Rise of Cosmology

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The first ~ 50 yrs

Big Bang → Hot BB (40's) → CMB (60's)

Rise of Particle Cosmology

- **neutrinos** mass (abundance: Lee & Weinberg 1977)

  # of neutrinos (nucleosynthesis, Chicago)

  [supersymmetric theories → DM relic densities]

- **GUT** inflation (1980) → CMB perturbations (1982)

  [phase transitions in the early Universe]

@Home: Matts Roos

neutrinos & prehistory

KE, K. Kainulainen, J. Maalampi: Refraction and Oscillations of Neutrinos in the Early Universe 1991

to do w. nucleosynthesis

KE, K. Kainulainen, M.J. Thomson: Stringent cosmological bounds on inert neutrino mixing 1992

to do w. nucleosynthesis

⇨ recognizion

EW phase transition Kajantie et al, 90's

Cosmology comes to an age: COBE DMR 1991

Temperature perturbations on the microwave sky

”The age crisis”

November 1997: Planck

Jussi Tuovinen, VTT Millilab: LFI

Local background: **zero**

Elina Keihänen
Hannu Kurki-Suonio

HIP project from 2008

The Theory Also Rises ...

HIP Theory Programme 1998: Particle Cosmology Project

KE, Kurki-Suonio, Neuhaus, Keihänen (grad.stud)

HIP Theory Programme 1999: Particle Theory & Cosmology

Huitu + 9

HIP Theory Programme 2010: Cosmophysics Kainulainen + 12

Laws of Nature ... Tuominen + 24

Money from Academy & elsewhere

Examples:

KE, J. McDonald: Q balls and baryogenesis in the MSSM 1997

balls of scalar fields carrying B-L that form after inflation

KE, M. Sloth: Adiabatic CMB perturbations in pre - big bang string cosmology 2001

"curvaton": generates perturbations by decaying after inflation

Subsequent diversity

Dark Matter, WIMPs, FIMPs, Higgs portal, beyond SM, BHs
Dark Energy, extended gravity, Palatini, backreaction
Baryo(lepto)genesis, phase transitions, cosmic strings
Gravitational waves in the early universe
Structure formation

astrophysics

Euclid – A space mission to map dark universe