

Milníky kosmologie II

planetum

Petr Kulháněk

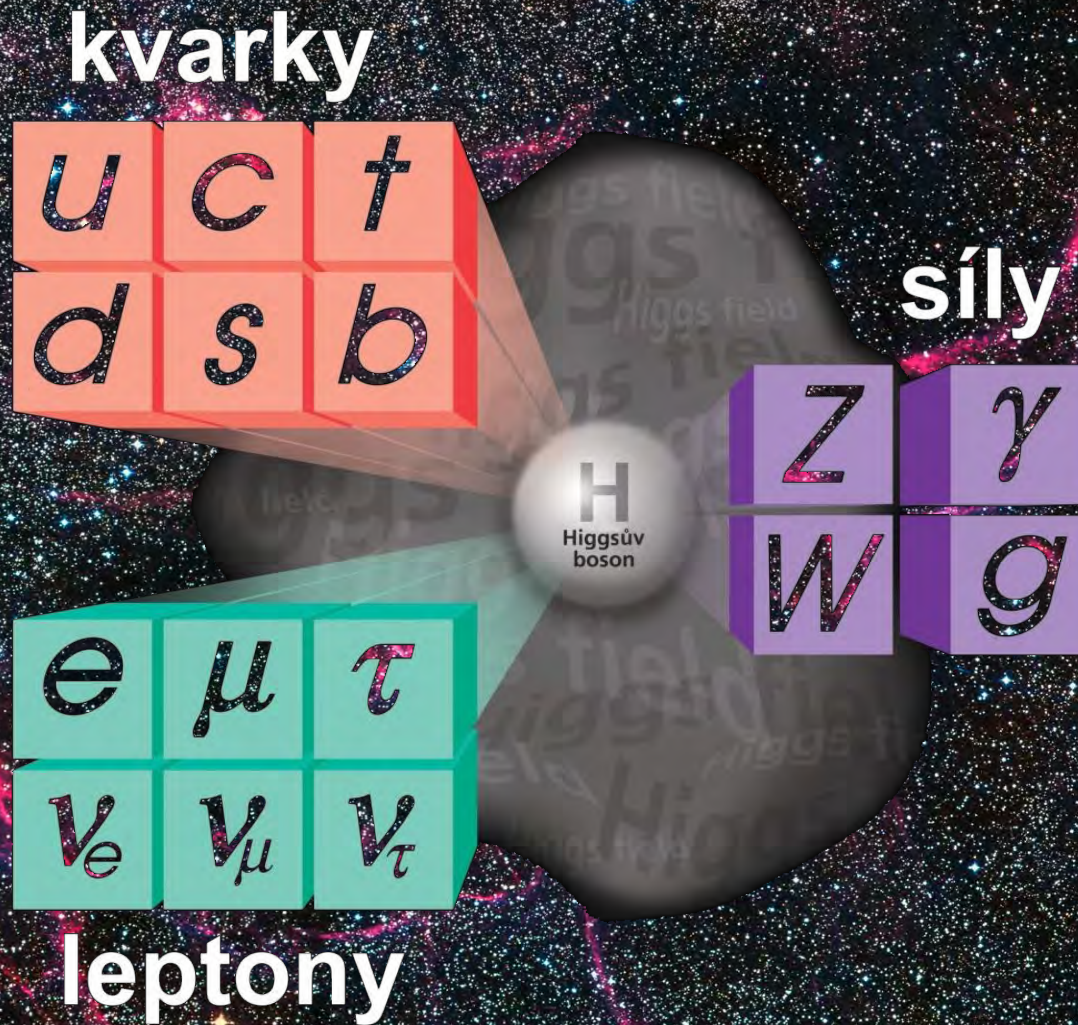
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www.aldebaran.cz

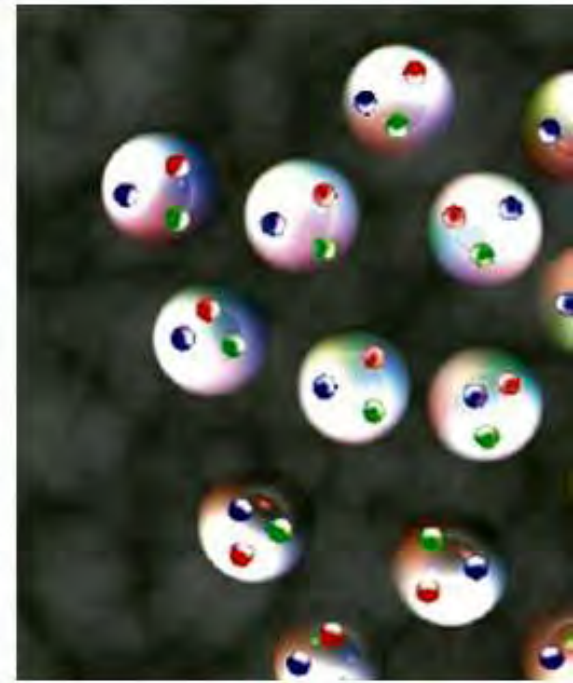
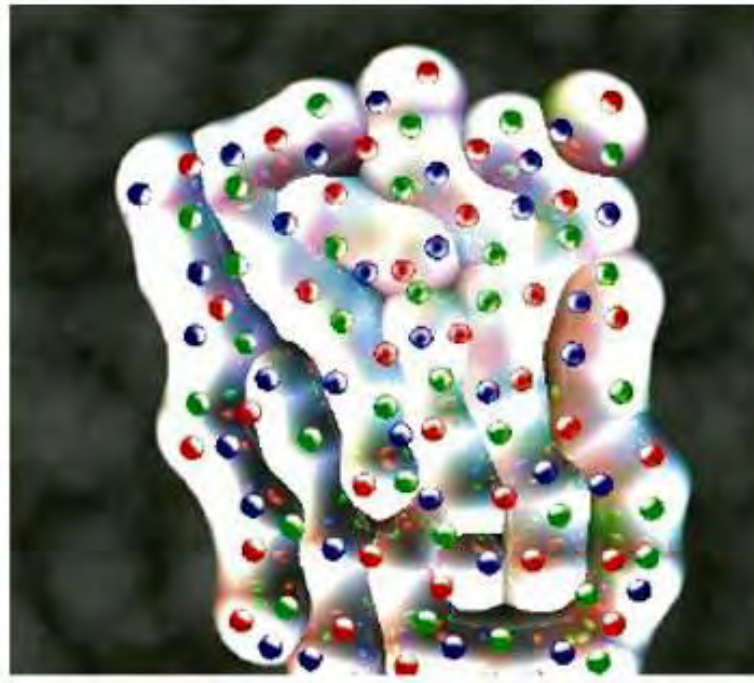
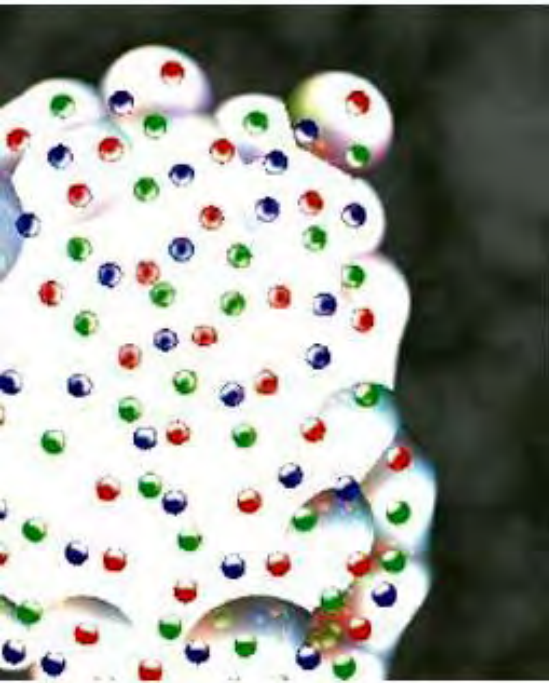


QGP

QGP – Standardní model

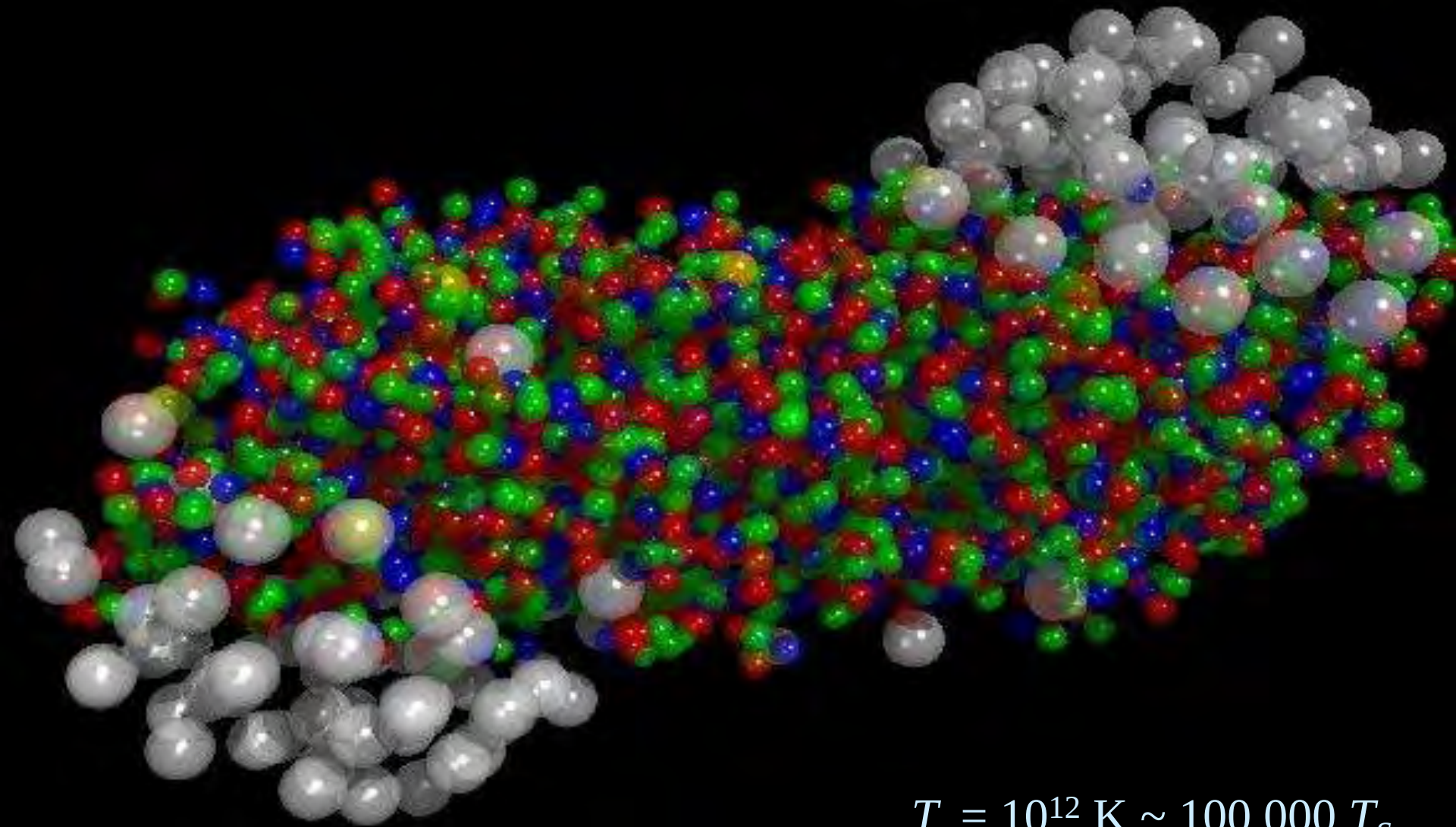


10^{-5} s: $T = 10^{13}$ K, $E = 1$ GeV



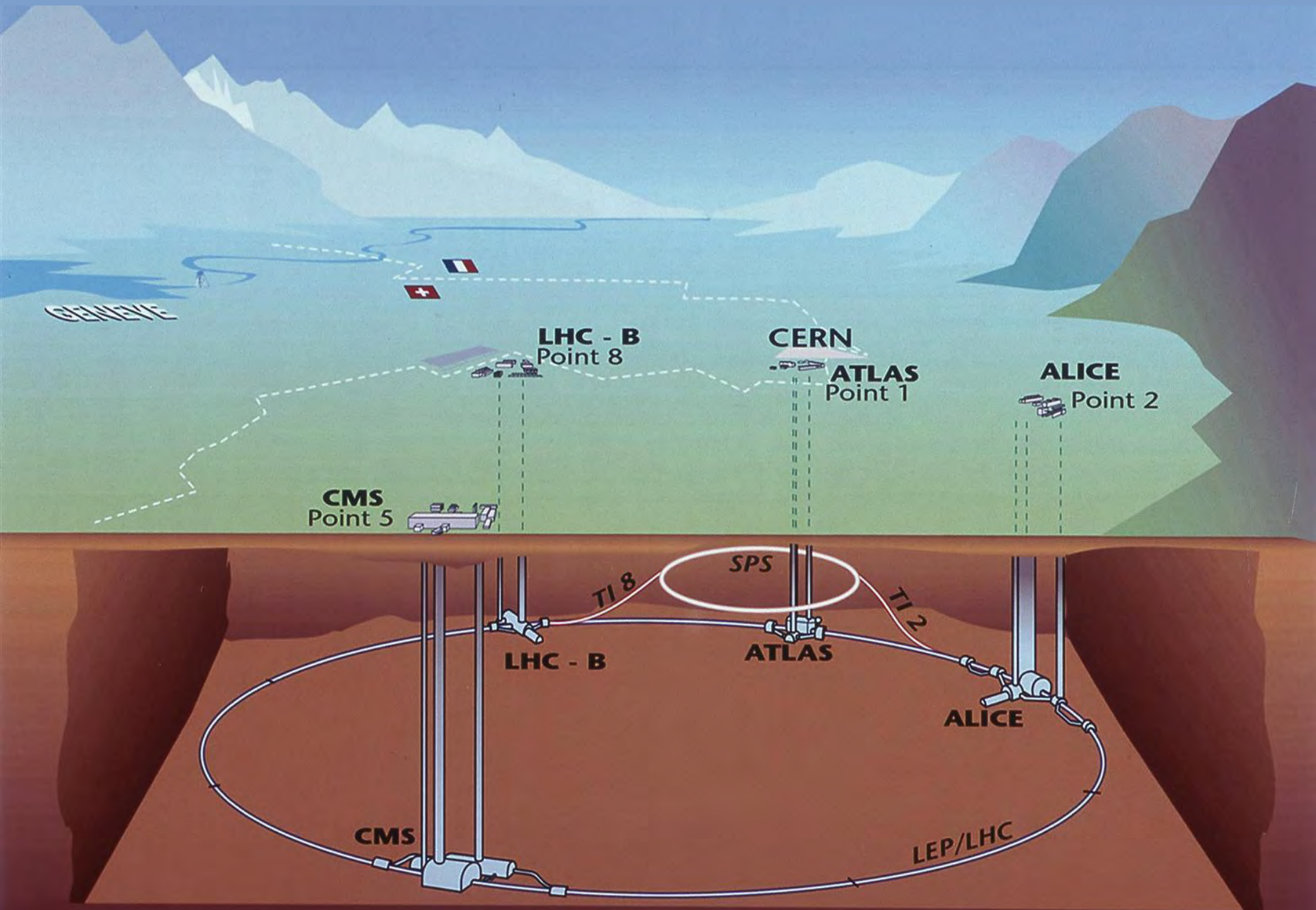
- hadronizace hmoty
- vznik baryonů a mezonů
- první protony a neutrony

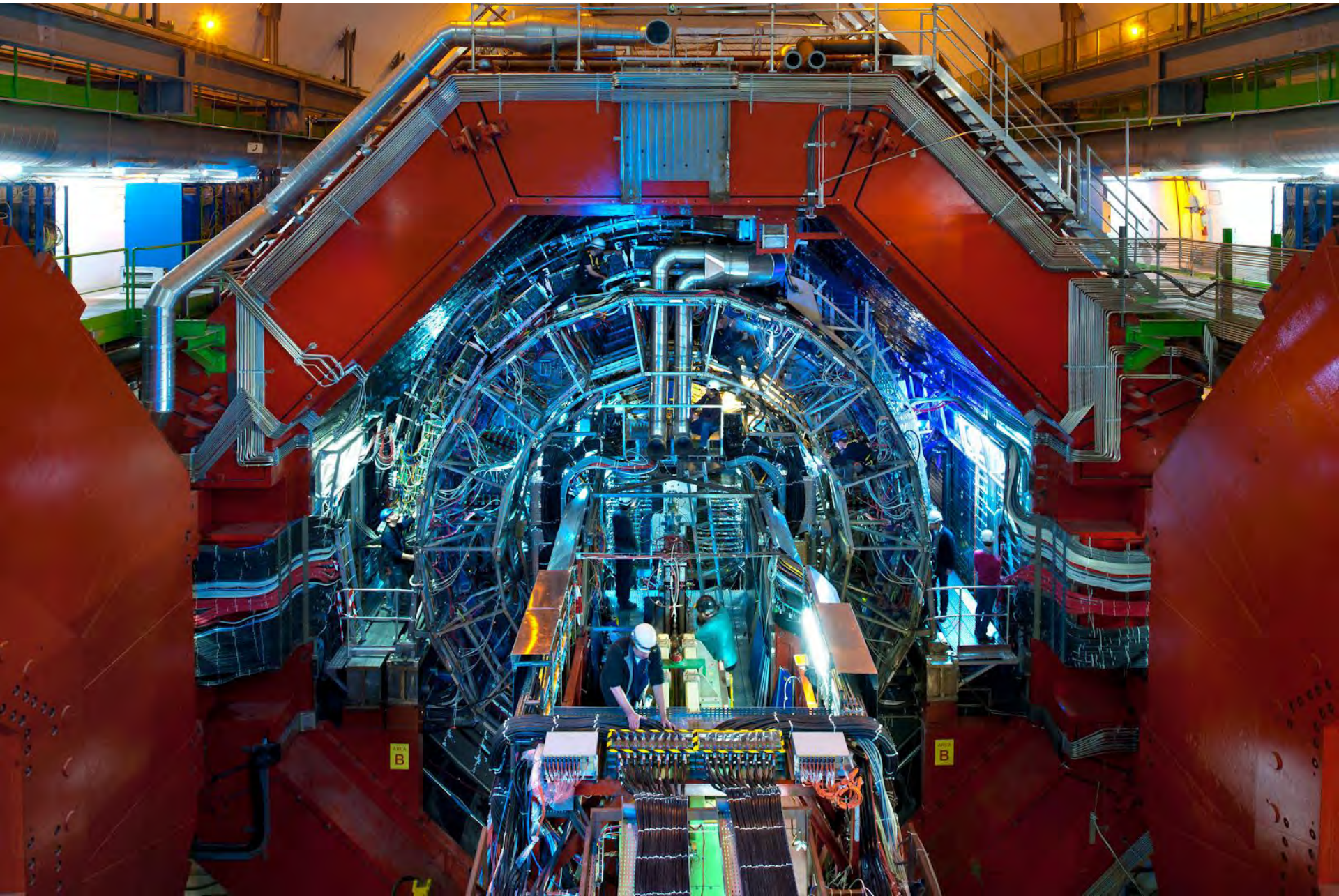
2000, QGP



$$T_c = 10^{12} \text{ K} \sim 100\,000 T_S$$

$$\rho_c = 1 \text{ GeV/fm}^3 \sim 20 \rho_{\text{jad}}$$



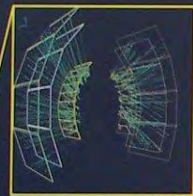
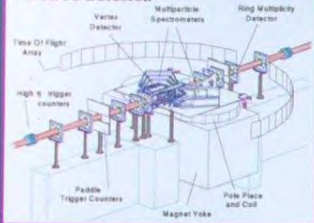


BROOKHAVEN
NATIONAL LABORATORY

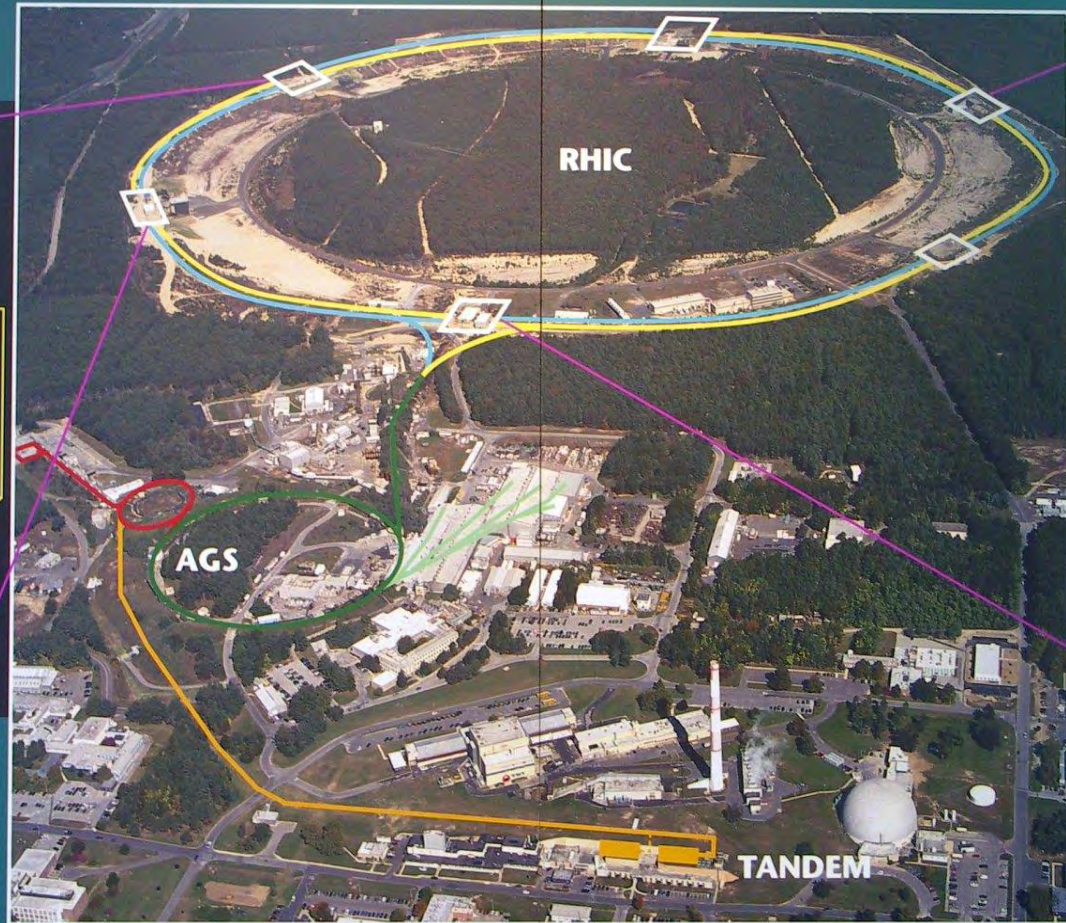
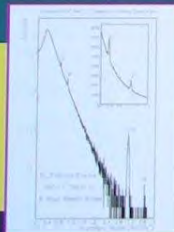


EXPERIMENTS AT RHIC

PHOBOS DETECTOR



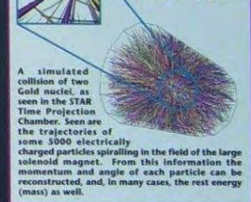
PHENIX DETECTOR



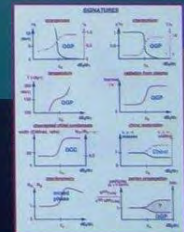
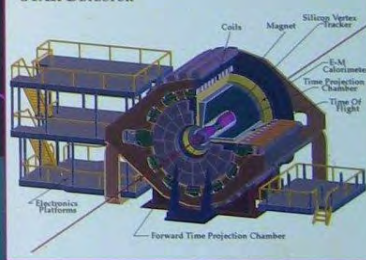
BRAHMS DETECTOR



STAR TPC EVENT



STAR DETECTOR



DETECTOR LINE-UP AT THE RHIC COLLISION AREAS

RHIC's colliding beams will produce much higher energies than presently available in nuclear interactions, offering unprecedented opportunities to study phenomena in a fundamentally new state of matter-- the quark-gluon plasma.

RHIC is designed to accommodate a varied program of heavy ion experiments to explore this new regime. Some of these experiments involve the construction of giant detectors, which will be among the most complex ever built, and will be operated for many years by large teams of scientists. Other experiments will be carried out with relatively small detectors on a shorter time scale.

A community of more than 800 scientists, representing a worldwide distribution of universities and laboratories, is engaged in the preparation of these first experiments.



Phenix

PHENIX

CAUTION-DO NOT ENTER

CAUTION-DO NOT ENTER

CAUTION-DO NOT ENTER

CAUTION



obvod: 6 834 metrů
energie: 200 GeV/nukleon

Long Island



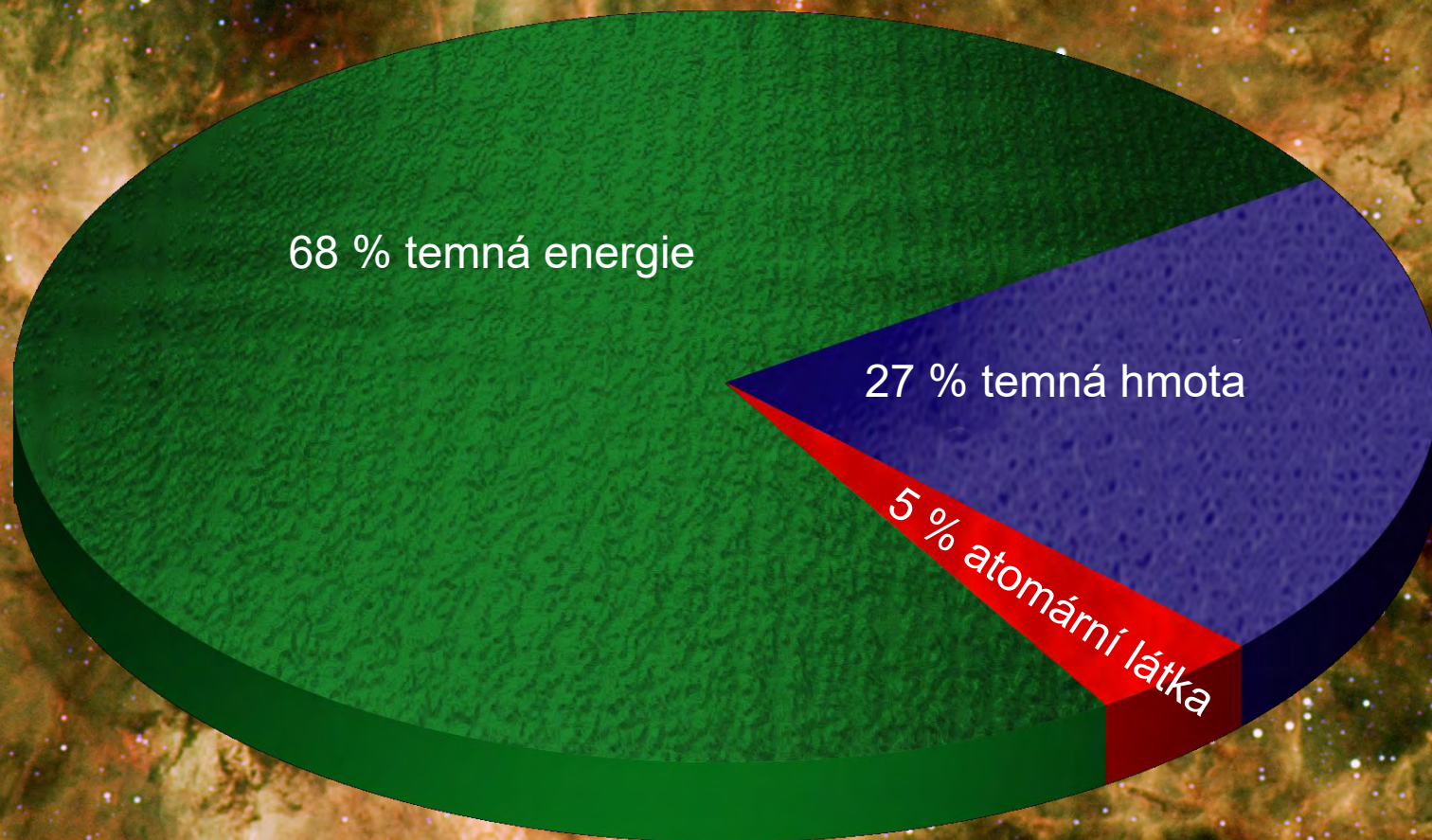
Long Island



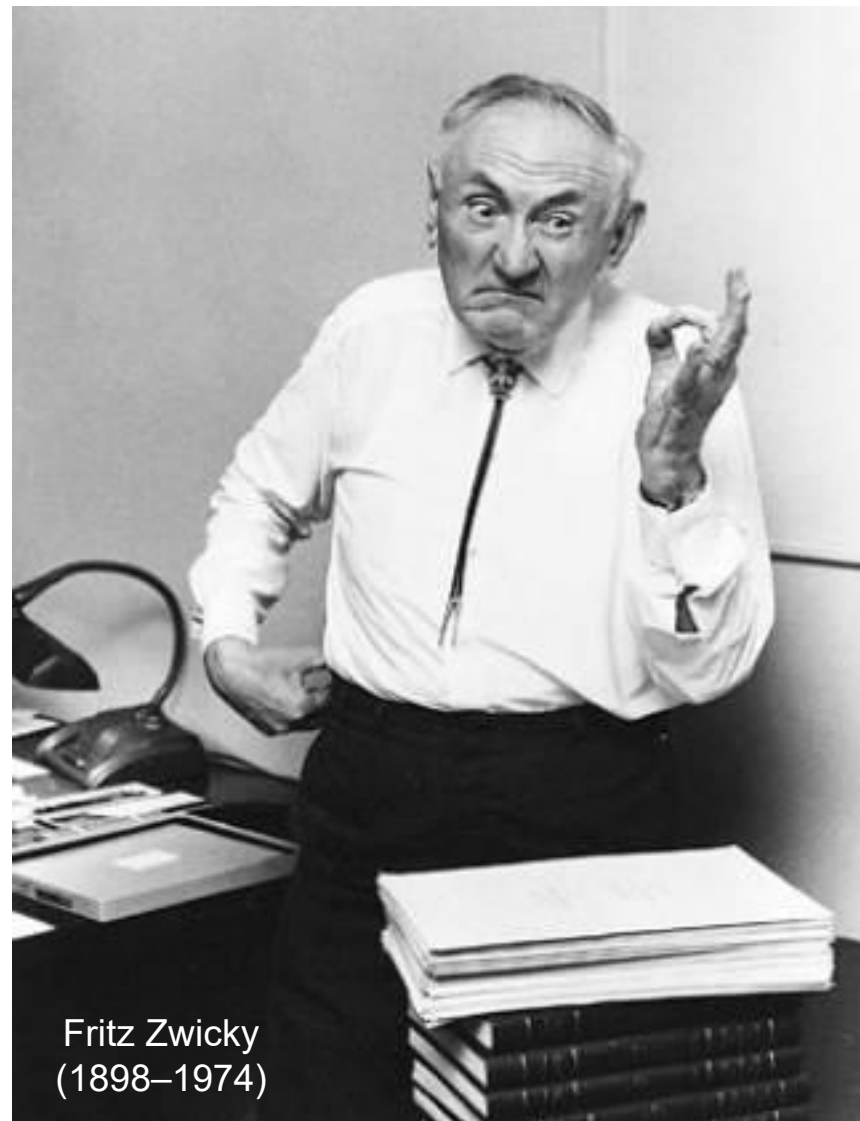
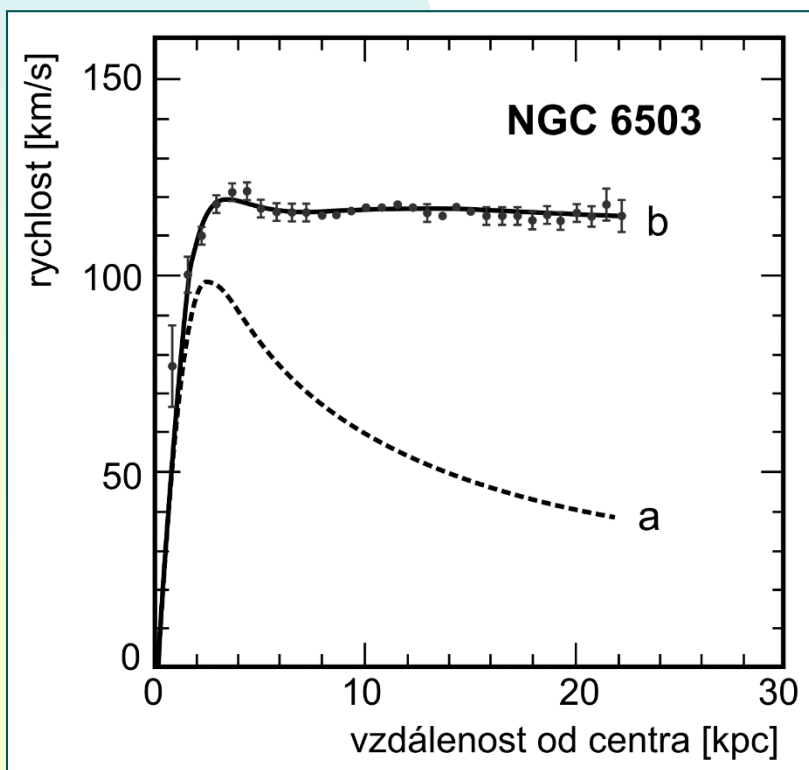


Temná hmota

ZÁKLADNÍ INGREDIENCE VESMÍRU



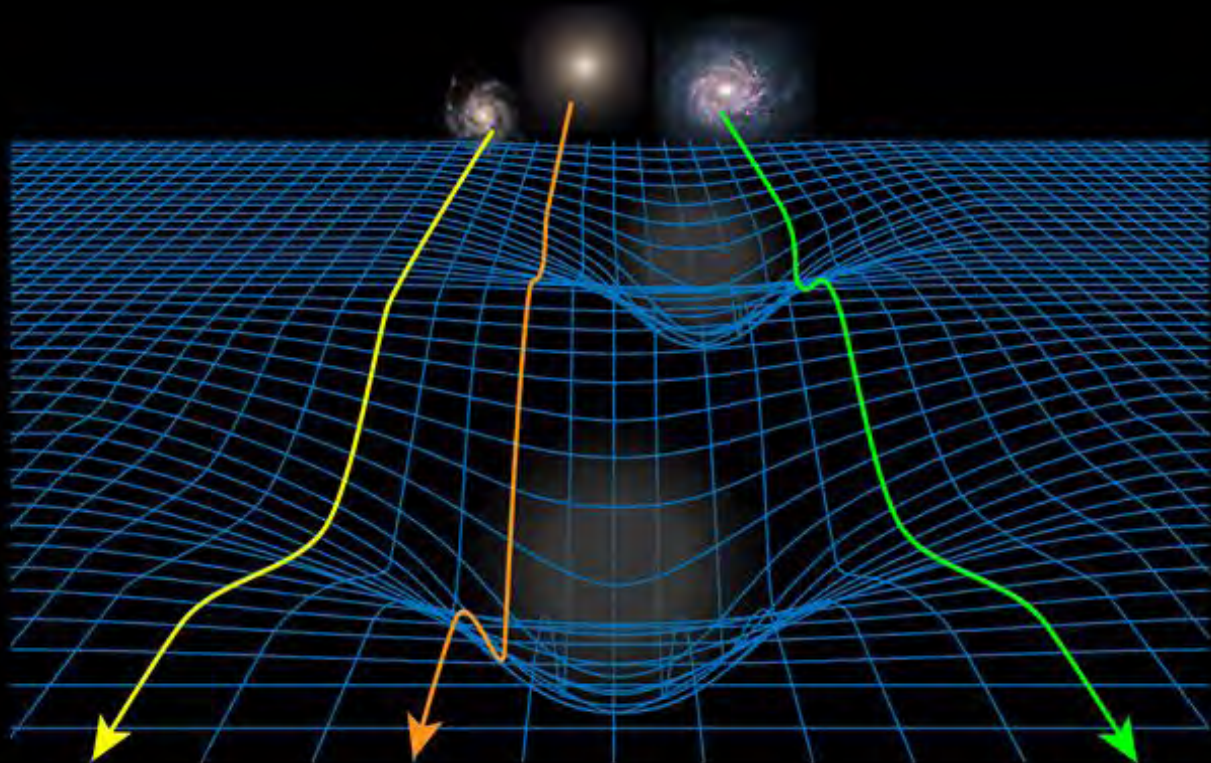
Temná hmota



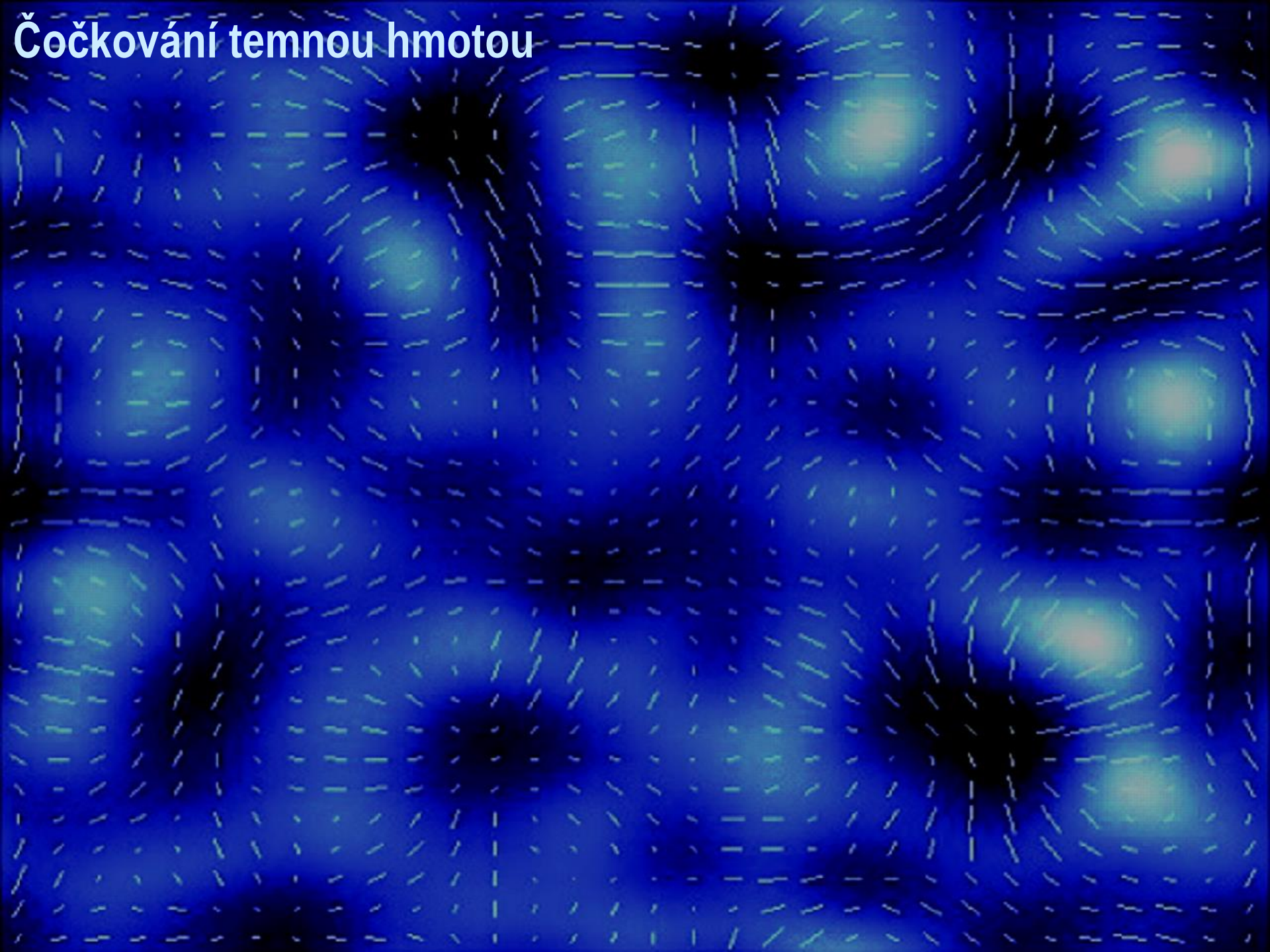
Fritz Zwicky
(1898–1974)

- 1934, Fritz Zwicky – nesoulad pohybu v kupě galaxií Vlasy Bereniky s množstvím látky)
- 1968, Vera Rubin – rotační křivky spir. galaxií
- nejpřesnější měření na vlně 21 cm
- 50 % hmoty galaxií, 23 % hmoty vesmíru

Čočkovaní temnou hmotou



Čočkování temnou hmotou

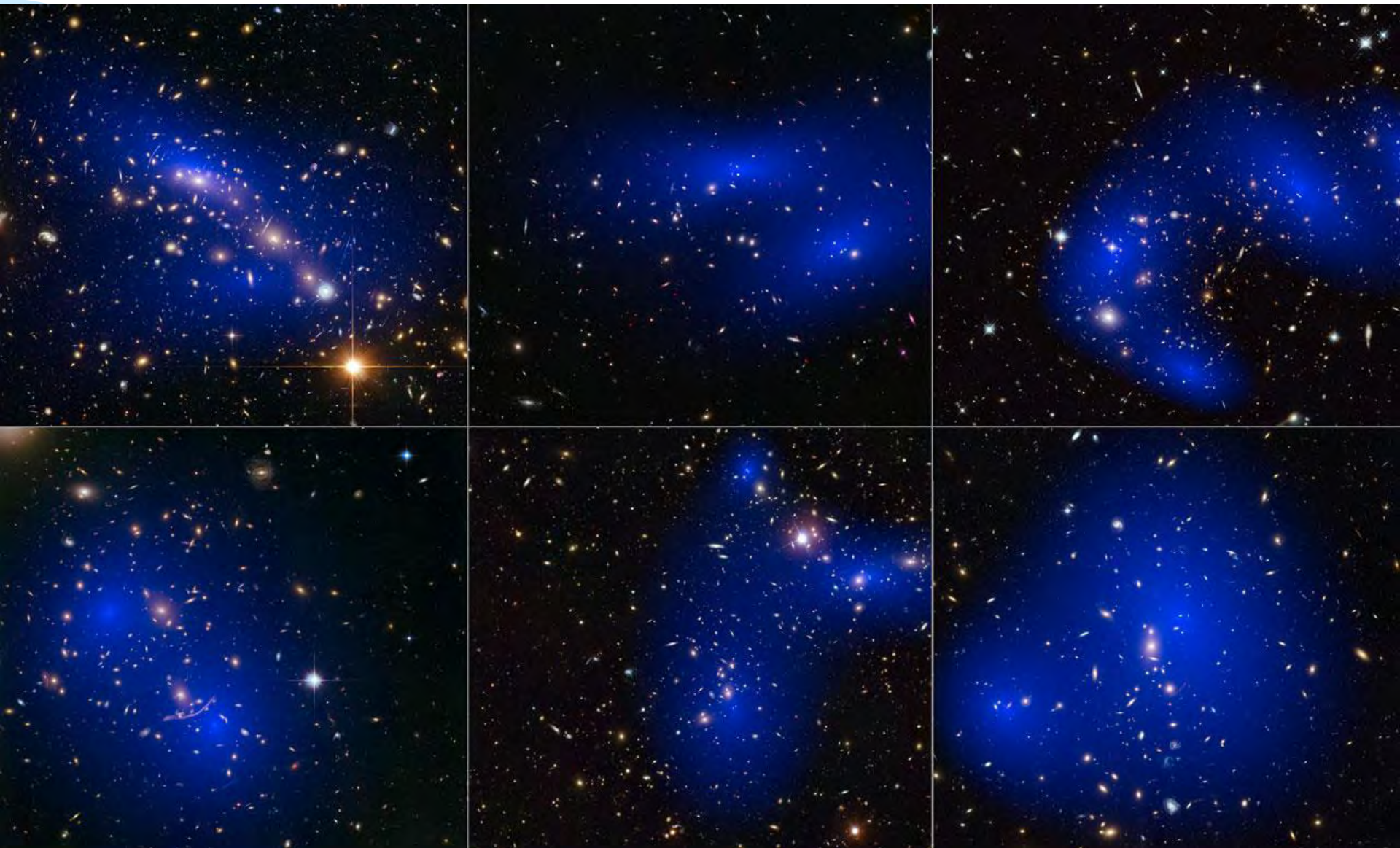


Temná hmota – kupa galaxií

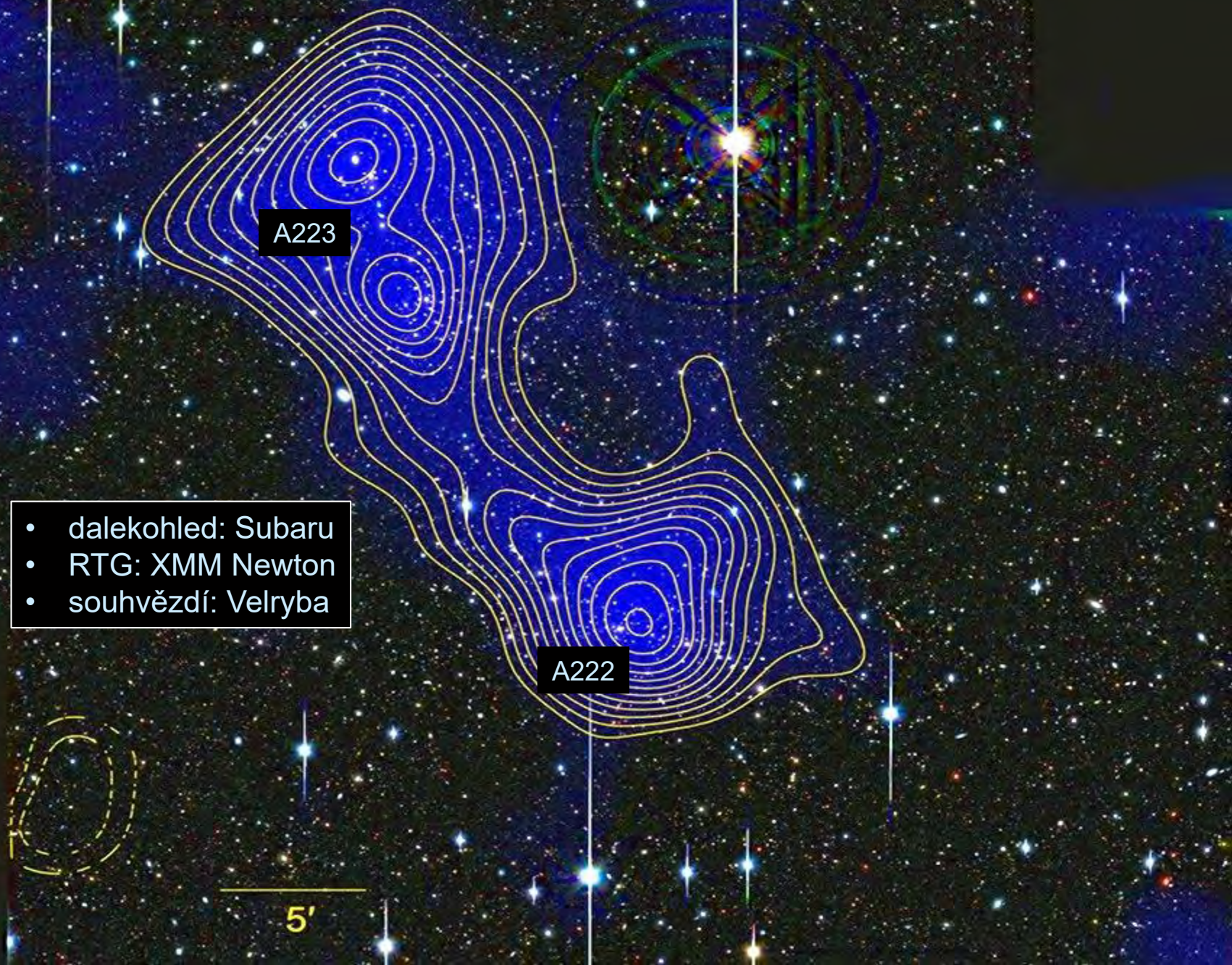


Obrázek gravitačně čočkující kupy galaxií pořízený HST byl zpracován v roce 2005 speciální technikou na univerzitě v Yale. Z efektu gravitačních čoček na jednotlivé členy kupy byla dopočtena temná hmota, která v kupě musí být. Na obrázku je zobrazena modrou barvou. Je vidět, že obklopuje jednotlivé galaxie v kupě.

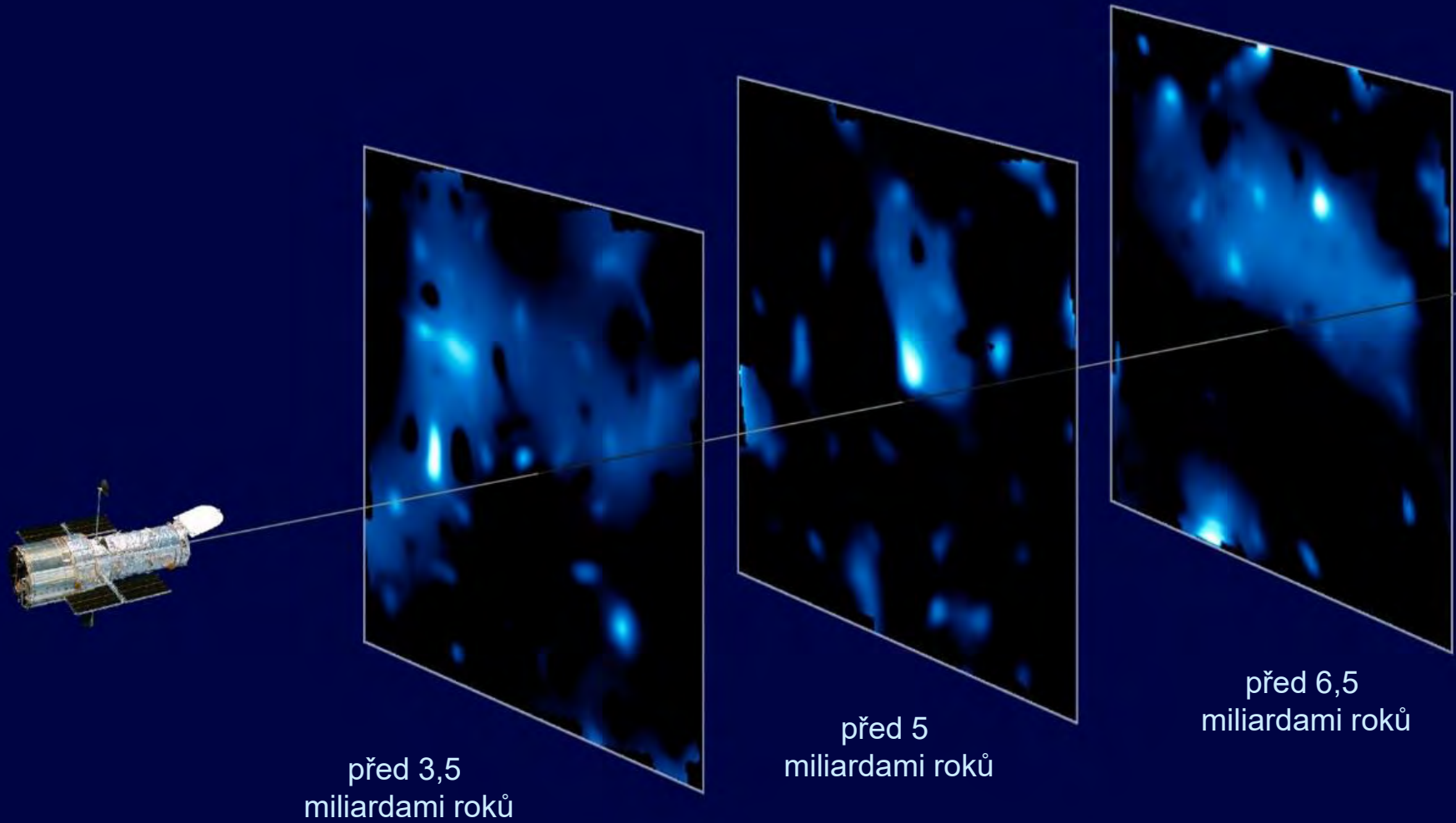
Mapy temné hmoty v kupách galaxií



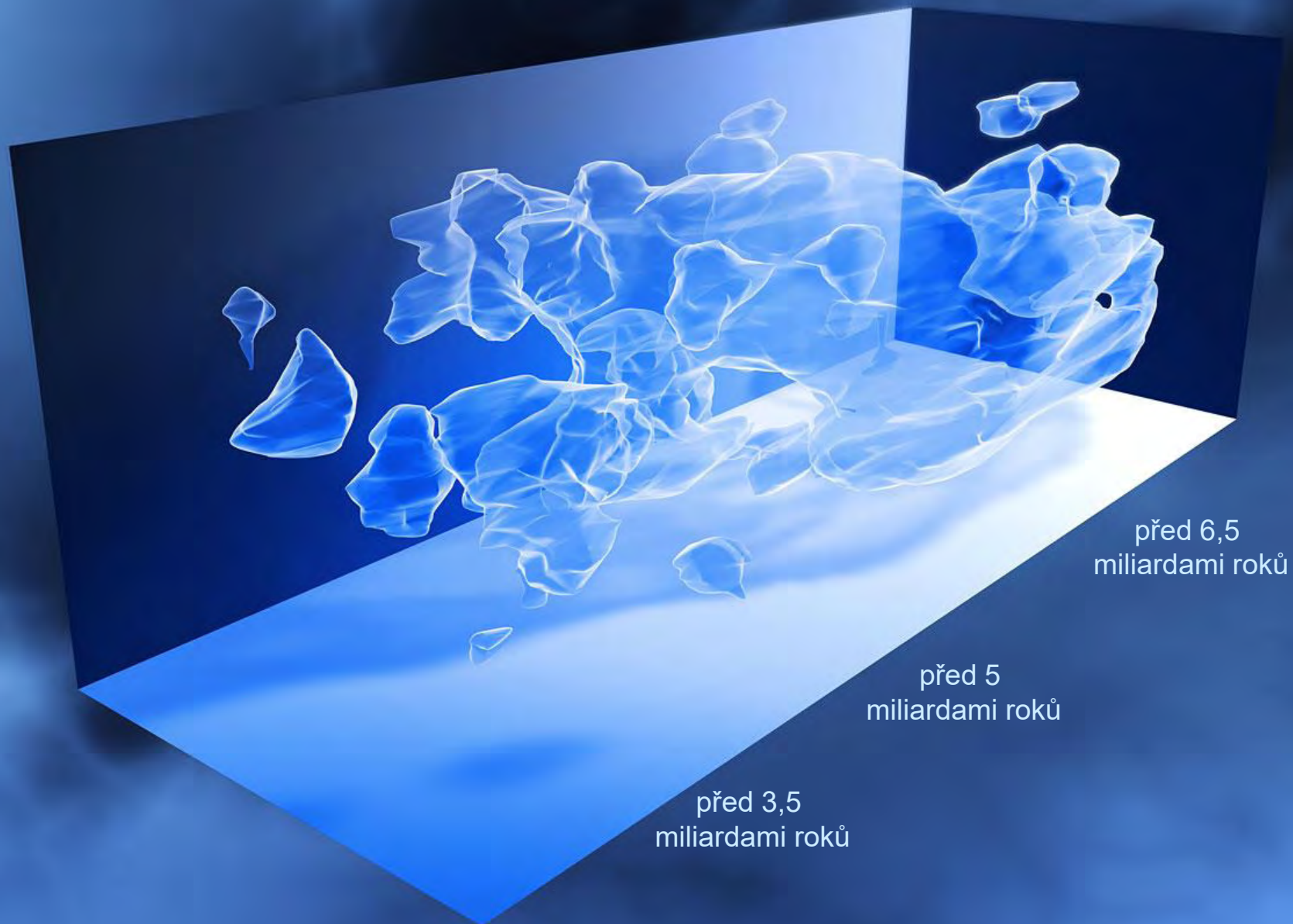
Most temné hmoty mezi kupami galaxií (2012)



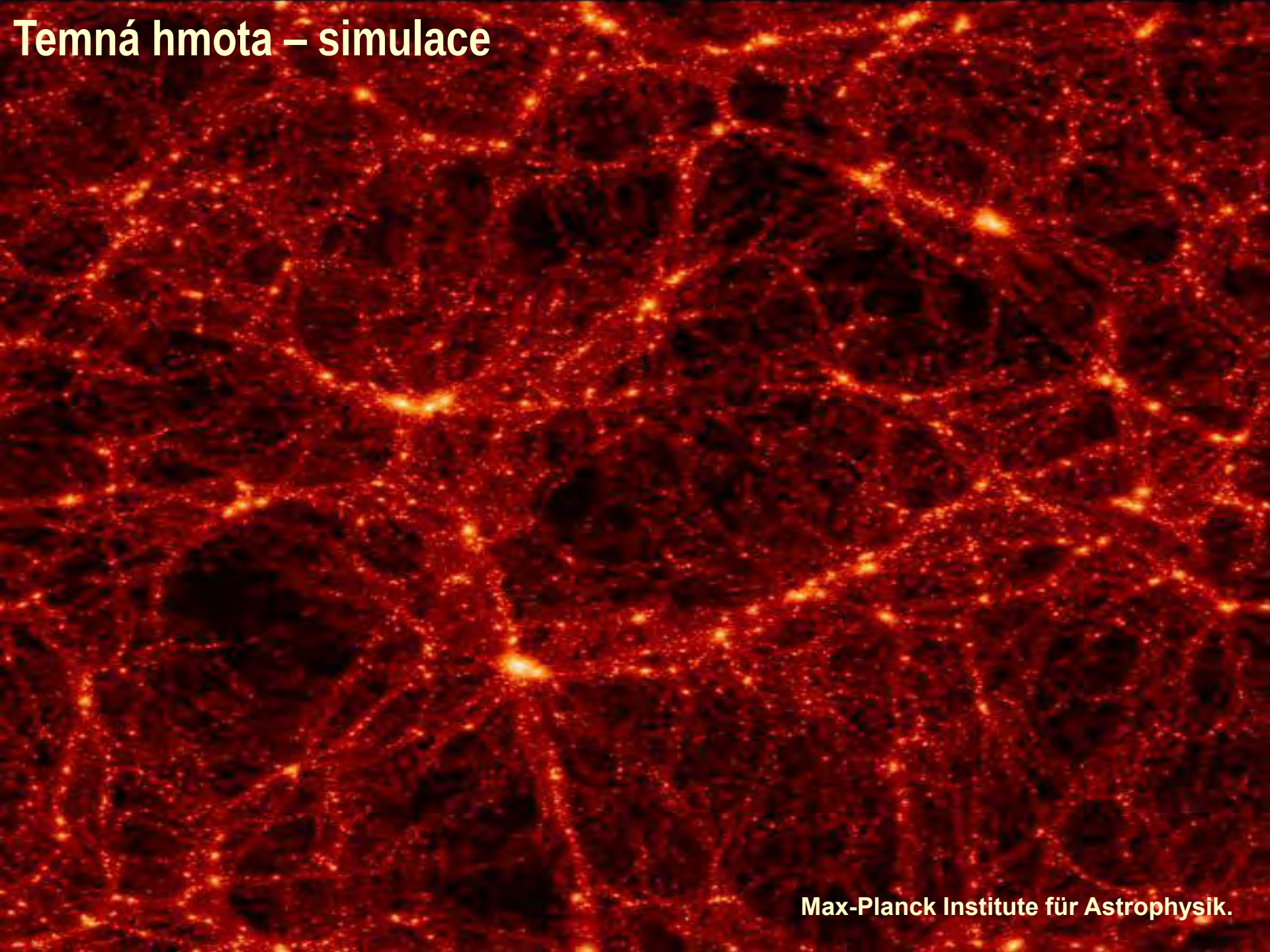
Časoprostorová mapa temné hmoty



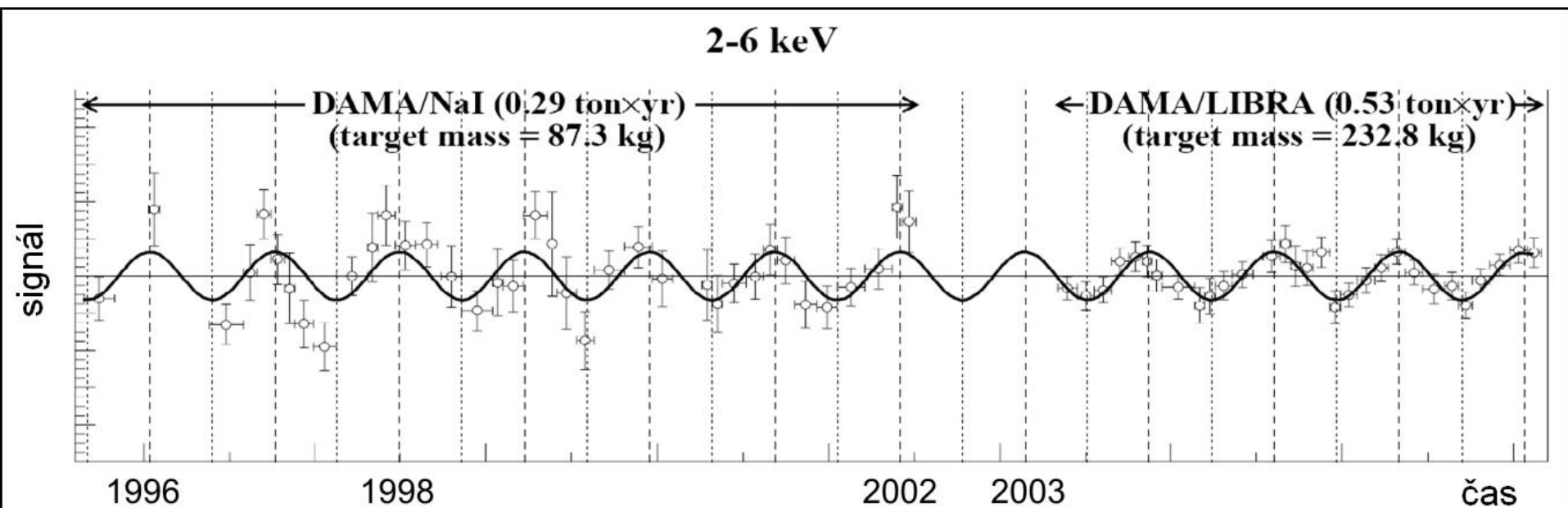
Časoprostorová mapa temné hmoty



Temná hmota – simulace



DAMA/Libra

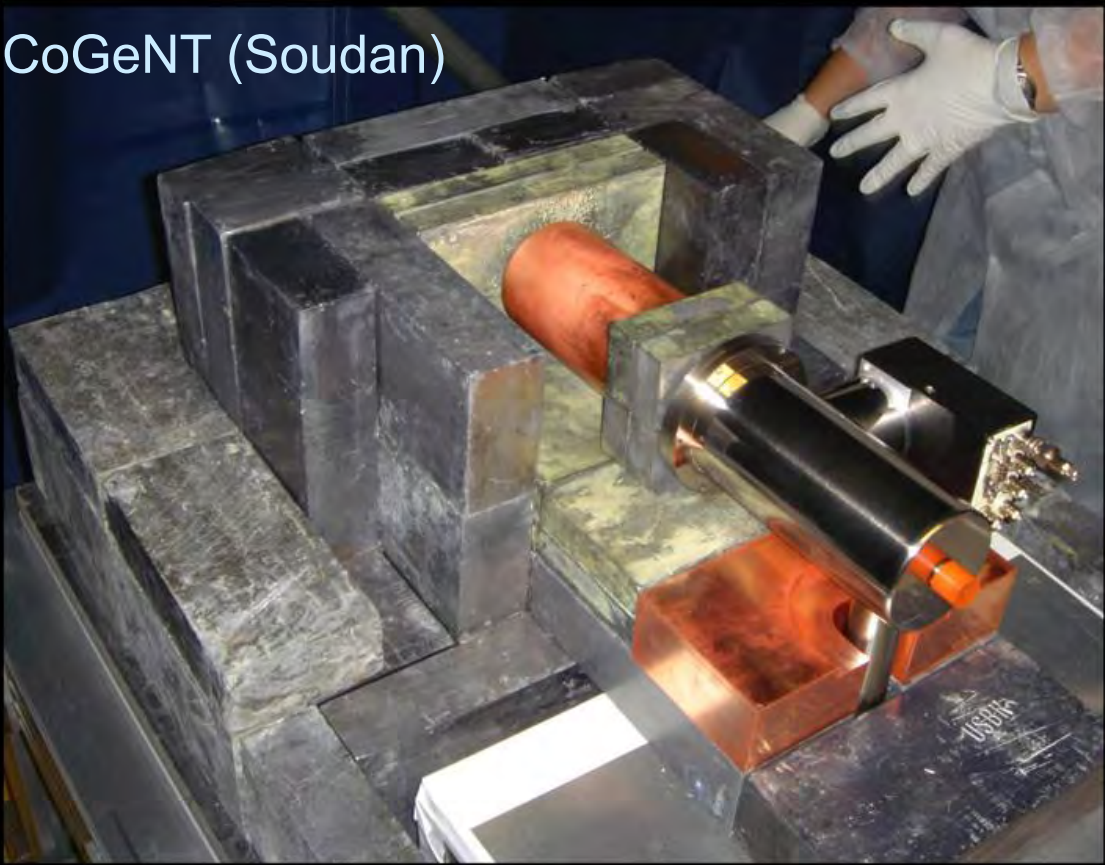
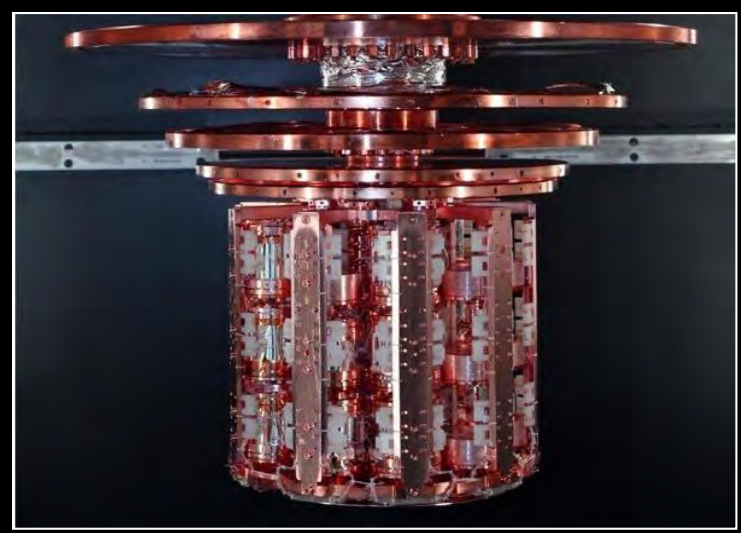




Fermi

CRESST
(CaWO_4)

$E_{\text{WIMP}} < 10 \text{ GeV}$



CoGeNT (Soudan)

