

Accelerated expansion by dark energy in the present Universe (A03)

Members

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Kiyotomo Ichiki, Shin'ichi Nojiri (Report)**

Summary of activity in 2016

Shinji Tsujikawa (TUS)

● Dark energy in massive vector (generalized Proca) theories

1. Cosmology in generalized Proca theories,
A. De Felice, L. Heisenberg, R. Kase, S. Mukohyama, S.T., Y. Zhang,
JCAP, 1606, 048 (2016)
2. Effective gravitational couplings for cosmological perturbations in generalized Proca theories,
Phys. Rev. D 94, 044024 (2016) [same authors as above]

On the construction of viable dark energy models in the framework of massive vector theories and their observational signatures

● Construction of health theories beyond generalized Proca theories

3. Beyond generalized Proca theories,
L. Heisenberg, R. Kase, S. Tsujikawa, Phys. Lett. B 760, 617 (2016)
4. Anisotropic cosmological solutions in massive vector theories,
L. Heisenberg, R. Kase, S. Tsujikawa, JCAP, 1611, 008 (2016)

Healthy extension of second-order generalized Proca theories keeping the same propagating degrees of freedom

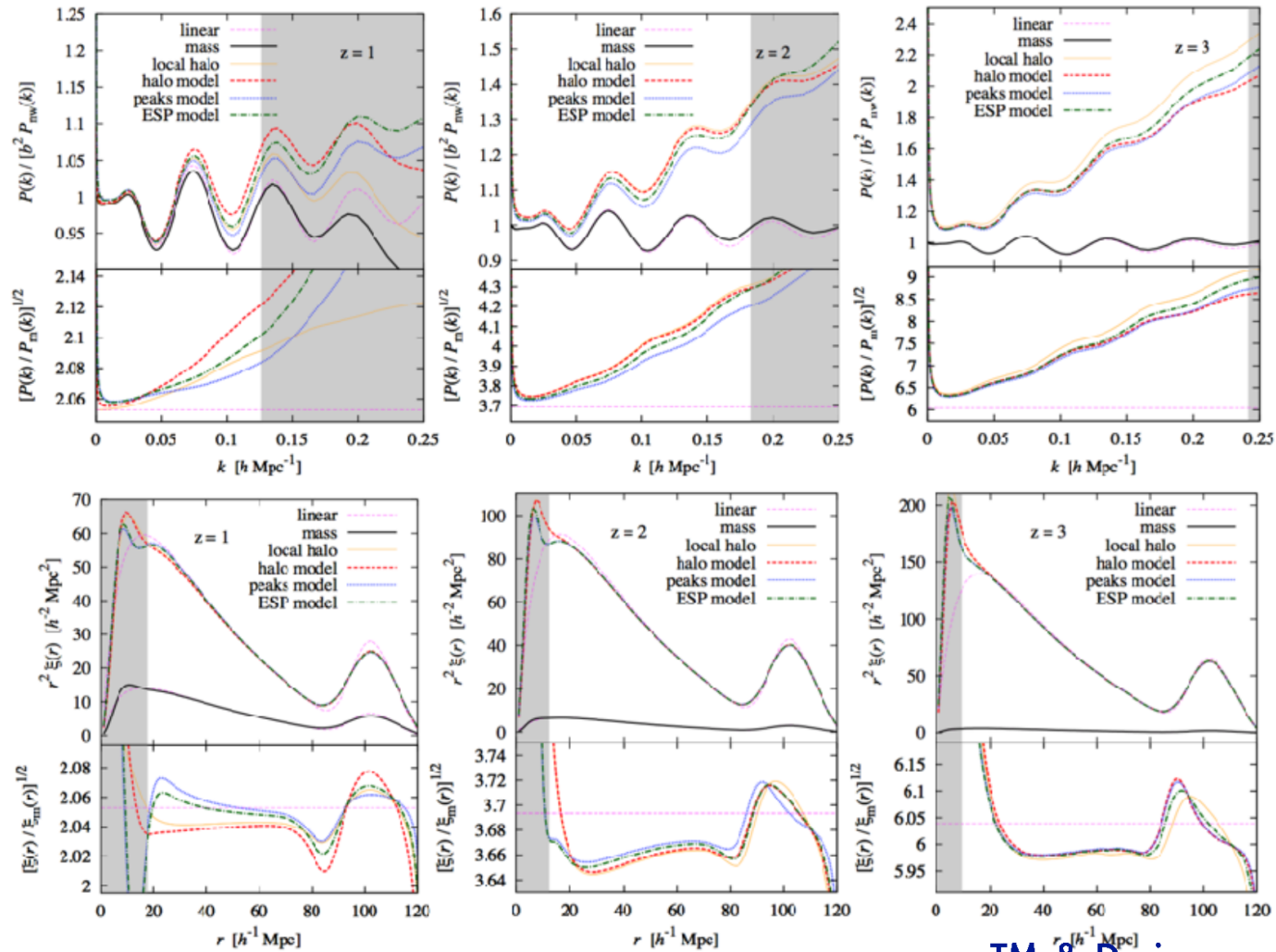
● Screening mechanism of massive vector fields in the solar system

5. Screening fifth forces in generalized Proca theories,
A. De Felice, L. Heisenberg, R. Kase, S. Mukohyama, S.T., Y. Zhang, G. Zhao,
Phys. Rev. D 93, 104016 (2016)

Developments of integrated Perturbation Theory (iPT): T. Matsubara

- iPT: nonlinear perturbation theory for observable quantities (redshift-space distortions, biasing)
- Model independent
- Next slide: examples of power spectra/ correlation functions with various biasing models

Power spectra & correlation functions



TM & Desjacques (2016)

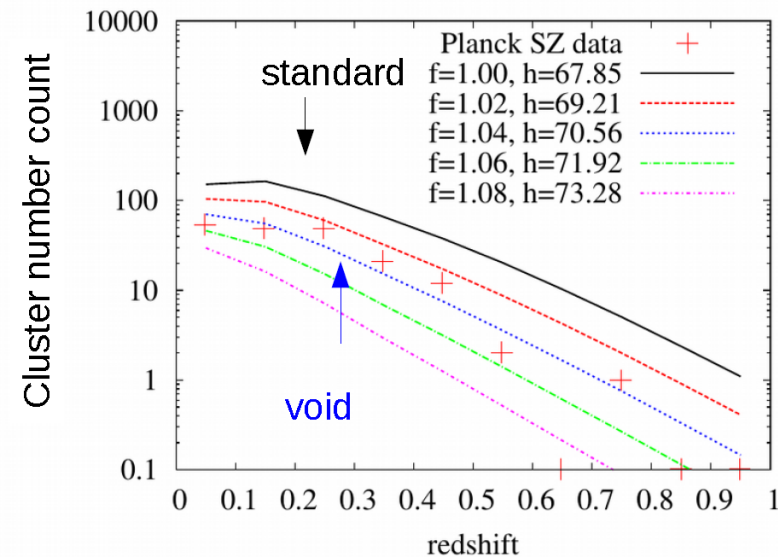
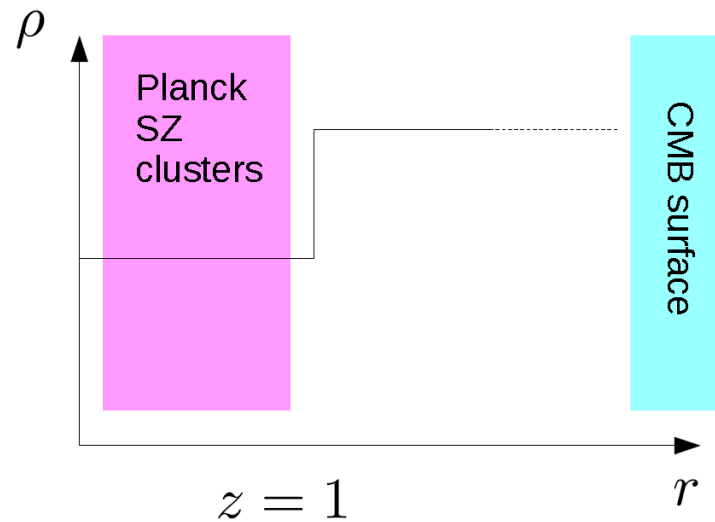
Hubble – σ_8 relation in a simple void model

Ichiki

K. Ichiki, C-M. Yoo and M. Oguri, PRD93, 2016

Two discrepancies in Planck cosmology: large H_0 and small σ_8 today

→ Local void may resolve them simultaneously



Assumption: We live in a large local void,
and the distance to the CMB is same as
the standard cosmology

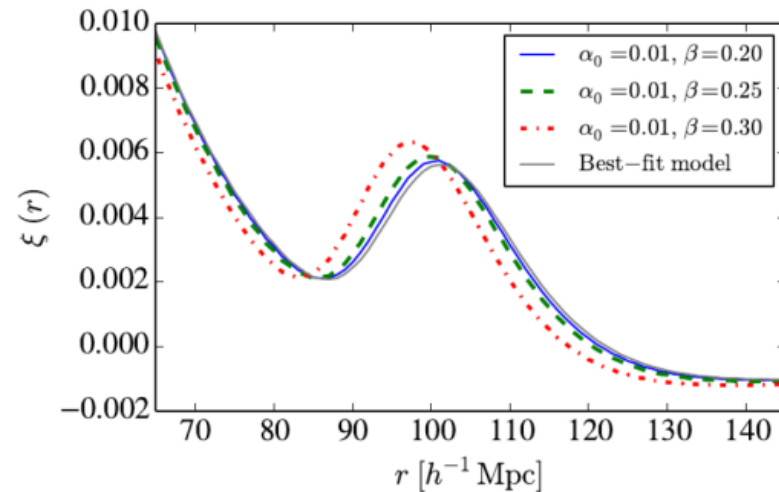
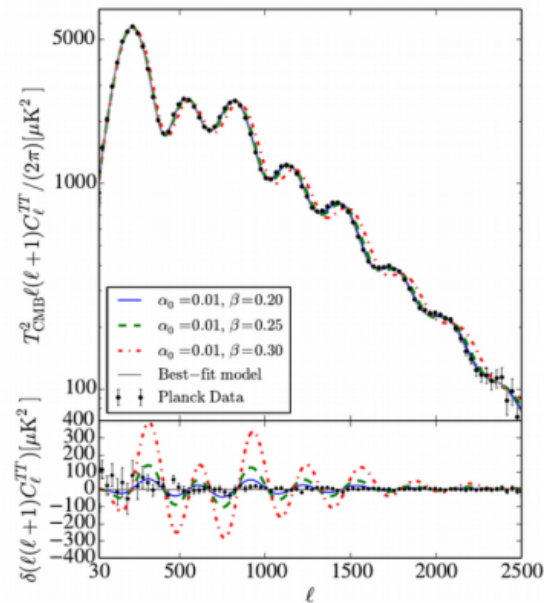
See Yoo-san's talk

Constraints on varying G

Observational constraints on scalar-tensor cosmology

J. Ooba, K. Ichiki, T. Chiba and N. Sugiyama, PRD93, 2016; 1702.00742

$$S = \int d^4x \sqrt{-g} \frac{1}{16\pi G} \left(\phi R - \frac{\omega(\phi)}{\phi} (\nabla\phi)^2 \right) + S_m(g_{\mu\nu}, \psi) \quad \rightarrow \quad G_{\text{eff}} = \frac{2\omega + 4}{2\omega + 3} \frac{1}{\phi}$$



→ Newton's gravitation constant can not vary very much between CMB and present epochs

$$\Delta G / G_0 \lesssim 1.9 \times 10^{-3}$$

Cosmological Constant Problem (Vacuum Energy) → Talk

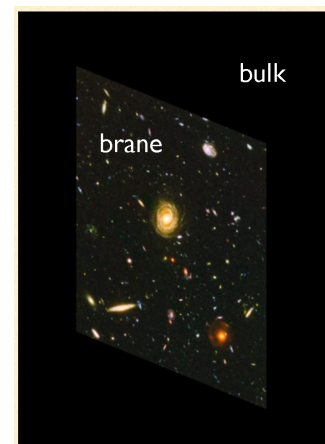
1. S. Nojiri, ``Some solutions for one of the cosmological constant problems,'
Mod. Phys. Lett. A31 (2016) no.37, 1650213
2. T. Mori, D. Nitta and S. Nojiri,
``BRS structure of Simple Model of Cosmological Constant and Cosmology,"
arXiv:1702.07063 [hep-th].

Gravitational Wave in Modified Gravity $\delta G_{\mu\nu} = \kappa^2 \delta T_{\mu\nu} \Leftarrow$ (depend on the modified gravity)

3. S. Capozziello, M. De Laurentis, S. Nojiri and S. D. Odintsov,
``The evolution of gravitons in accelerating cosmologies: the case of extended gravity,"
arXiv:1702.05517 [gr-qc].

Domain Wall FRW Universe (localization of vector field)

4. M. Higuchi and S. Nojiri, ``Localization of Vector Field on Dynamical Domain Wall,"
Phys. Lett. B766 (2017) 196



Mimetic Gravity, Unimodular Gravity

5. S. Nojiri, S. D. Odintsov and V. K. Oikonomou,
``Viable Mimetic Completion of Unified Inflation-Dark Energy Evolution in Modified Gravity,"
Phys. Rev. D94 (2016) no.10, 104050

6. S. Nojiri, S. D. Odintsov and V. K. Oikonomou,
``Newton law in covariant unimodular F(R) gravity," Mimetic gravity
Mod. Phys. Lett. A31 (2016) no.30, 1650172

$$g_{\mu\nu} = -\hat{g}^{\rho\sigma} \partial_\rho \phi \partial_\sigma \phi \hat{g}_{\mu\nu}$$

7. S. Nojiri, S. D. Odintsov and V. K. Oikonomou,
``Unimodular-Mimetic Cosmology," Unimodular constraint
Class. Quant. Grav. 33 (2016) no.12, 125017

$$\sqrt{-g} = 1$$

8. S. Nojiri, S. D. Odintsov and V. K. Oikonomou,
``Bounce universe history from unimodular F(R) gravity,"
Phys. Rev. D93 (2016) no.8, 084050

Meeting on January 12th

Sugiyama, Tsujikawa, Matsubara, Ichiki, A.J. Nishizawa, Urakawa, Nitta, Nojiri, ...

Talks by Tsujikawa and Nojiri

Tsujikawa, “Classifications of modified gravity models”
Scalar, Massive Vector, Massive Gravity, ...

Nojiri $\Rightarrow$ Talk
Started a collaboration with Nitta.