

Ako meriame



svet

Daniel Nagaj (Uni Wien, 21. 5. 2013)



VEDA

VEDEC

ZVEDAVEC

Z čoho
je zložený
svet?

Ako
funquje
svet?

voda

vzduch

oheň

zem

voda

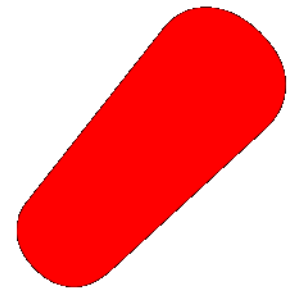
vzduch

oheň

zem

littlealchemistry.com

teória



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teoría

ó

ó

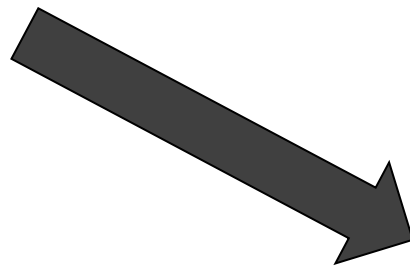
ó

ó

The background of the image is a grid of thin, light-colored lines. Overlaid on this grid are various handwritten sketches in black ink. These sketches include several circles of different sizes, some with internal lines or dots, and some with arrows indicating direction. There are also some irregular shapes and lines that appear to be part of a larger diagram or set of calculations. The overall appearance is that of a page from a notebook or a set of working papers for a scientific or mathematical project.

teória

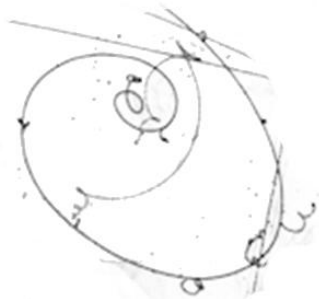
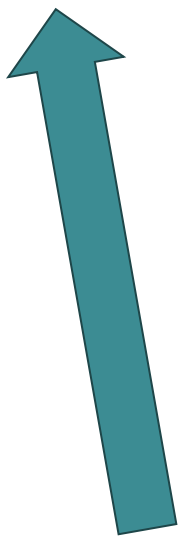
skúsiť



vysvetliť



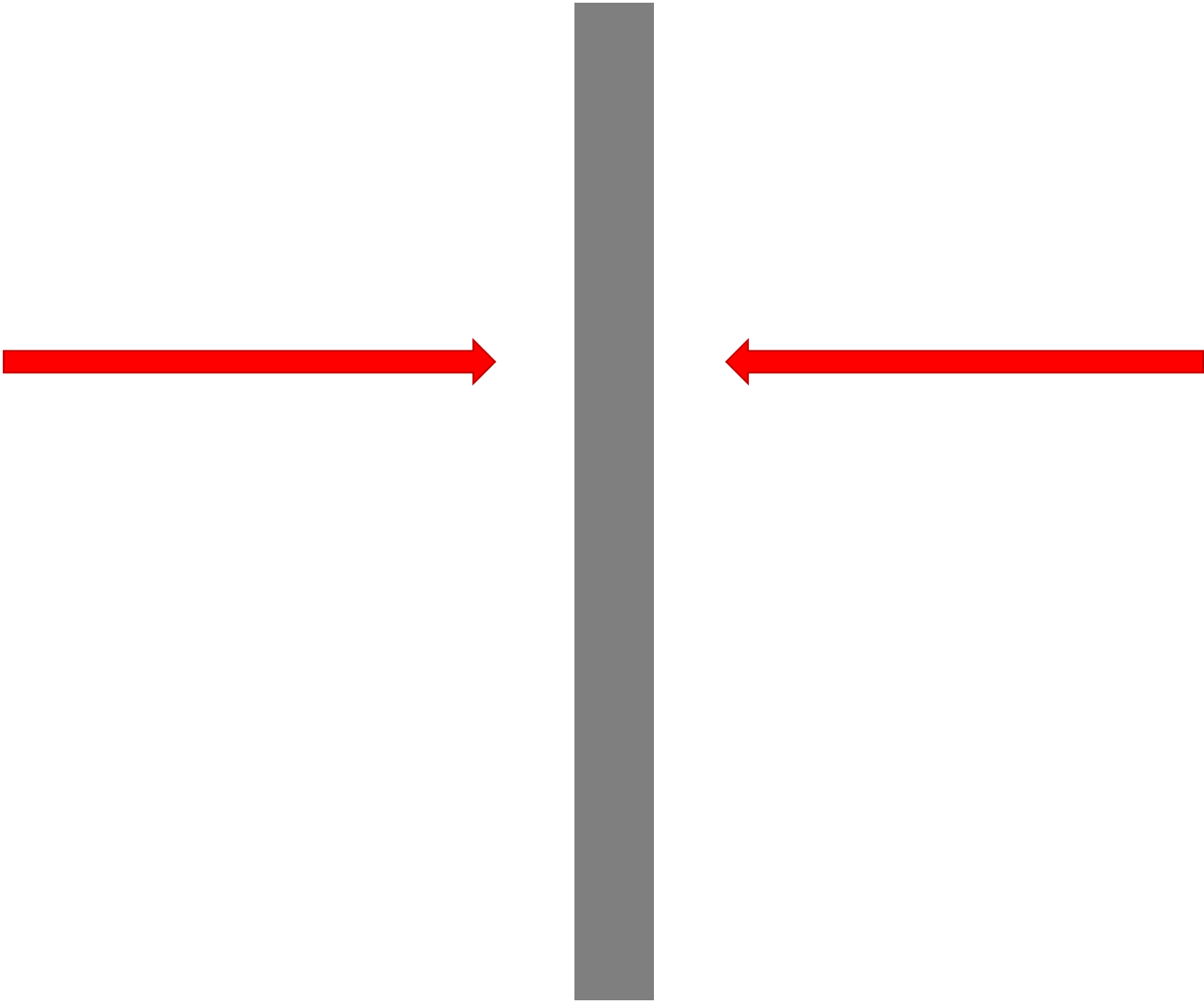
predpovedať

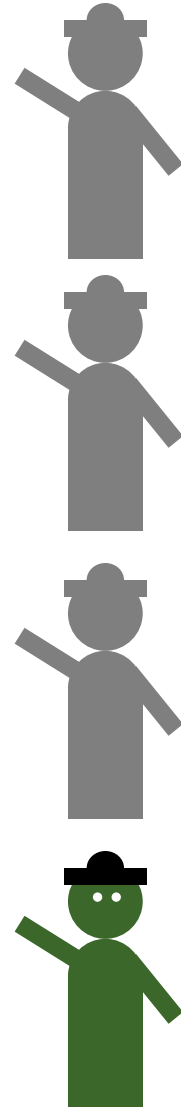
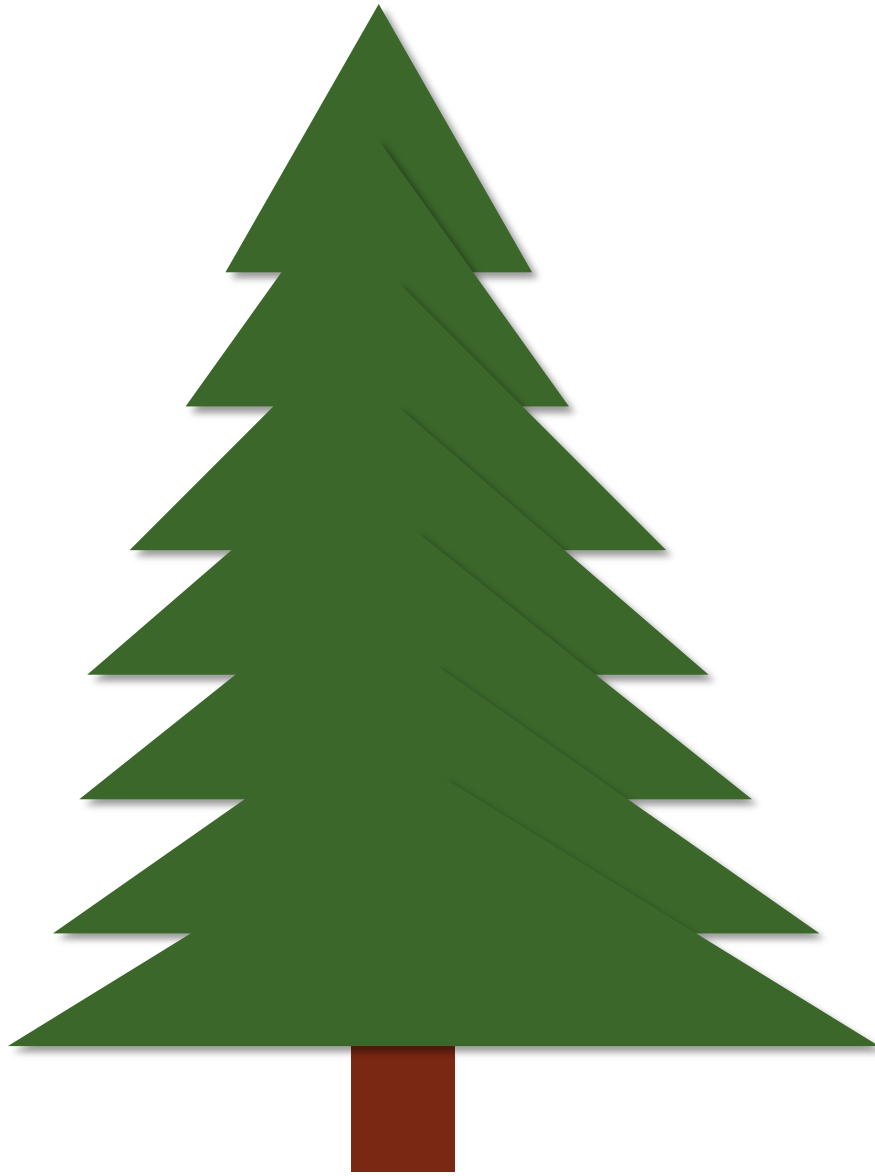


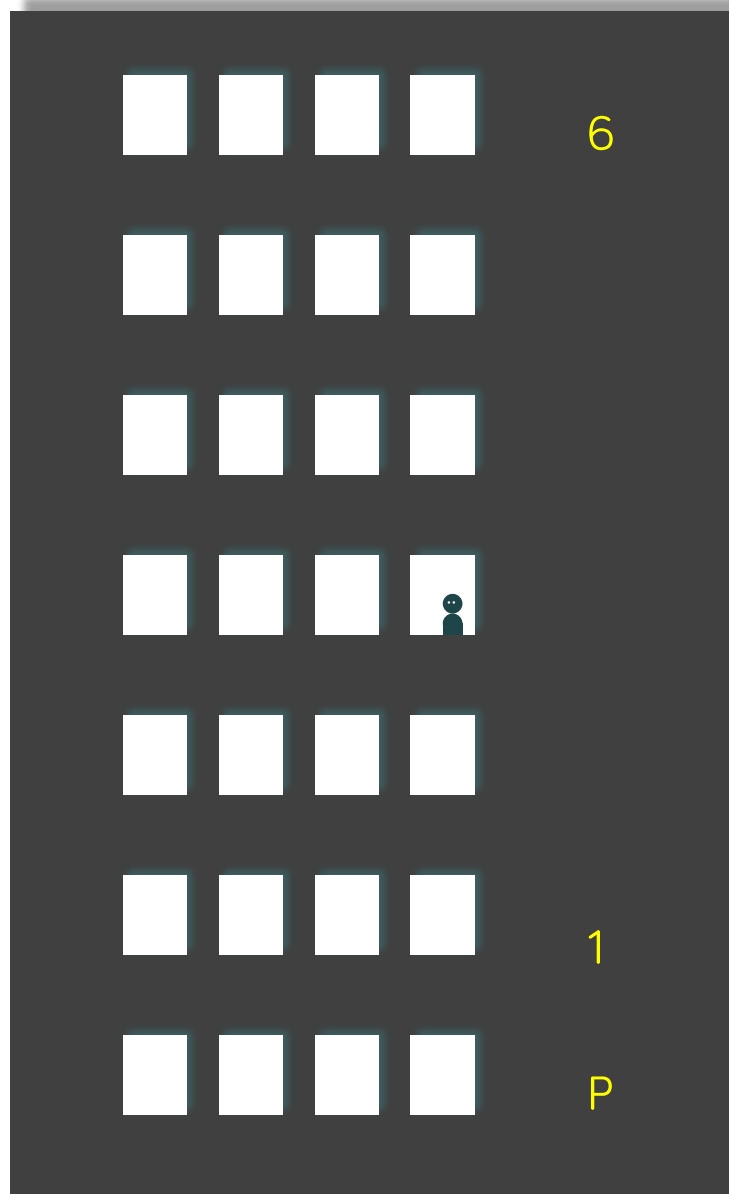
preto meriame



svet





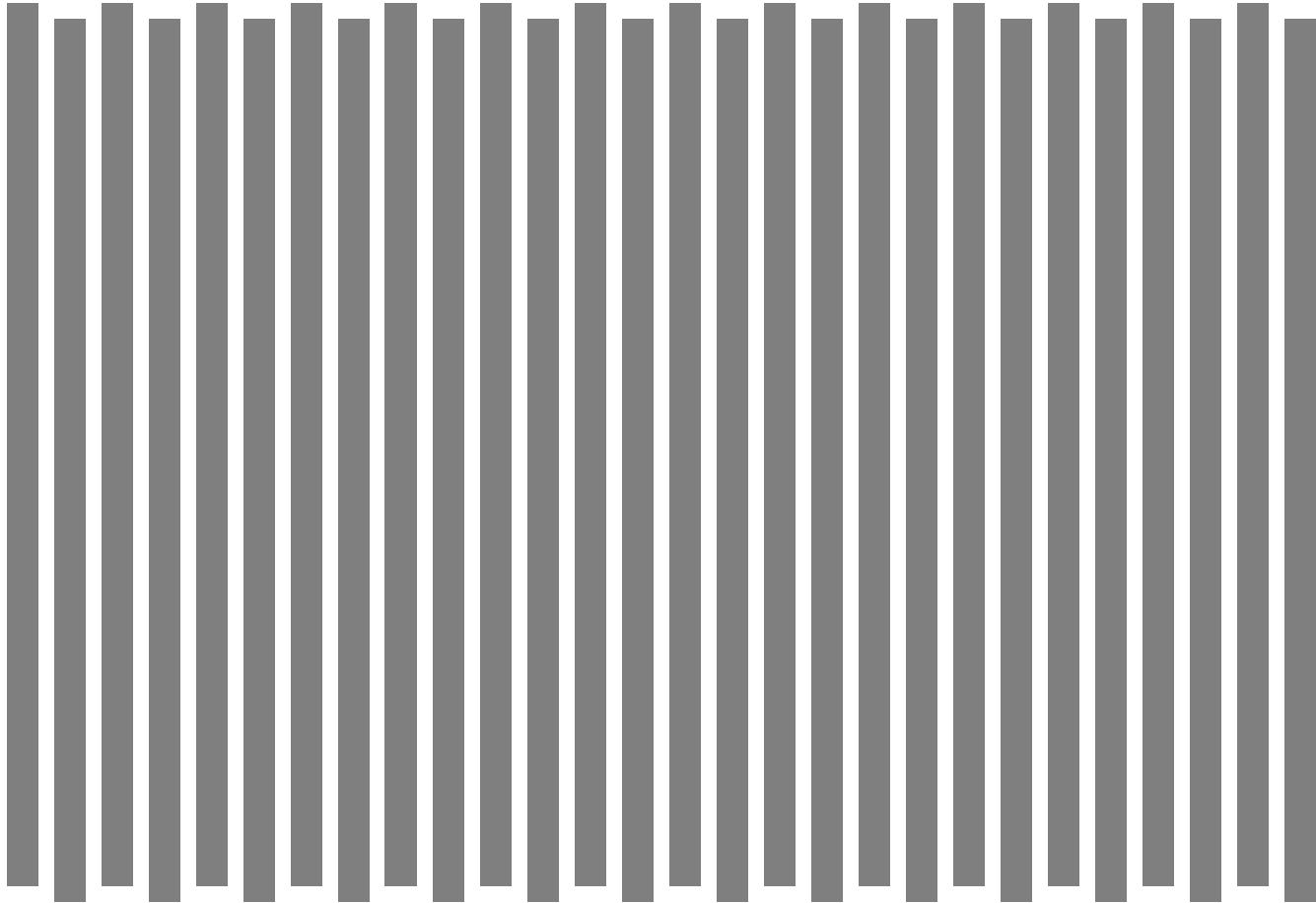
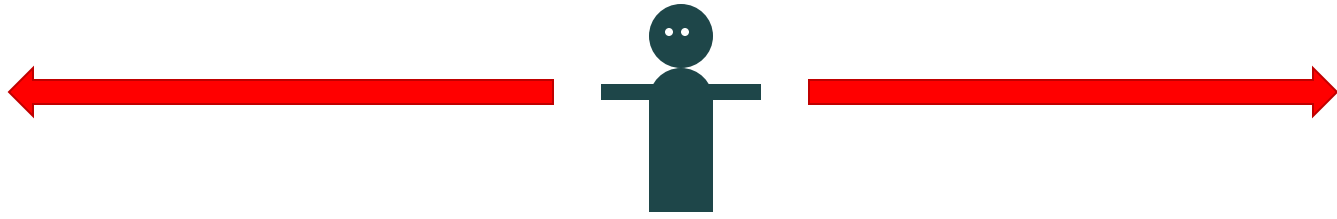


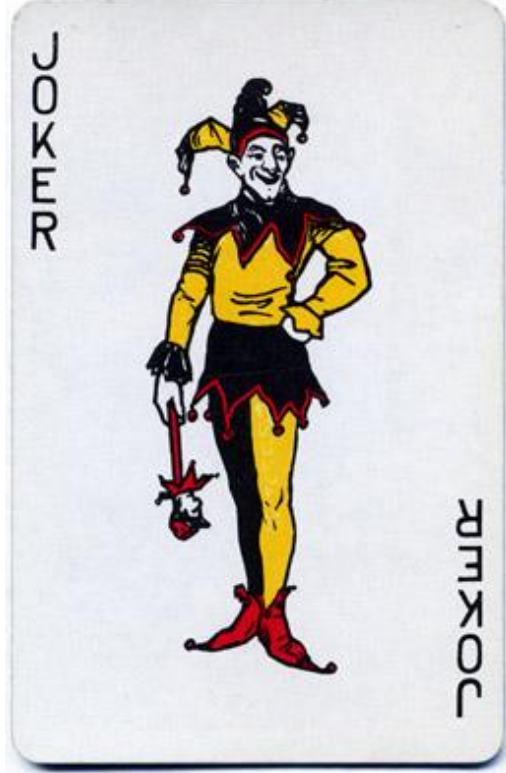
6

1

P



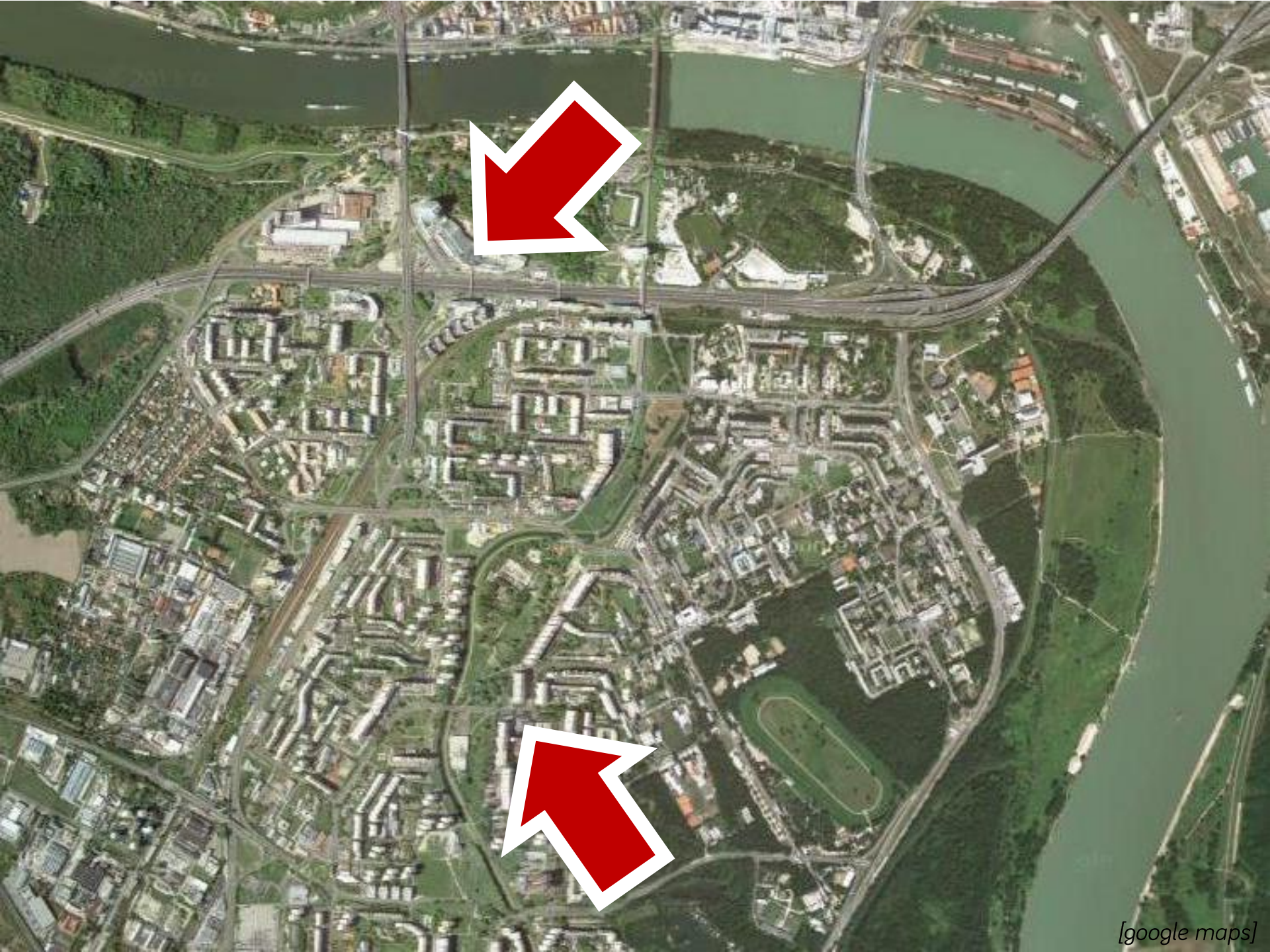




















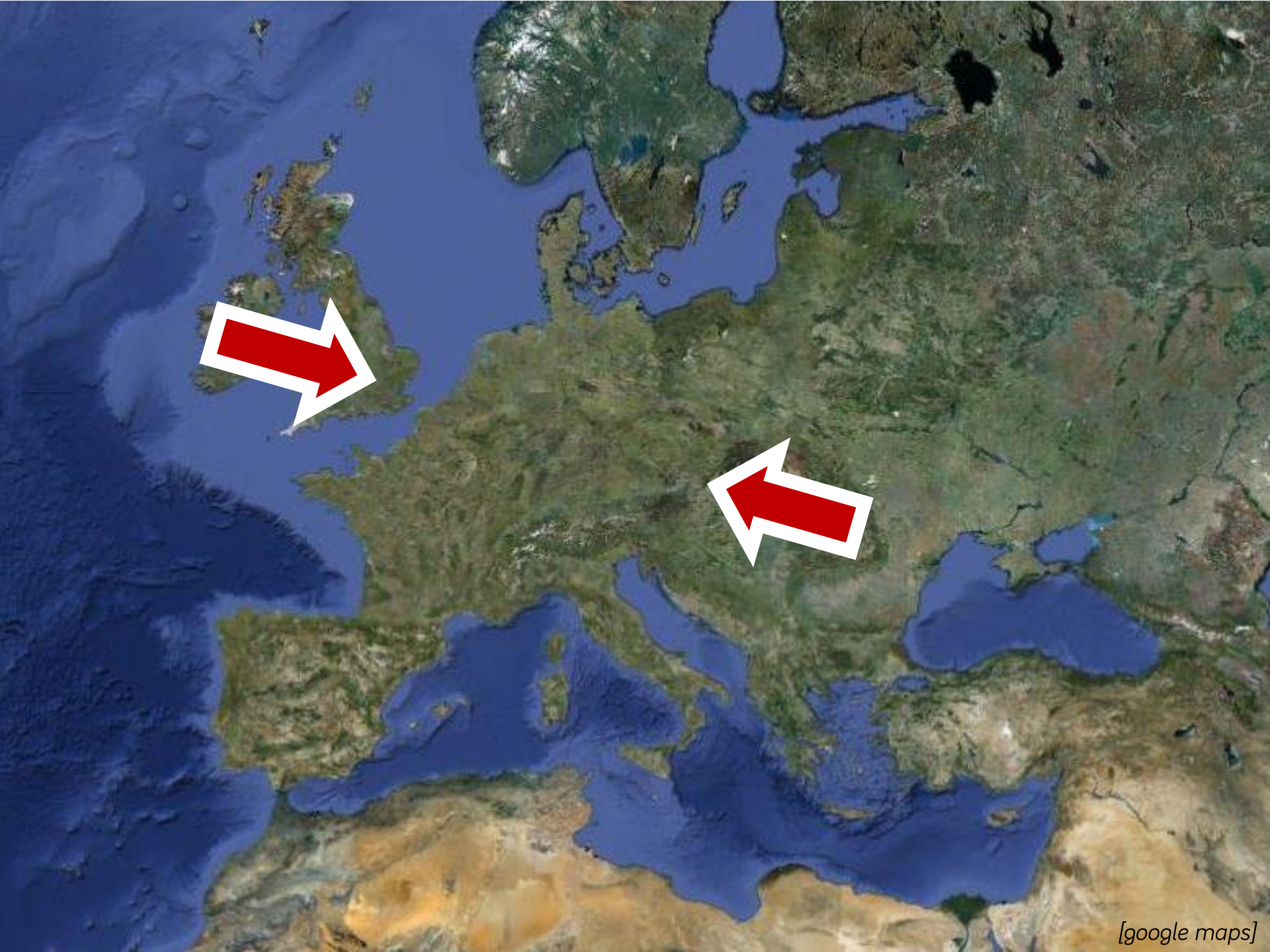




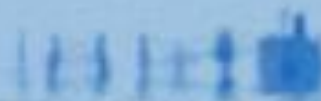




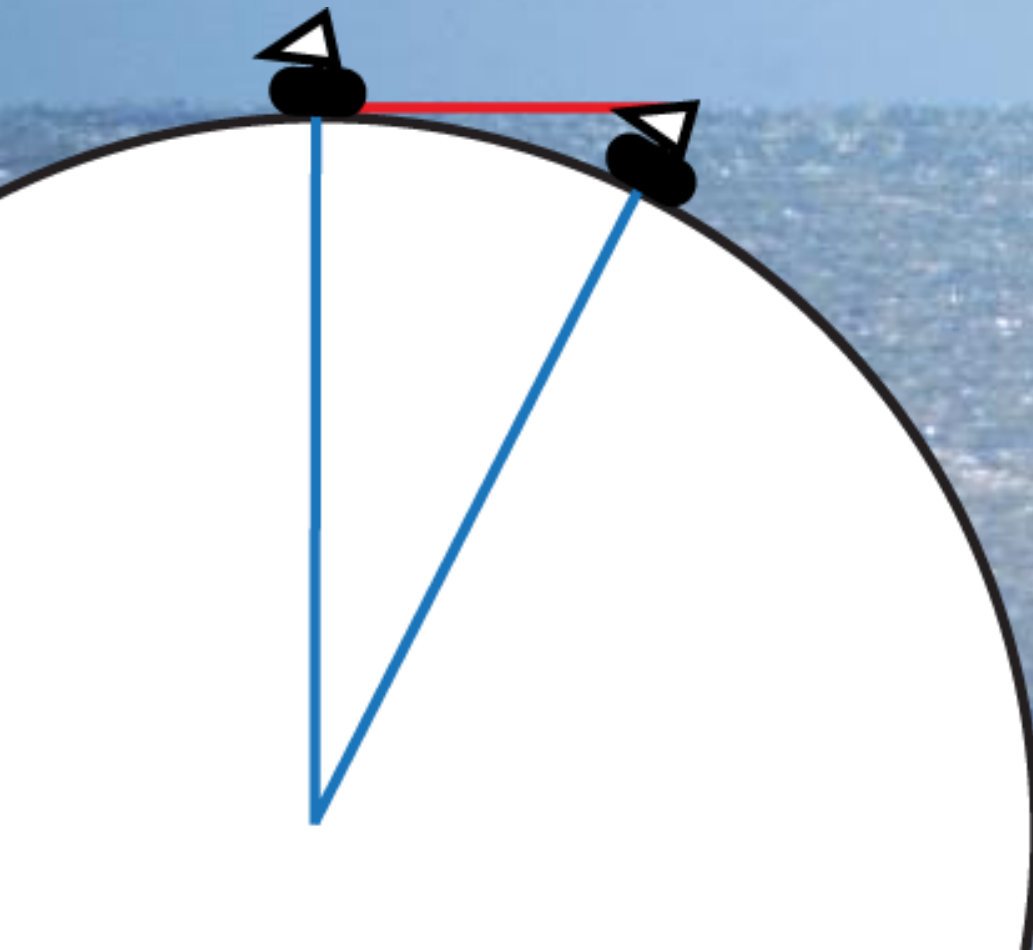




Lode miznú za obzorom.



Zem je zakrivená!



Predpoved':
tieň Zeme
je okrúhly.





**Ako d'aleko
je na Mesiac?**



[NASA]



Mesiach



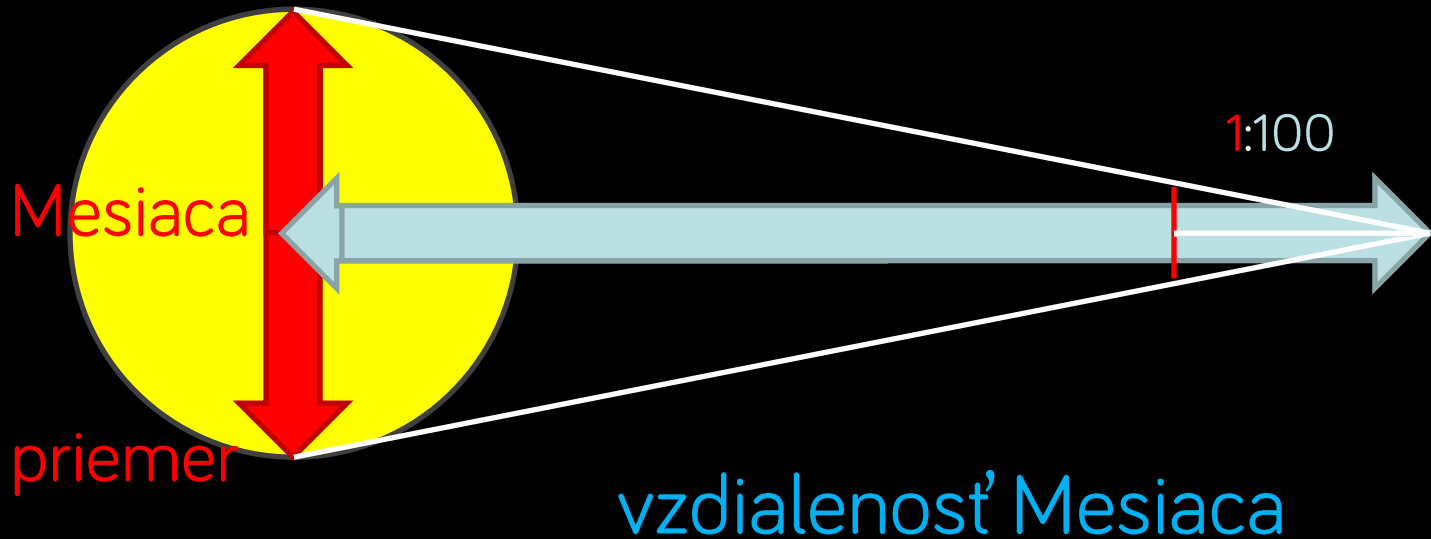
Mesiac



Mesiac

Žmúríme medzi prsty.

1:100



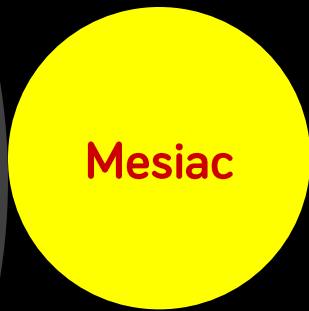
Aký veľký je Mesiac?



Aký veľký je Mesiac?



Odmeriame to počas zatmenia.



tieň Zeme

Mesiac

Mesiac ~ 3 300 km



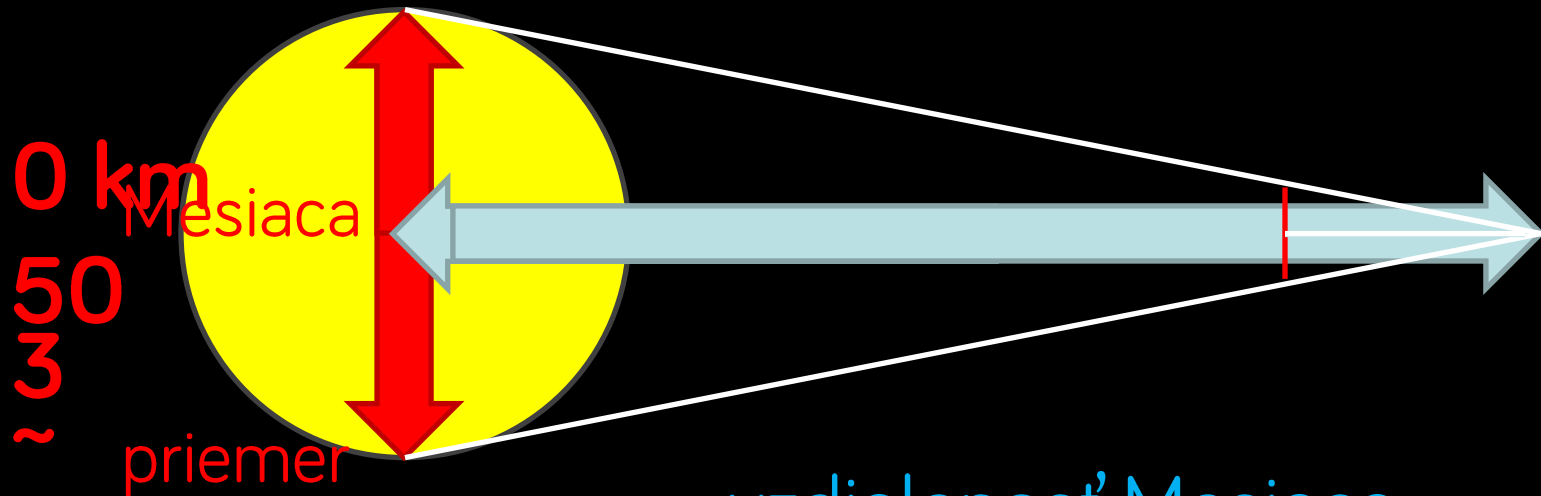
Mesiac

Zem ~ 13 000 km

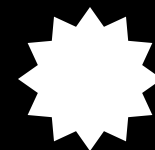
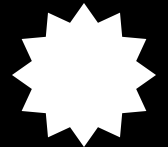
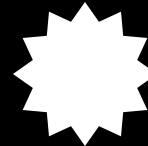
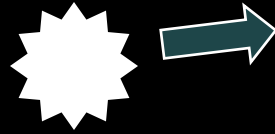
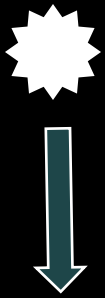
Ako d'aleko je
na Mesiac?



1:100



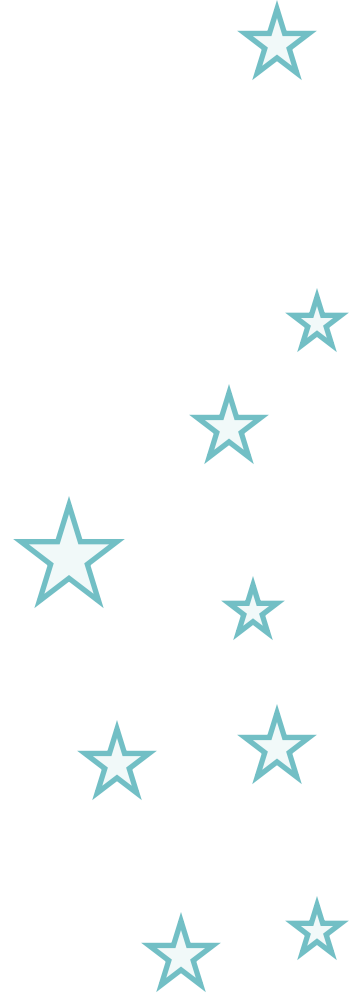
vzdialenosť Mesiaca
~ 350 000 km



Ako d'aleko
sú hviezdy?

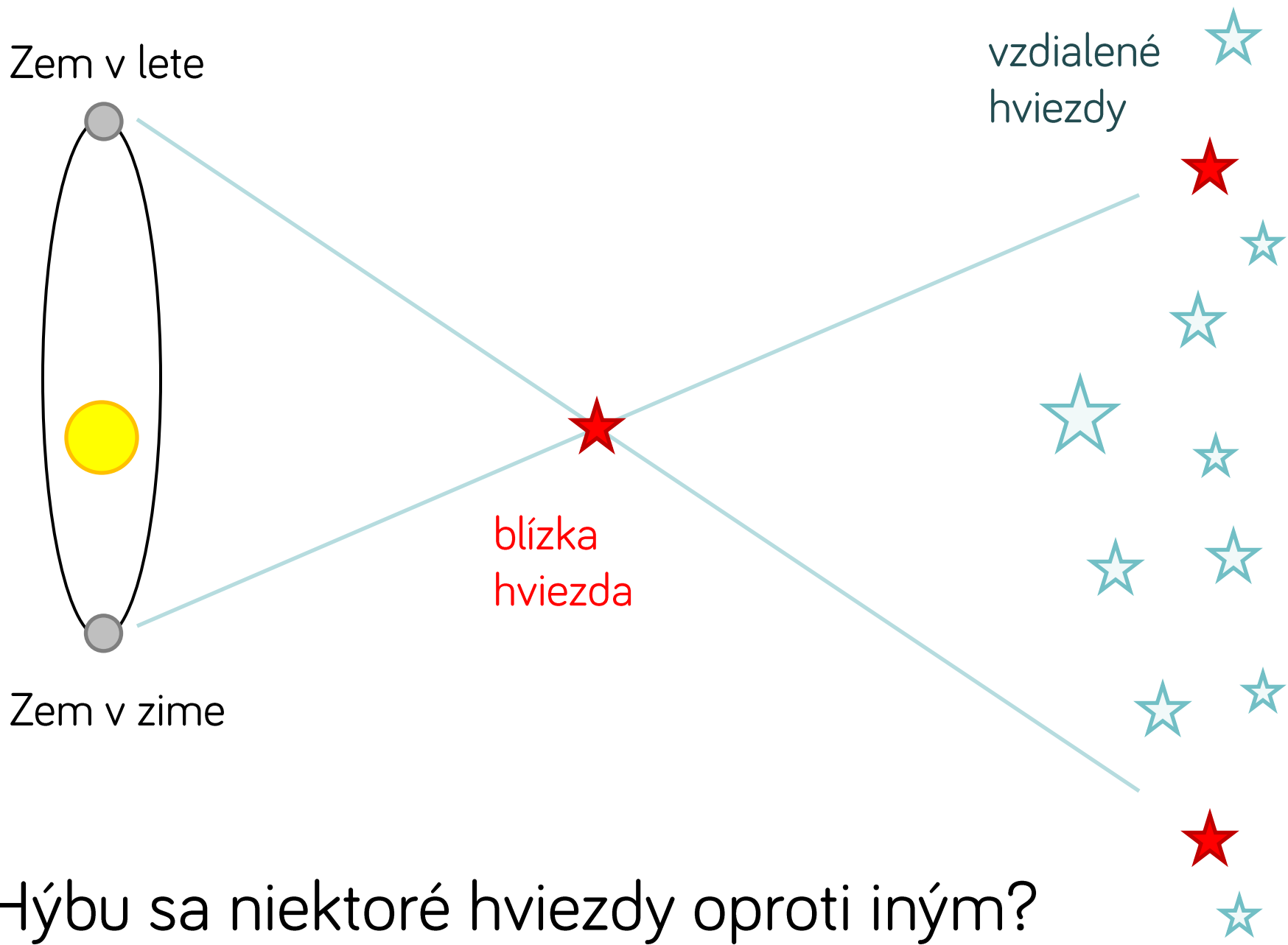


Súhvezdia sa nemenia.



Hýbu sa niektoré hviezdy oproti iným?







[Mashiko]



[Mashiko]



Friedrich Bessel | 1838



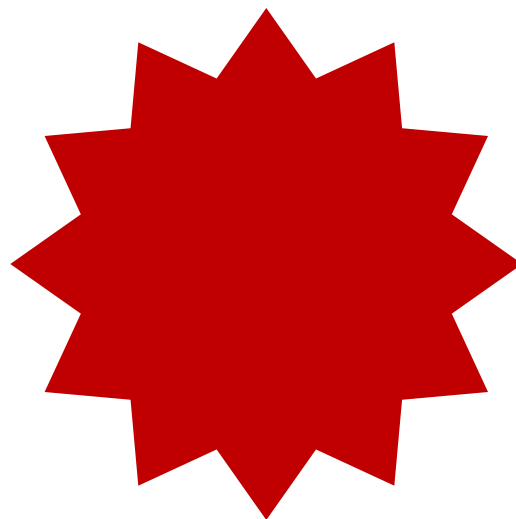
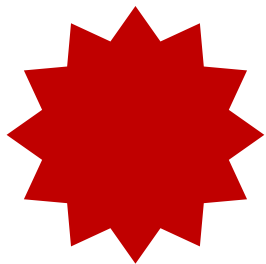
paralaxa 61 Cygni

10^{14} km = 11.4 svetelných rokov

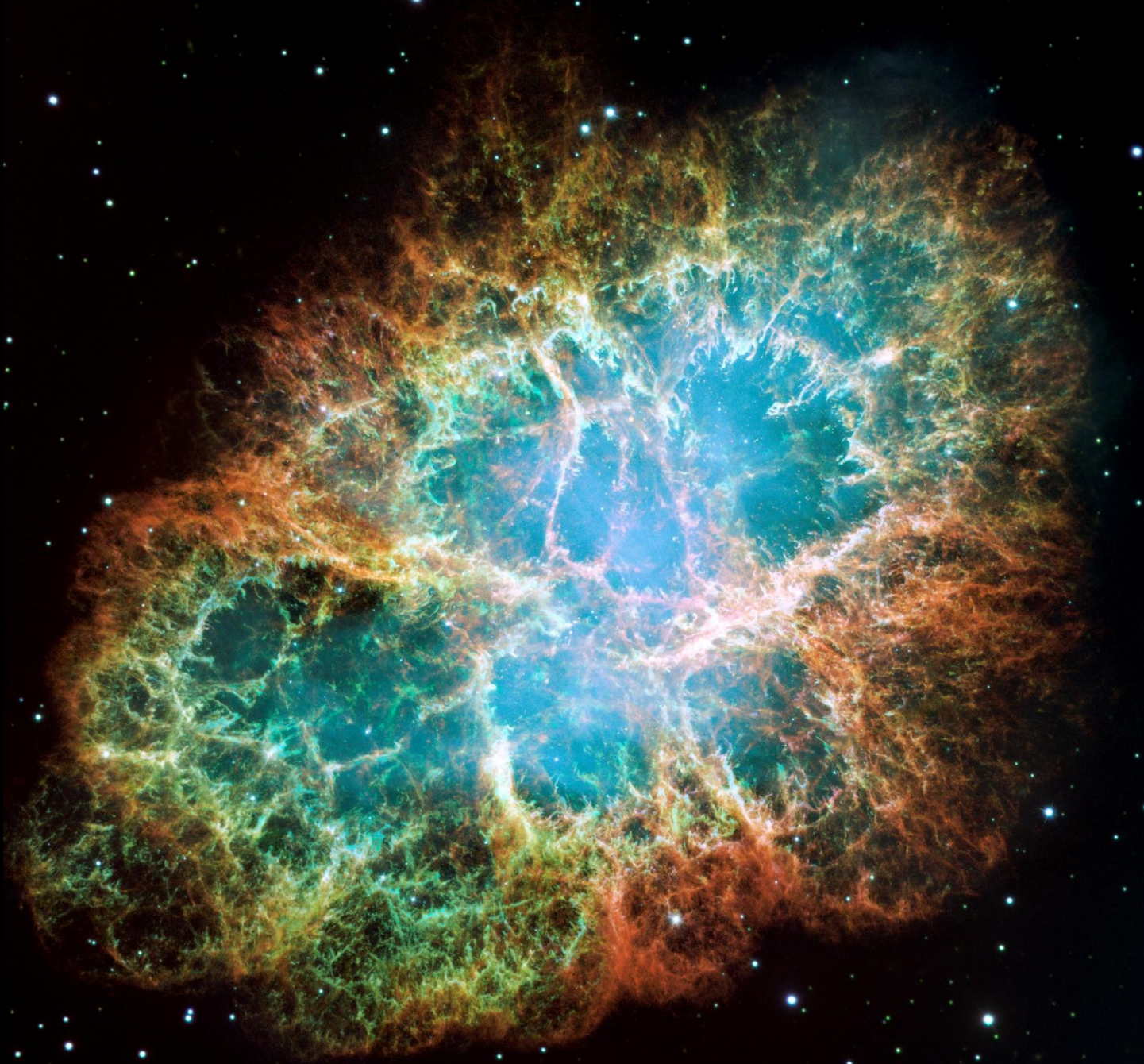
100 000 000 000 000 km

Slnko 150 000 000 km, Proxima Centauri 4.2 lyr

Hviezdy sú d'aleko!



aj tie **najbližšie**
hviezdy sú **d'aleko**





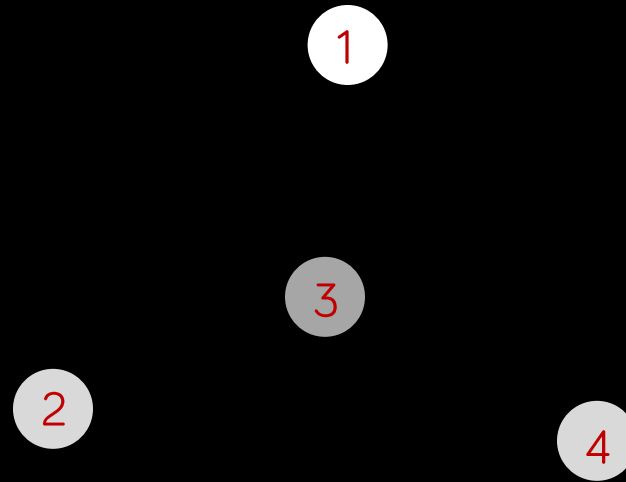
Large

Mage

Cloud

[NASA

Ako sú ďaleko?



rôzne typy hviezd :-)

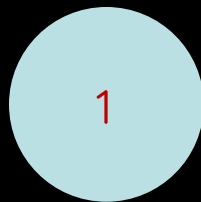
Slnko



3



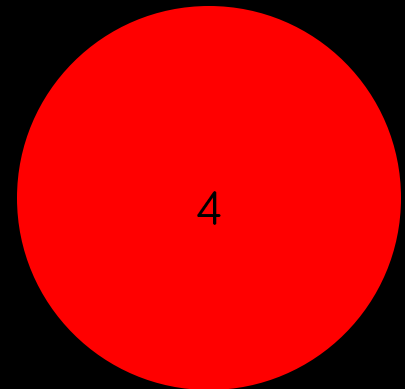
1



2



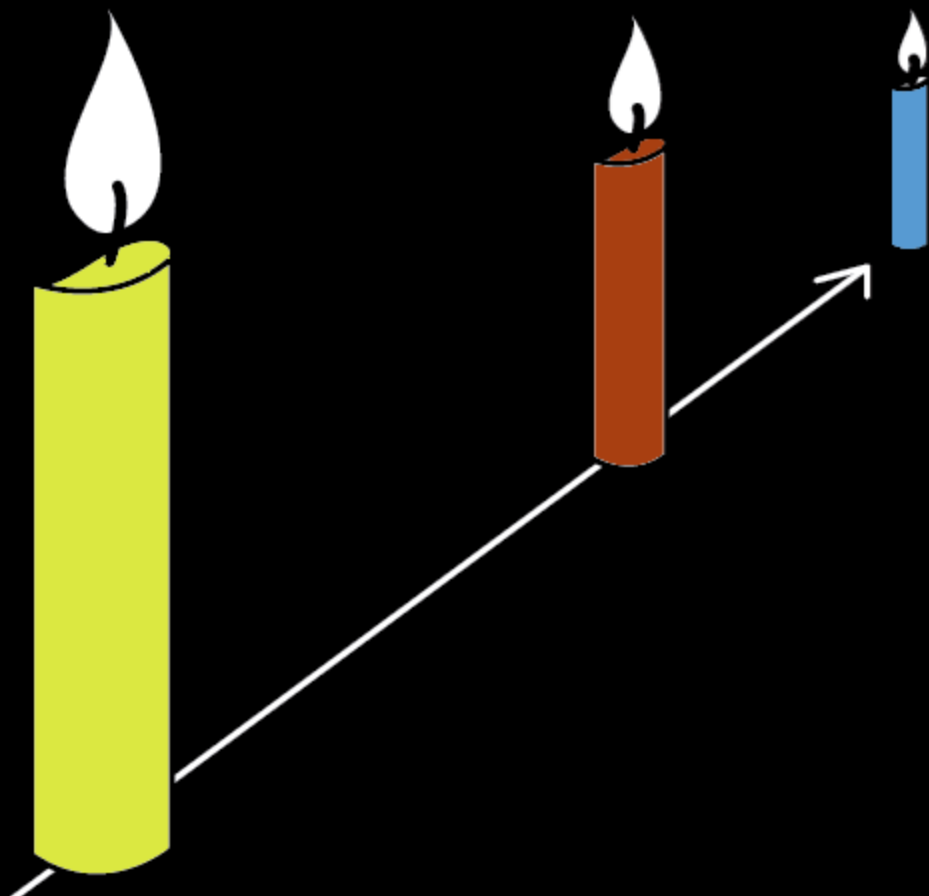
4



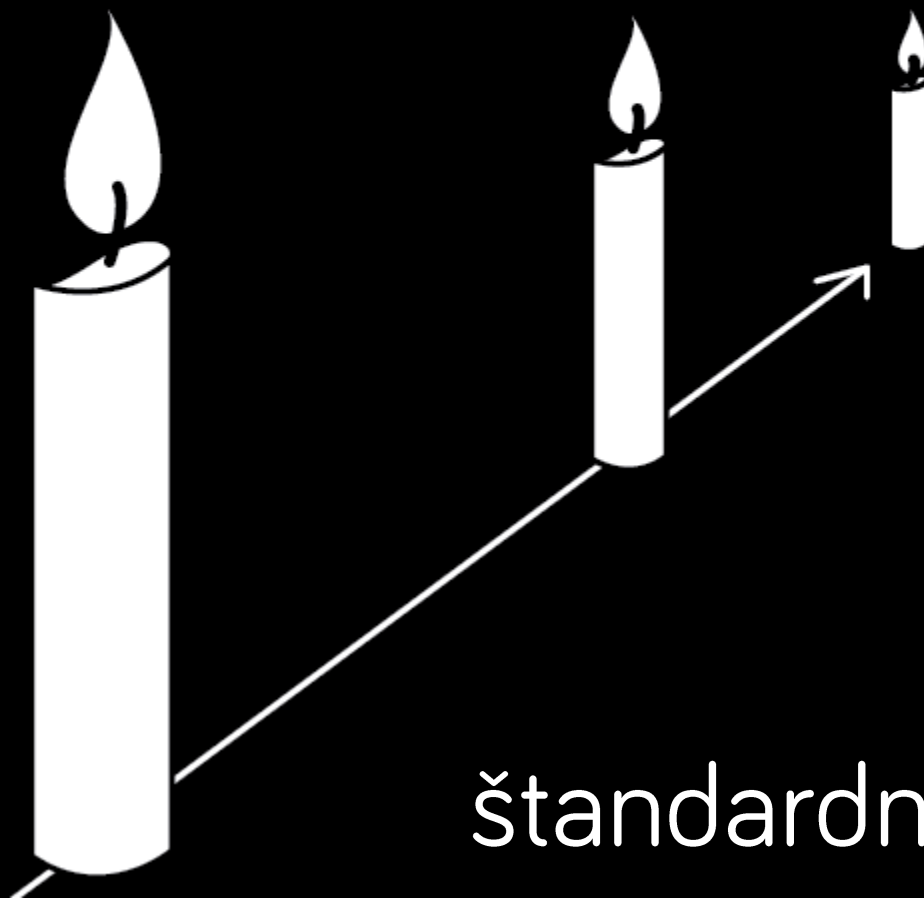
vzdialenosť



[nobel.org]



sviečka



štandardná sviečka

CEFEIDY



premenlivé hviezdy

CEFEIDY



premenlivé hviezdy



160 000

svetelných rokov

Large

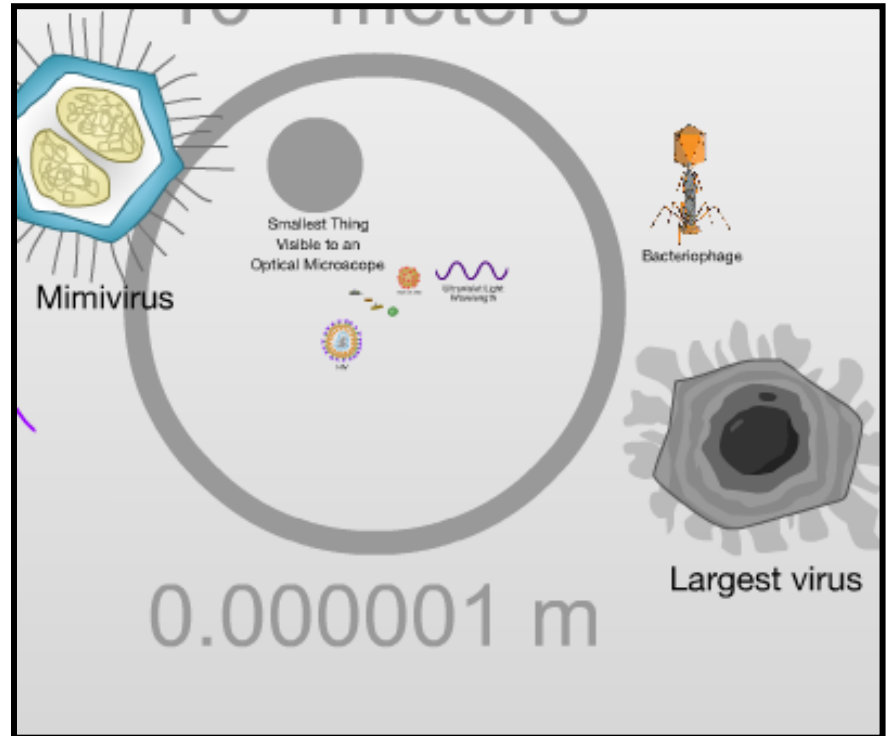
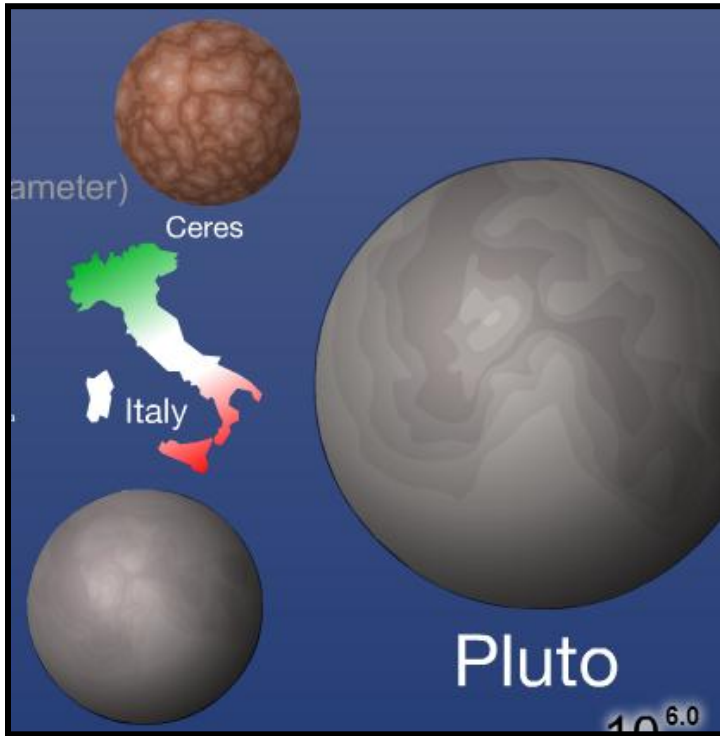
Mage

Cloud

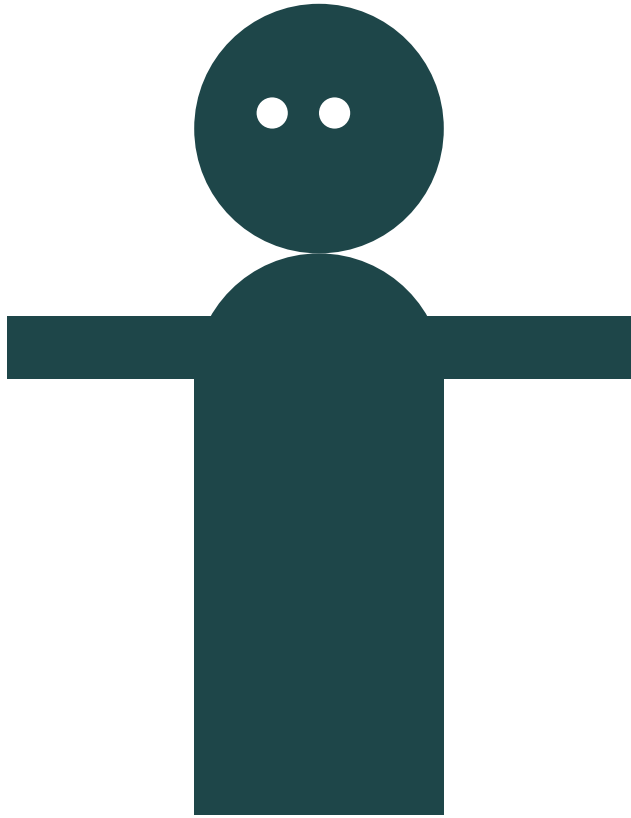
[NASA

100000 m

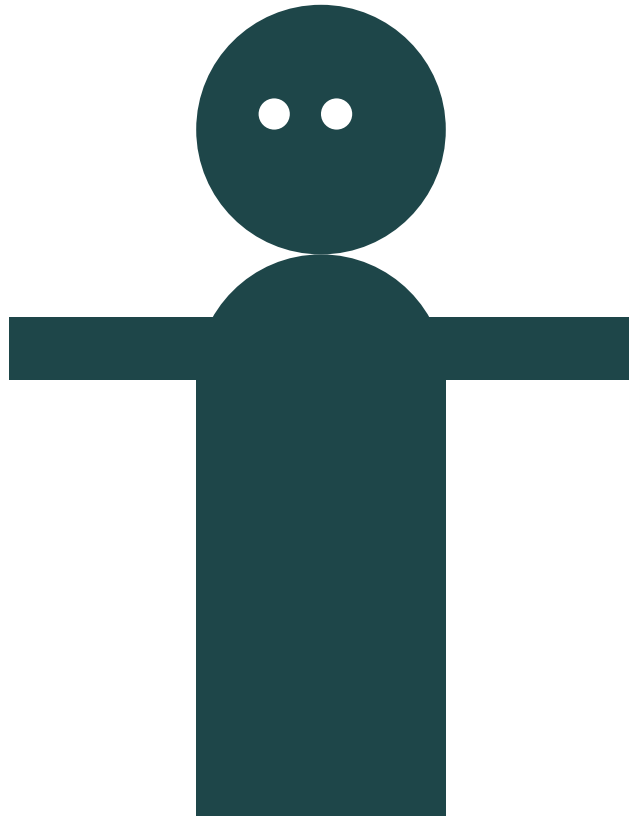
0.000001 m



htwins.net/scale2



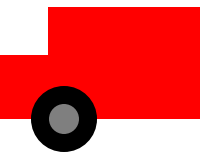




hodiny



PRESNÉ hodinky





Slovák bežal stovku za 9,9. Ručne mu čas nameral tréner

Vydané 19. 5. 2013 o 18:55

Po 16 rokoch padol slovenský rekord v hladkom šprinte, ktorý držal prekážkar. Senzačne hneď o 11 stotín. Slovensko má talent.



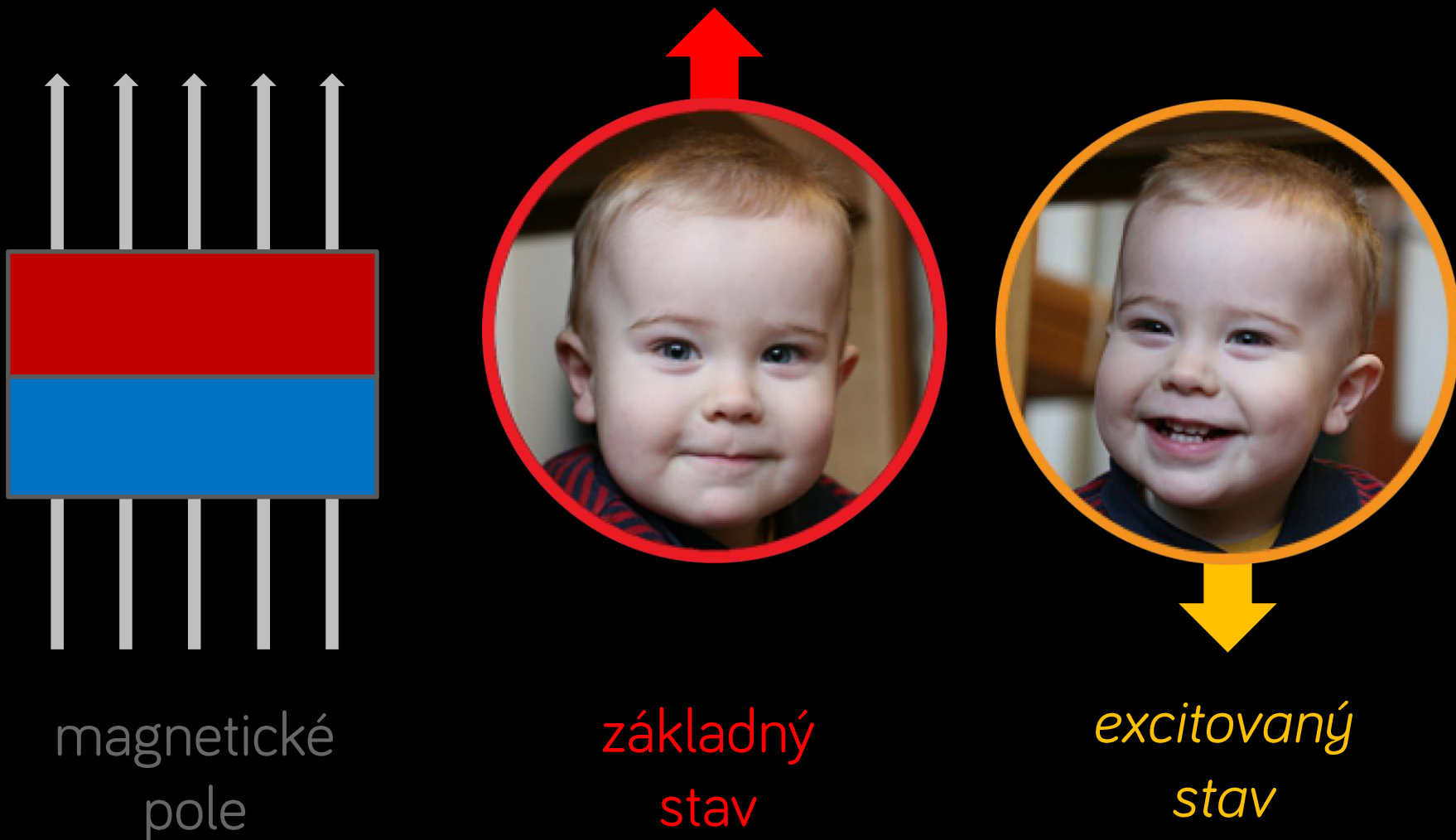
Foto: PAVOL UHRIN

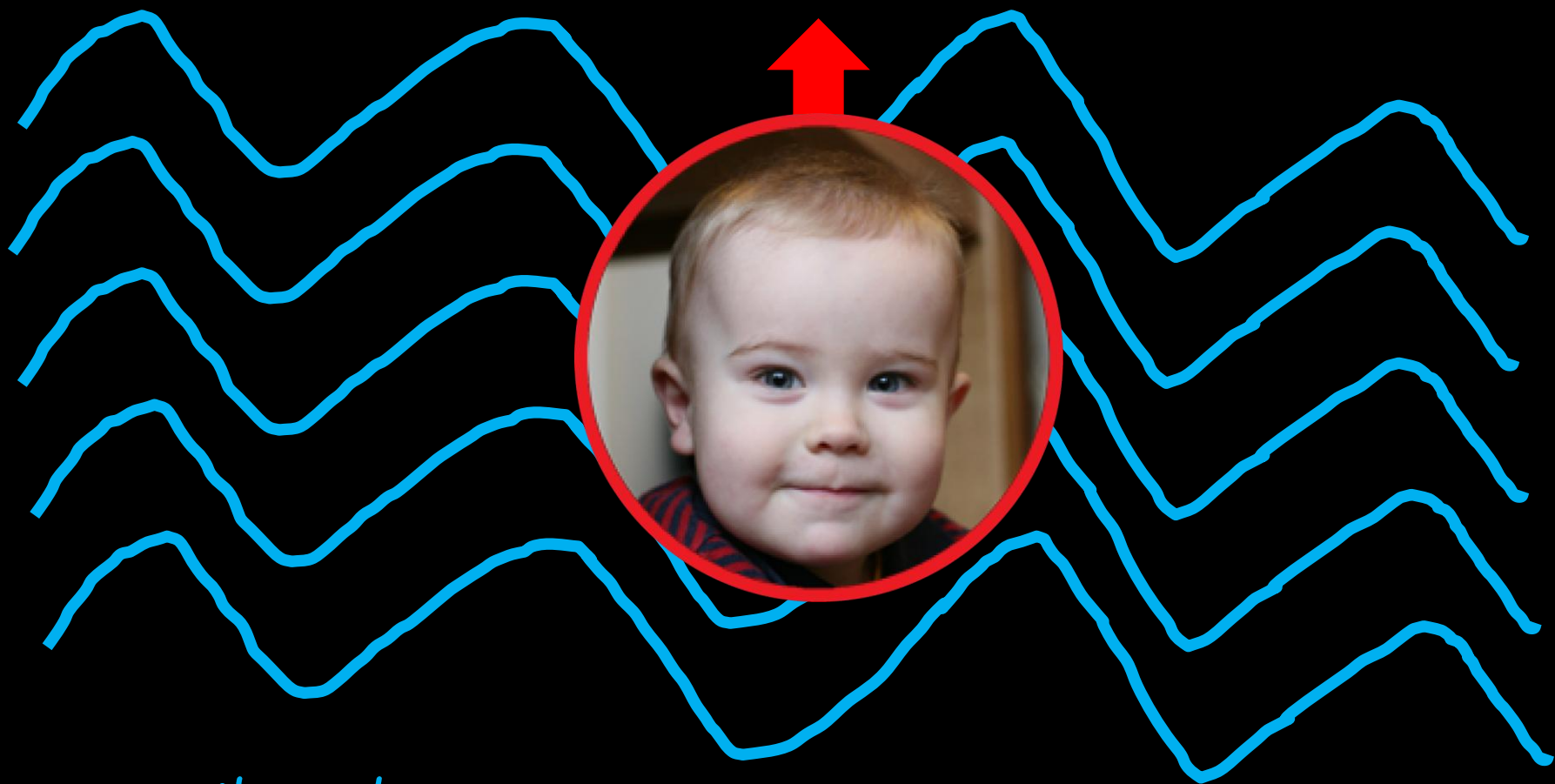
PRESNÉ
hodinky



Atómové hodiny

Cs¹³³





mikrovlny



mikrovlny



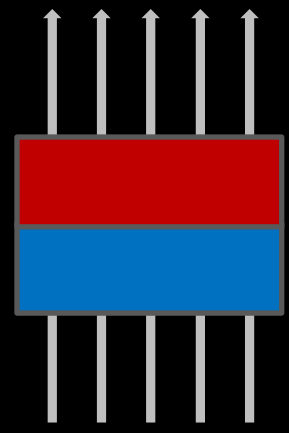
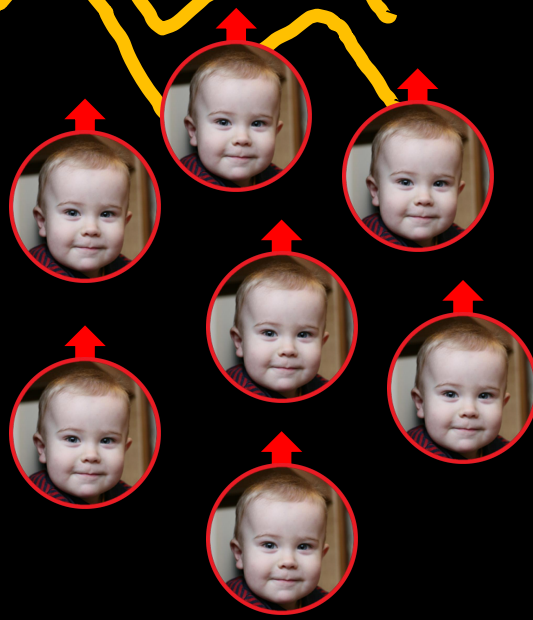
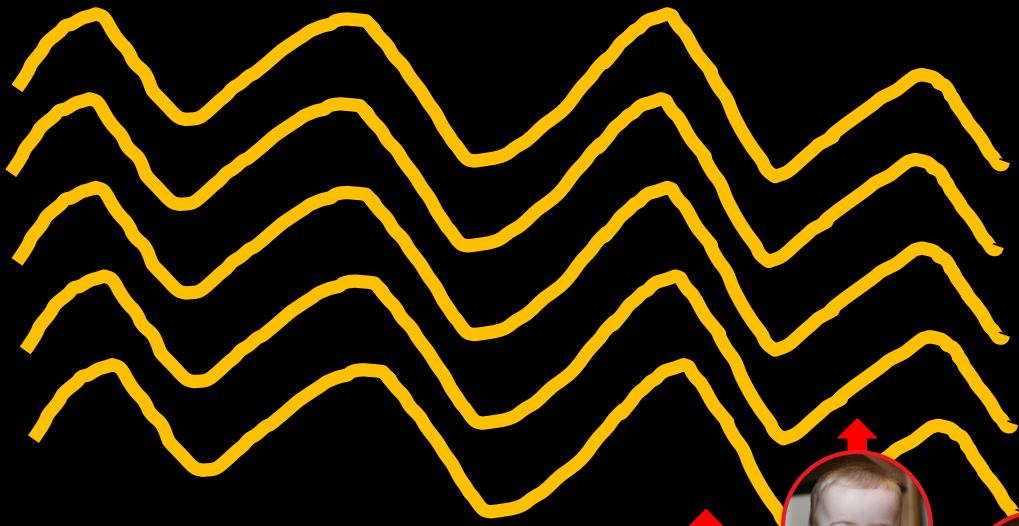
*excitovaný
stav*

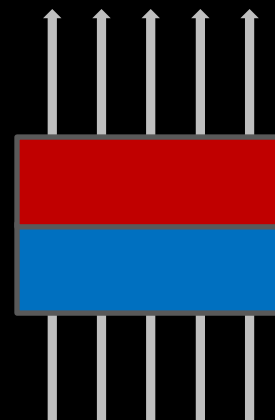


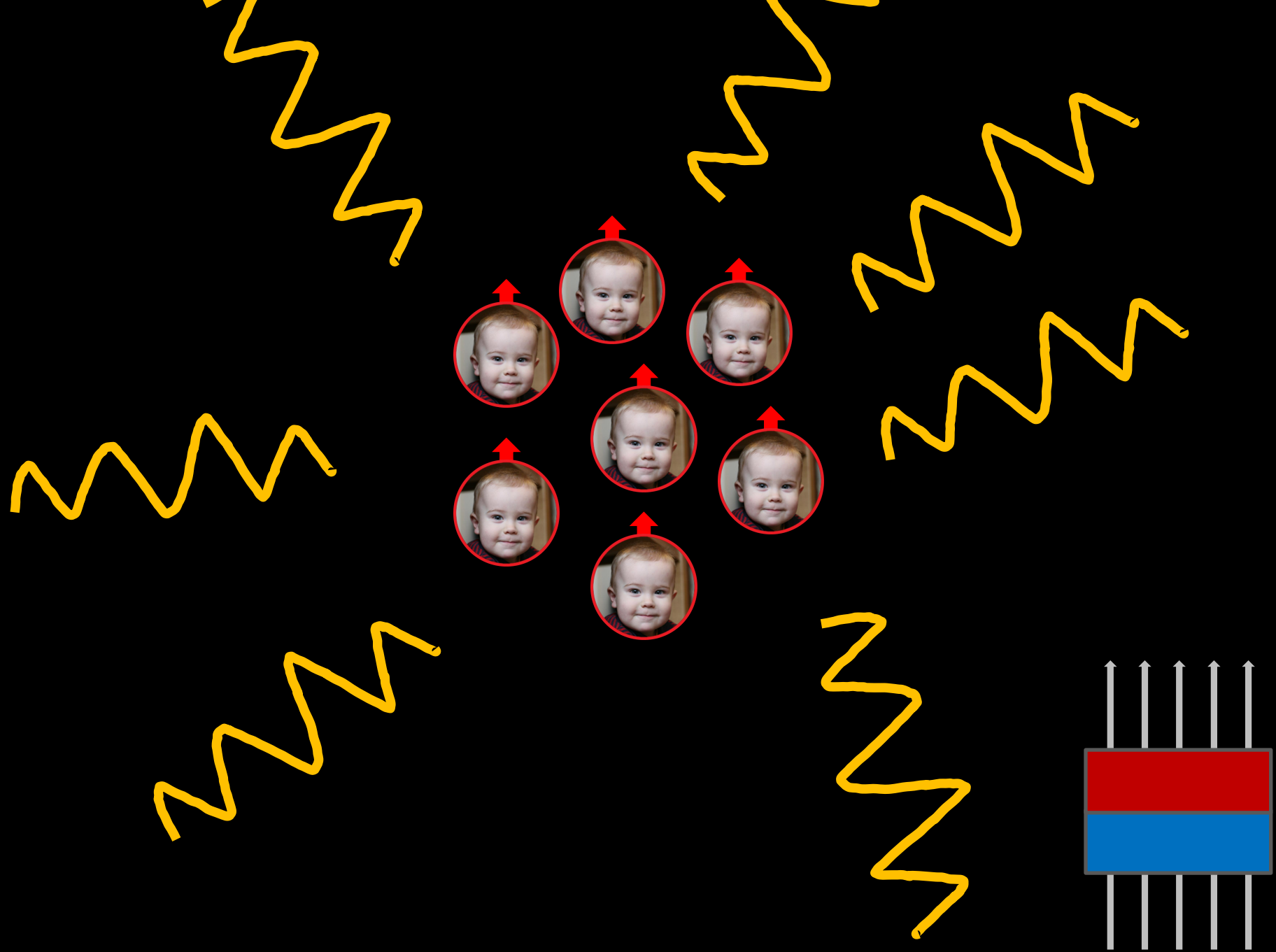
*základný
stav*



*vyžiarený
fotón*





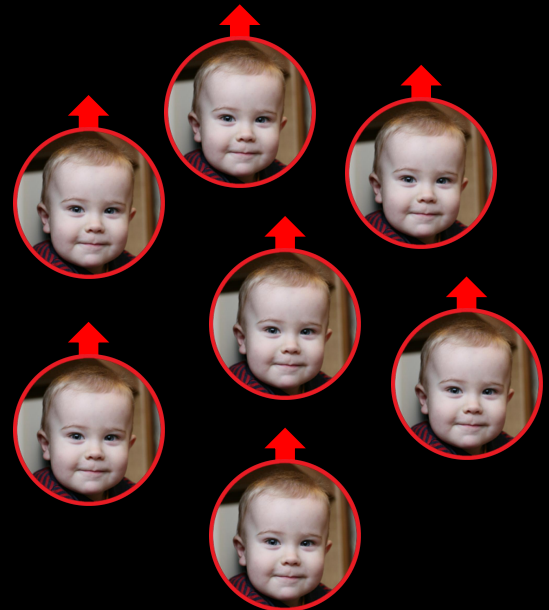


Atómové hodiny

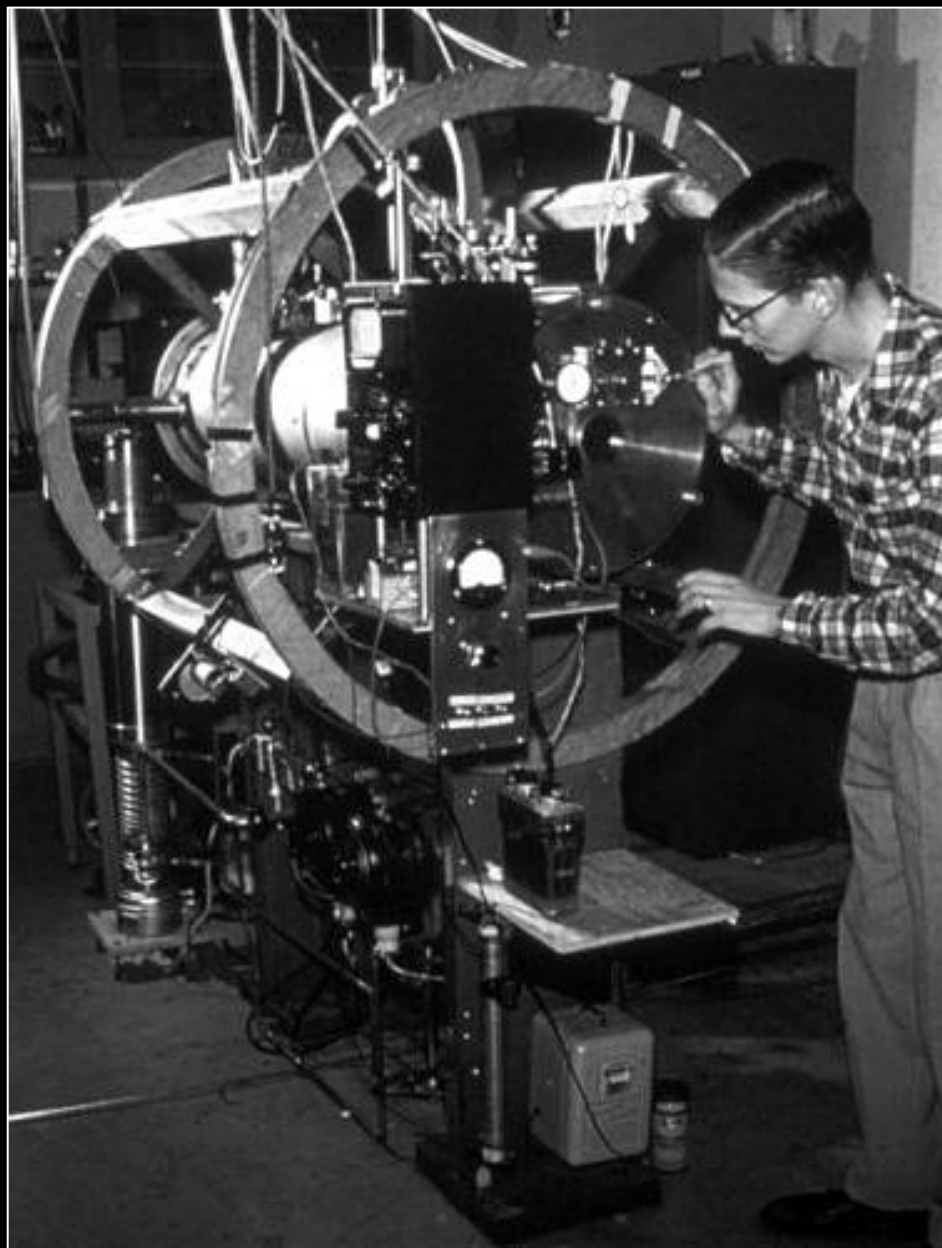
Máme hodinky
(mikrovlnku)
správne nastavené?



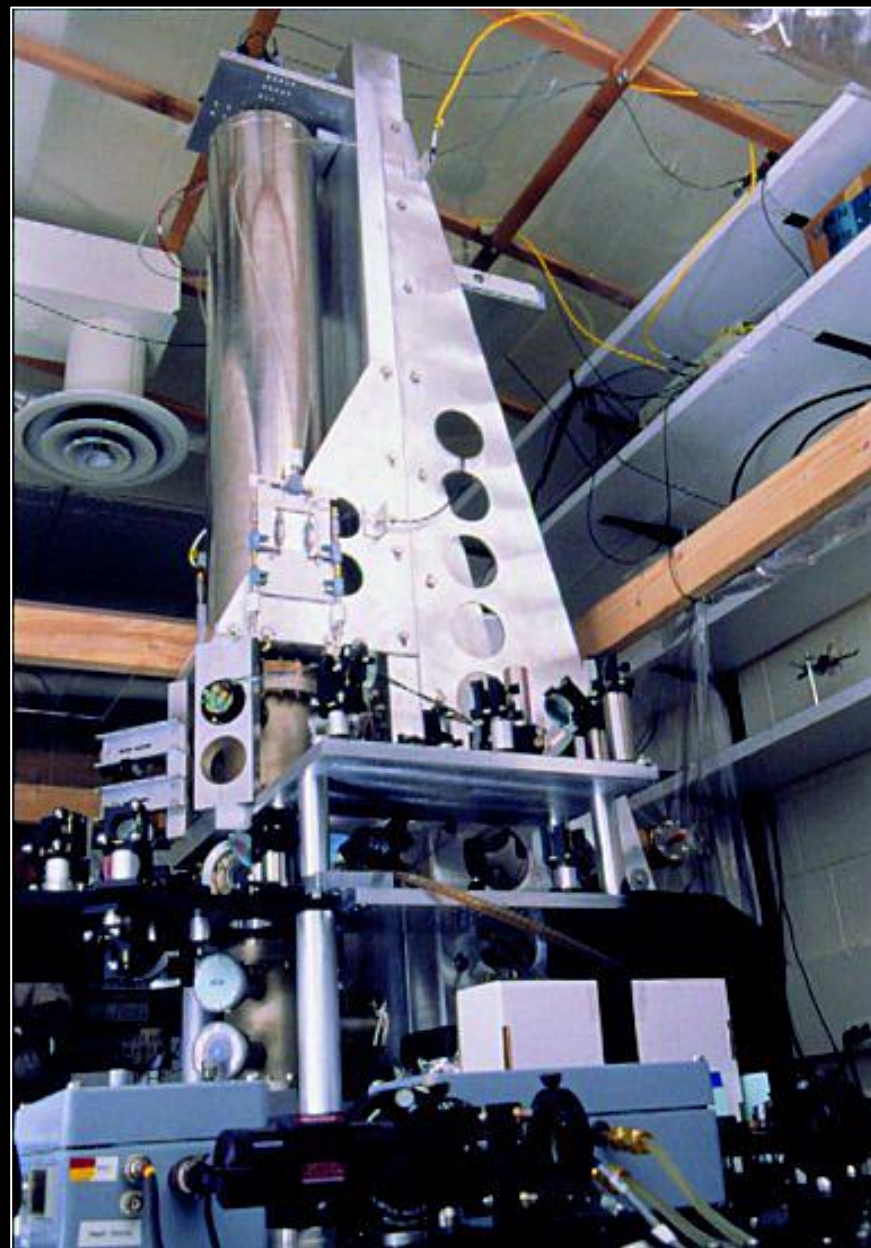
9 192 631 770
kmitov za sekundu



NIST-NBS-1 (1952)



NIST-F1 (1999)

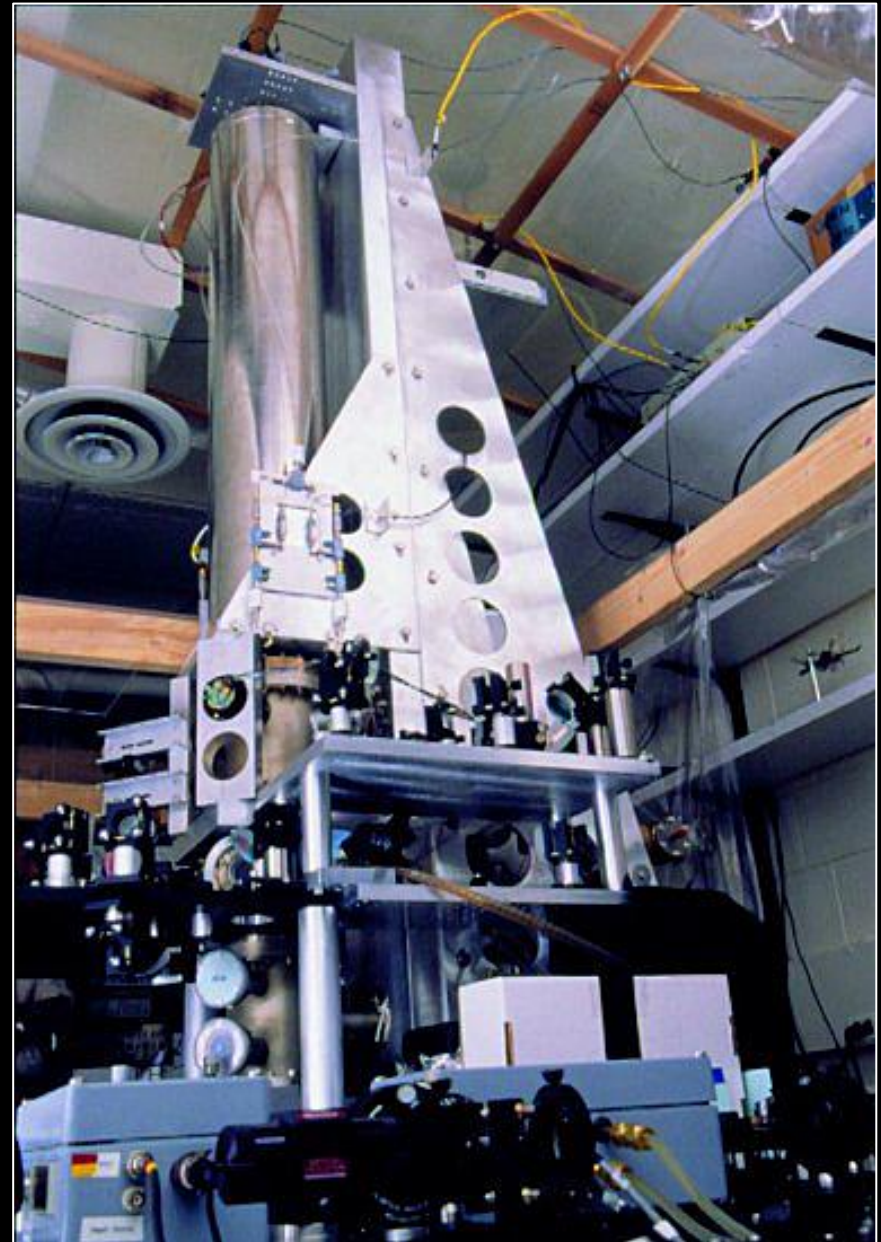


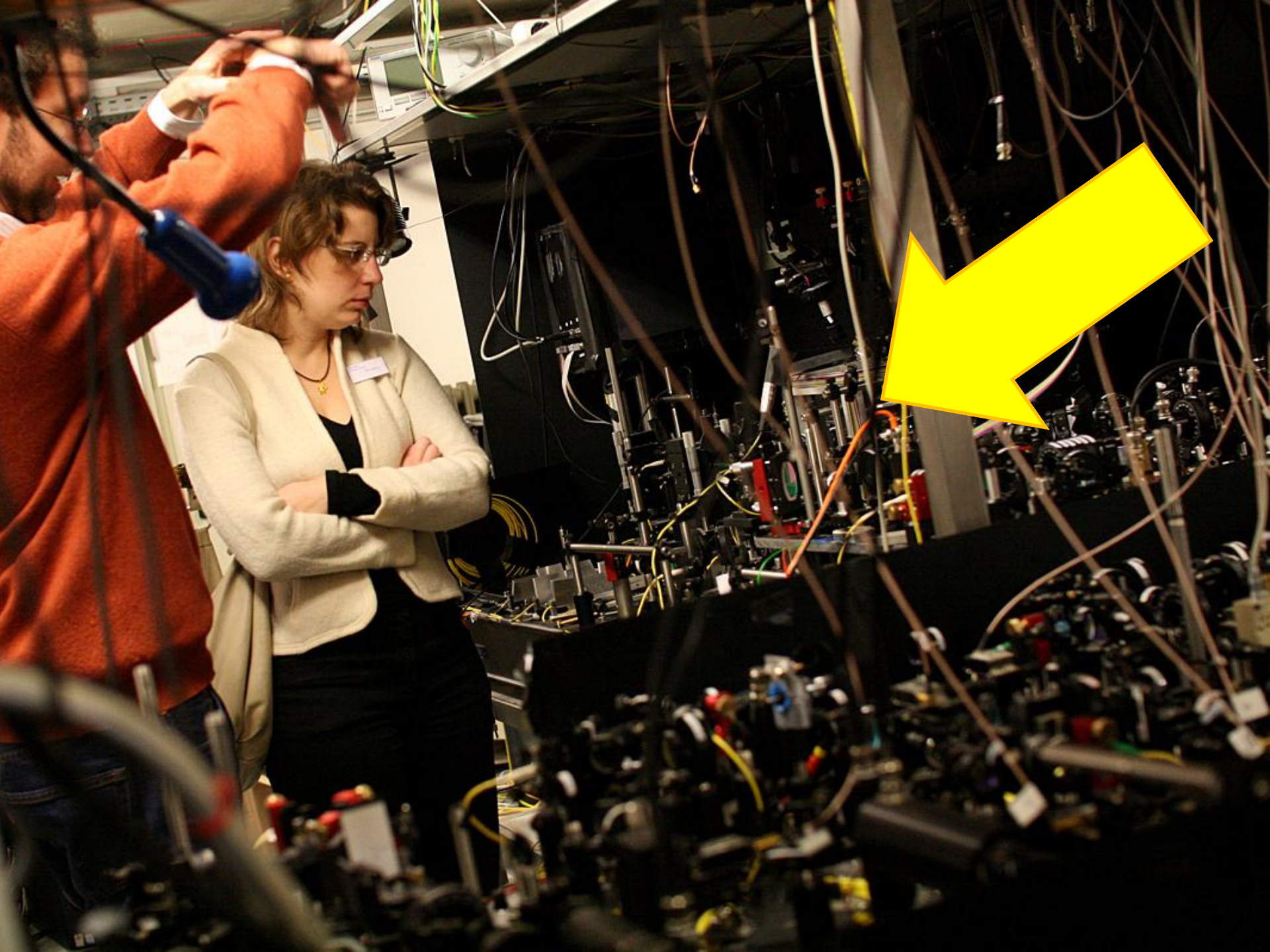
chyba?

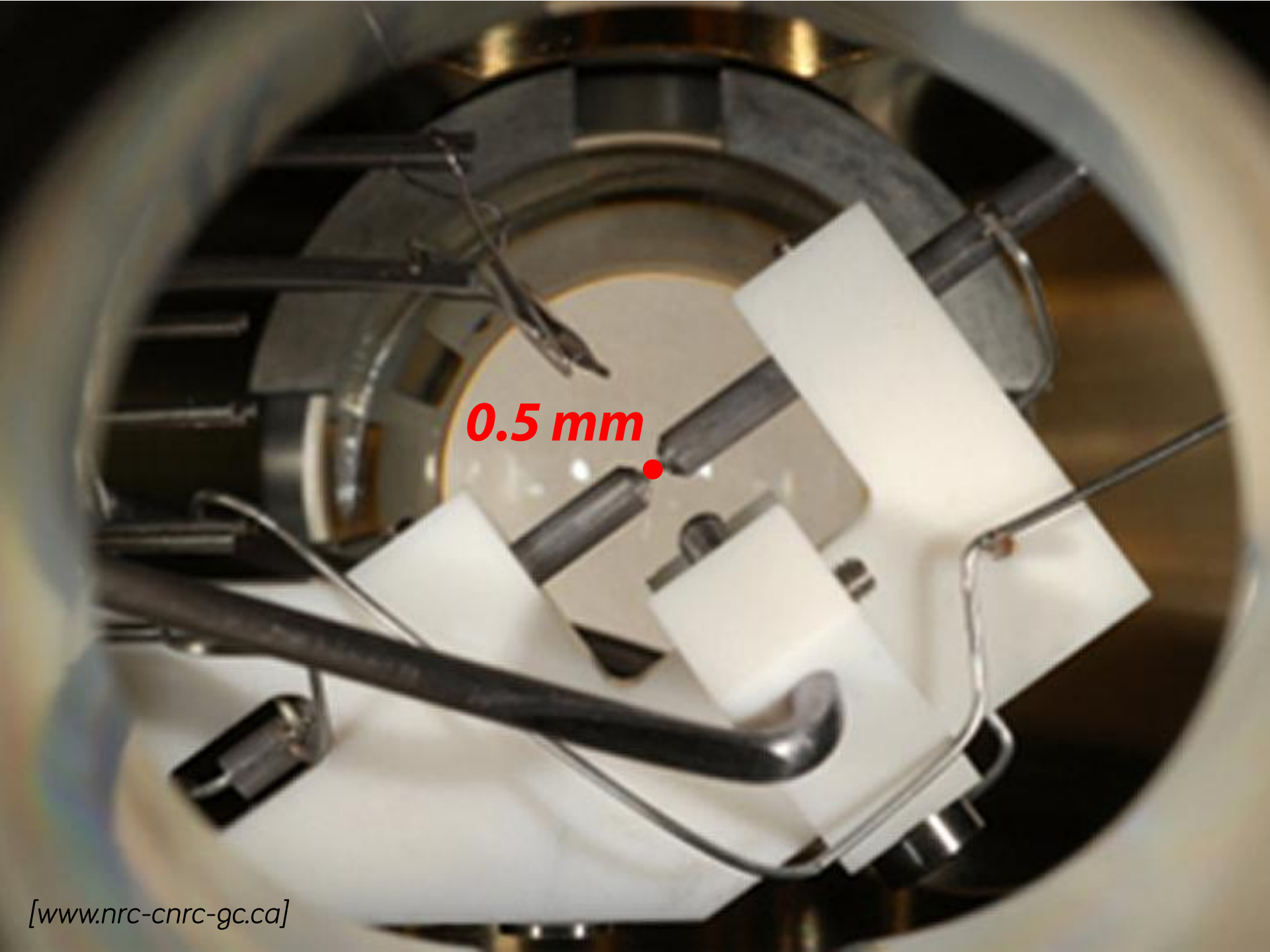
1 sekunda

za

60 000 000
rokov



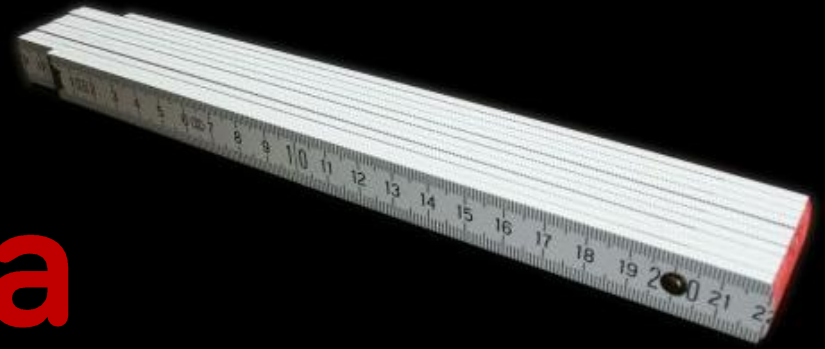




0.5 mm



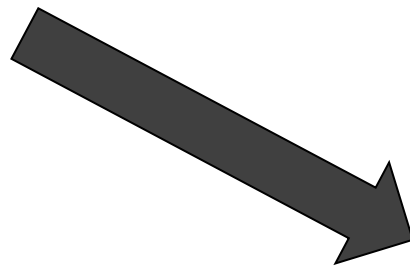
metro**l**ógia



mete**o**ro**l**ógia



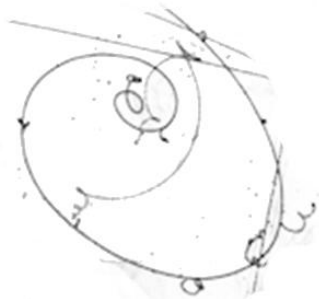
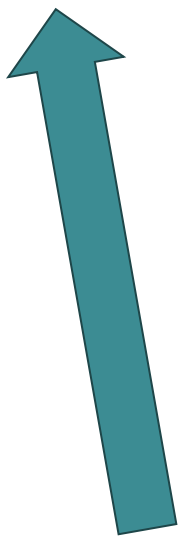
skúsiť



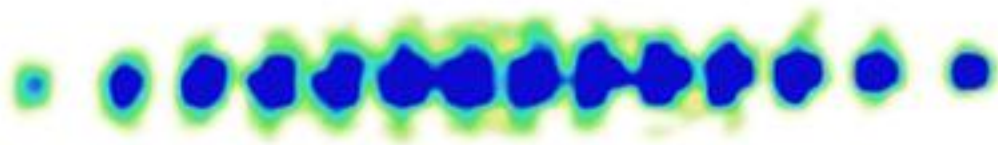
vysvetliť



predpovedať



KVANTOVÉ POČÍTAČE



ktoré ešte nemáme

Ako meriame



svet

Daniel Nagaj (Uni Wien)



