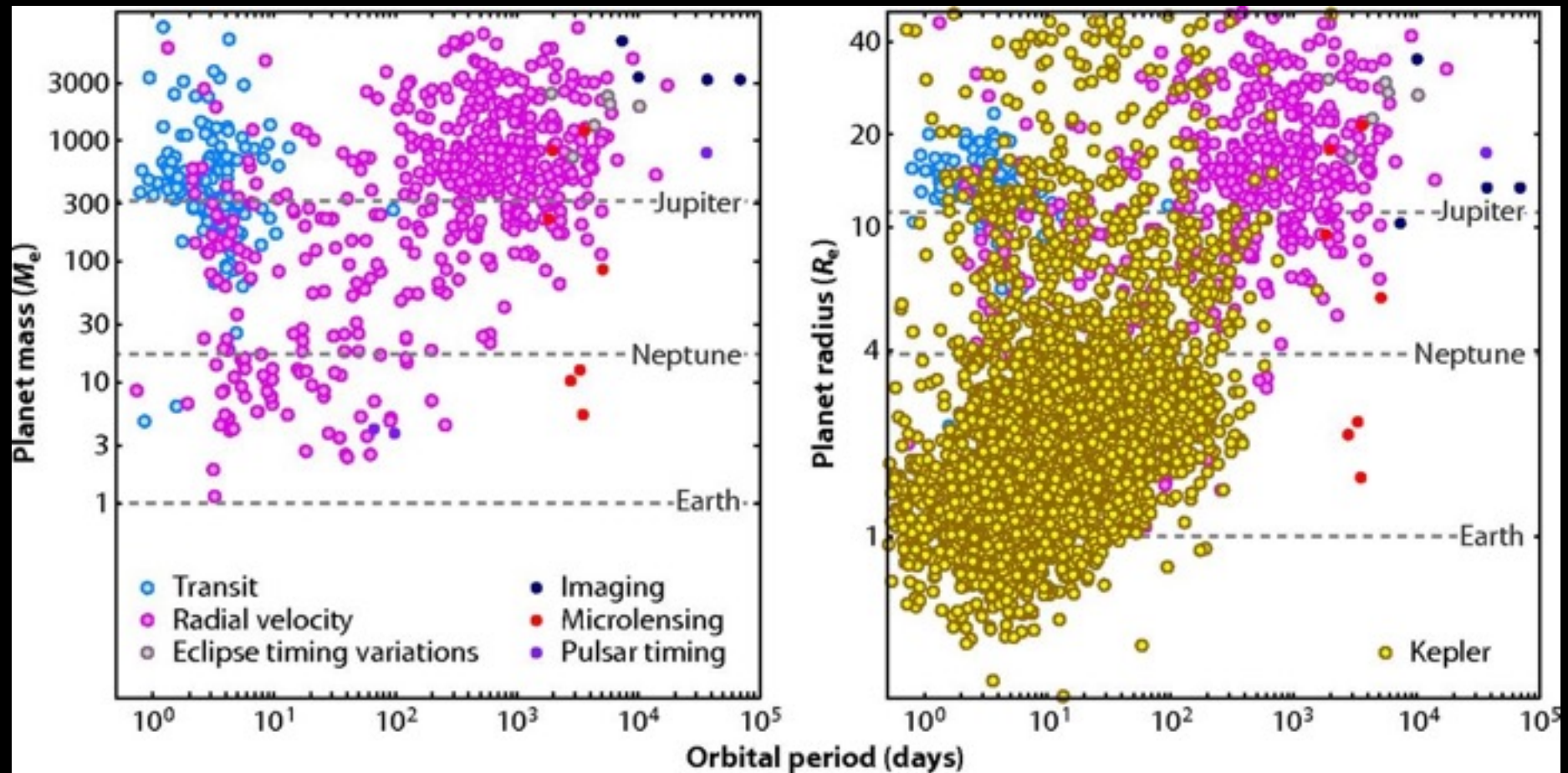
Exoplaneter - en gylden æra?



Hvor mange? Hvor store? Hvilke afstande? Alder? Komposition? Atmosfære? Liv?

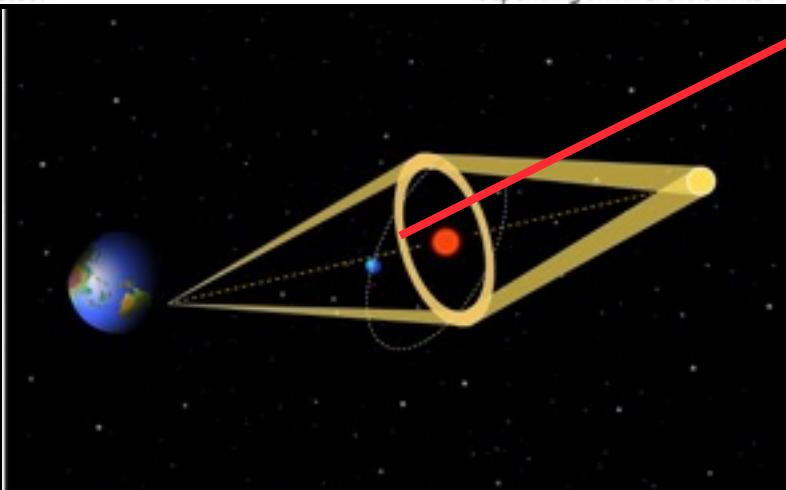
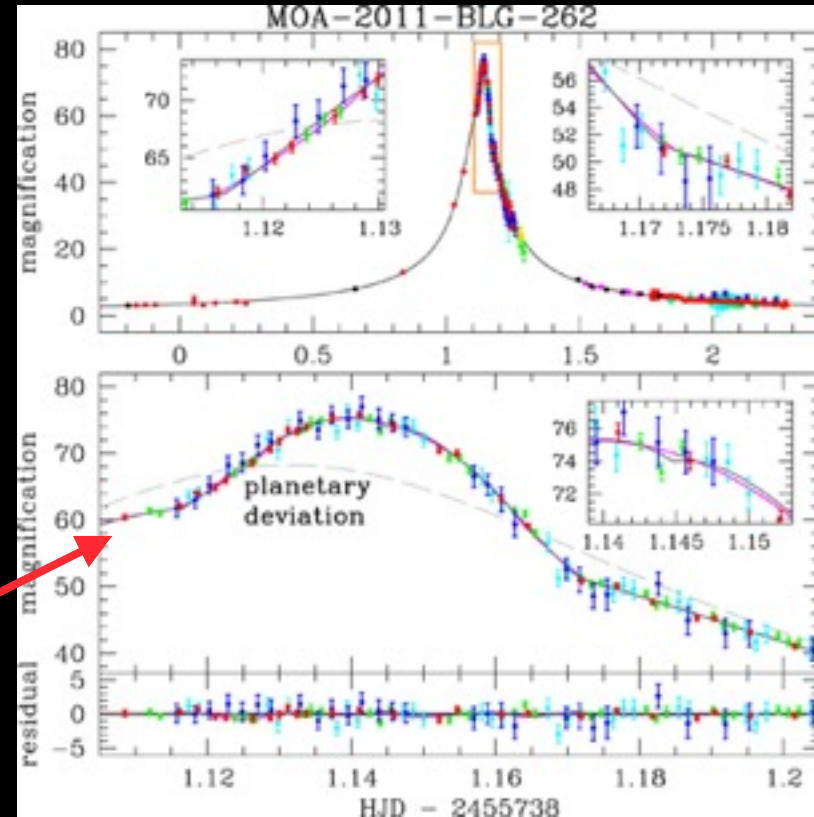
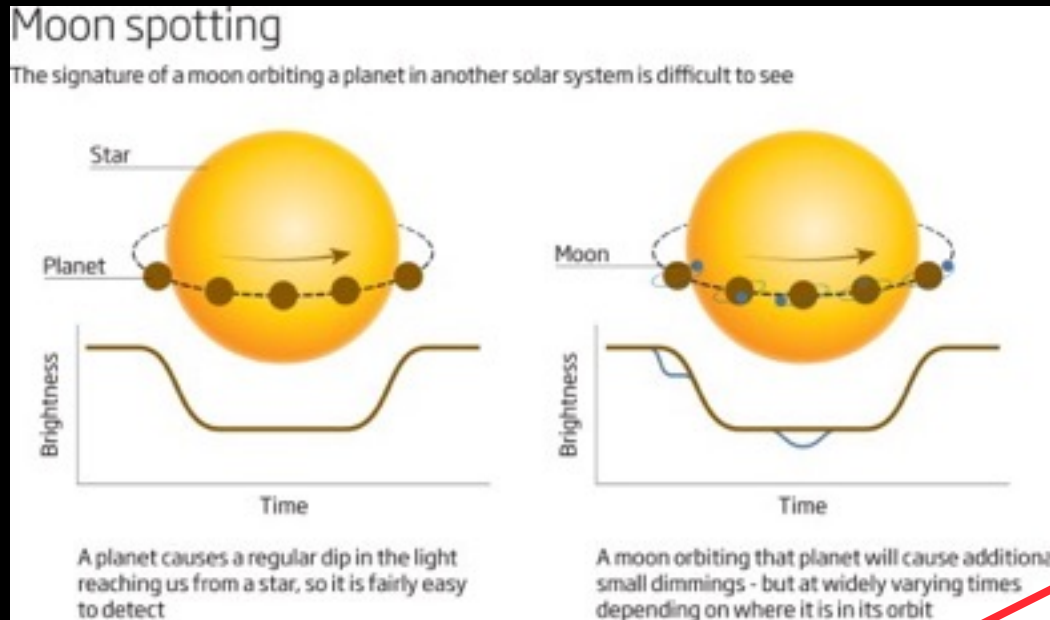


Hvor mange? Hvor store? Hvilke afstande? Alder? Komposition? Atmosfære? Liv?



Exomåner

Exomåner skulle være små "hop" på de allerede små exoplanet signaler.



Interessant nok har man muligvis allerede set en exomåne (med gravitational lensing).