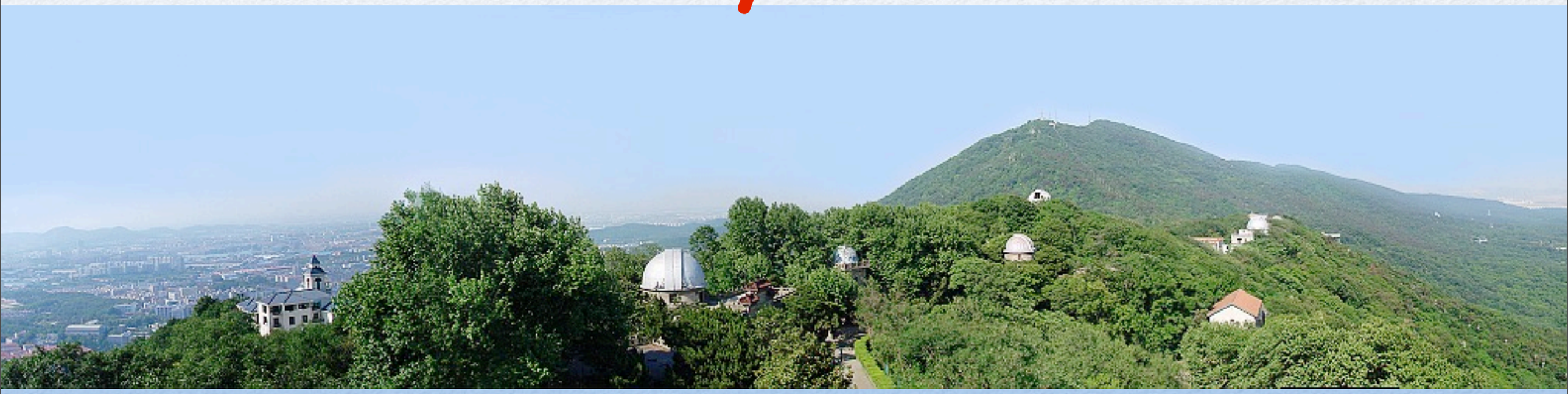
UV Emission Mapping for IGM & Nearby Galaxies



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Key Laboratory of Dark Matter and Space Astronomy
Chinese Academy of Sciences

2014.2.26 CAS-ESA Joint Science Space Mission 1st Workshop

Team in China

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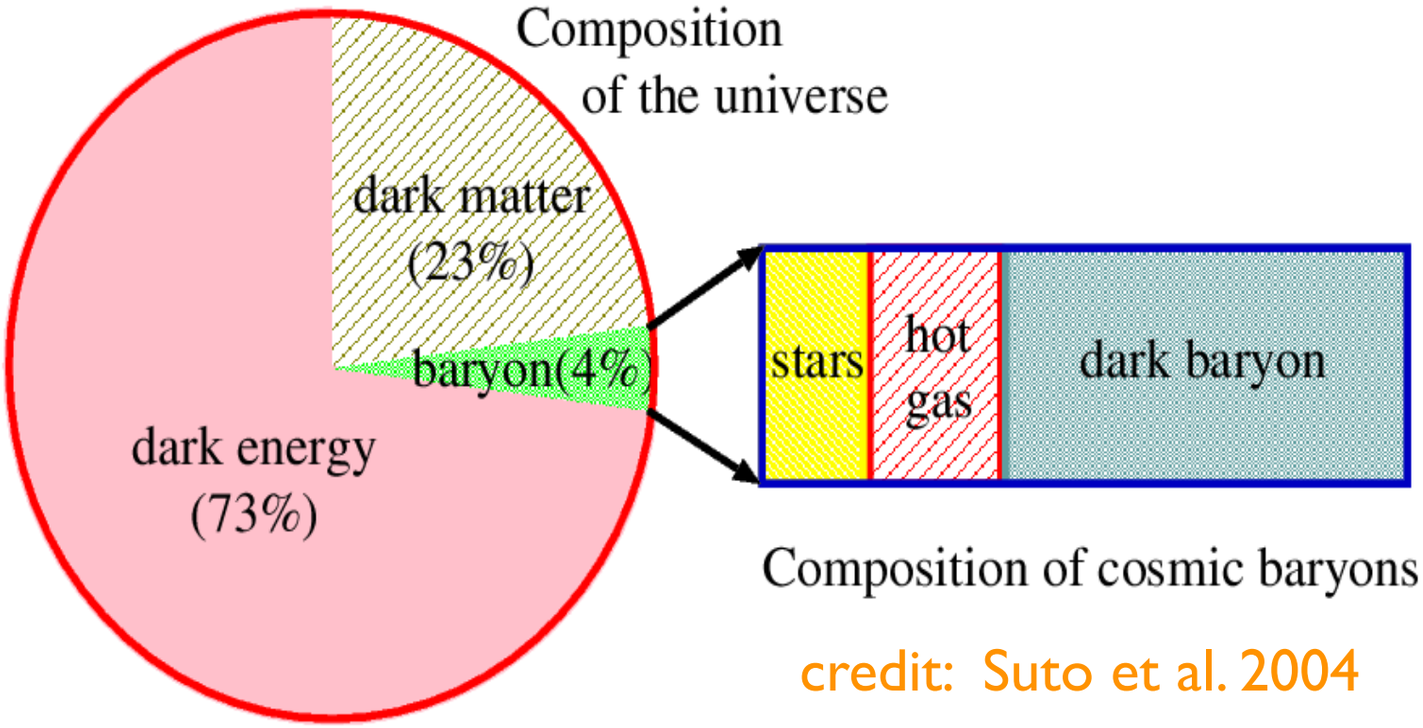
Cosmic Web



credit: Suto et al. 2004

- the threads connecting galaxies & the large-scale structures of the Cosmic Web

- Warm-hot Intergalactic Medium (WHIM)

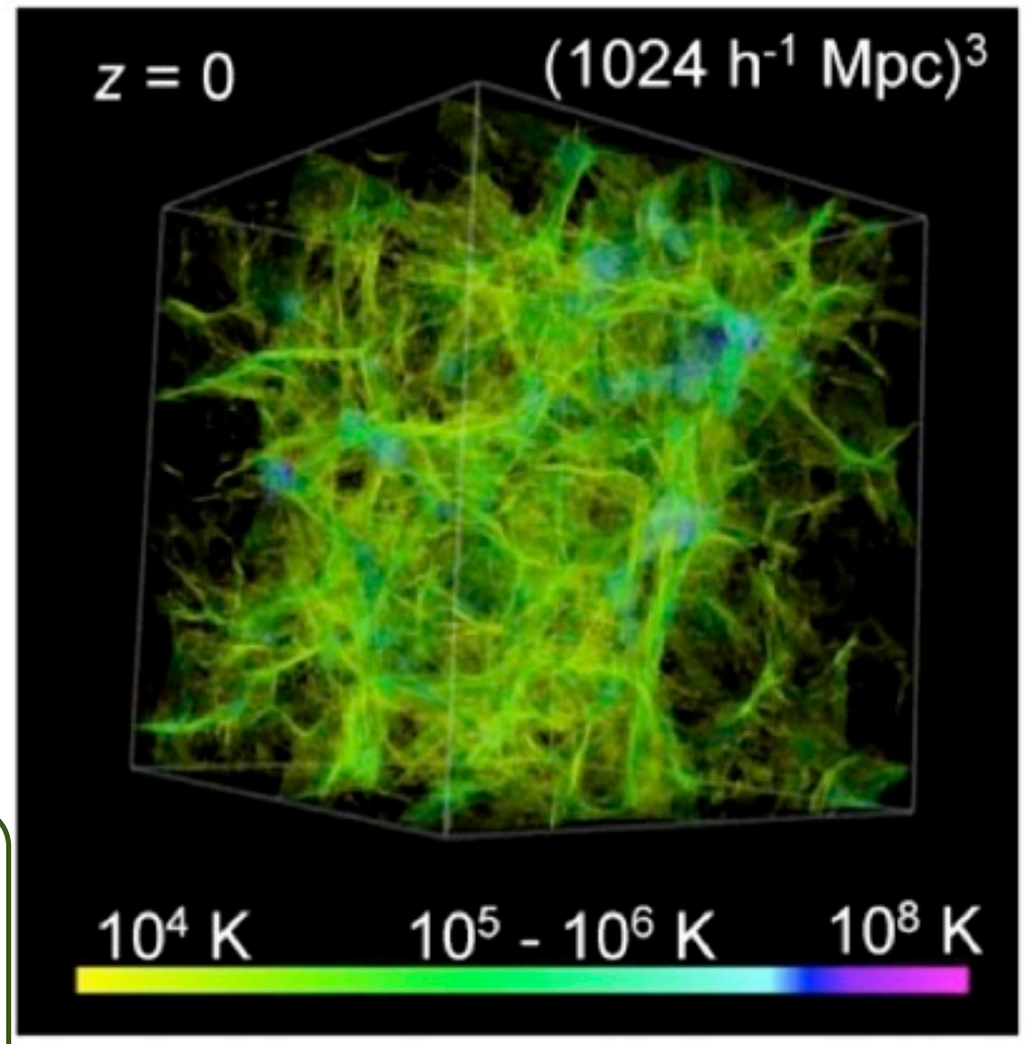


Figure 3: The cosmic web at zero redshift (Kang et al. 2005).

Baryon density in the Universe

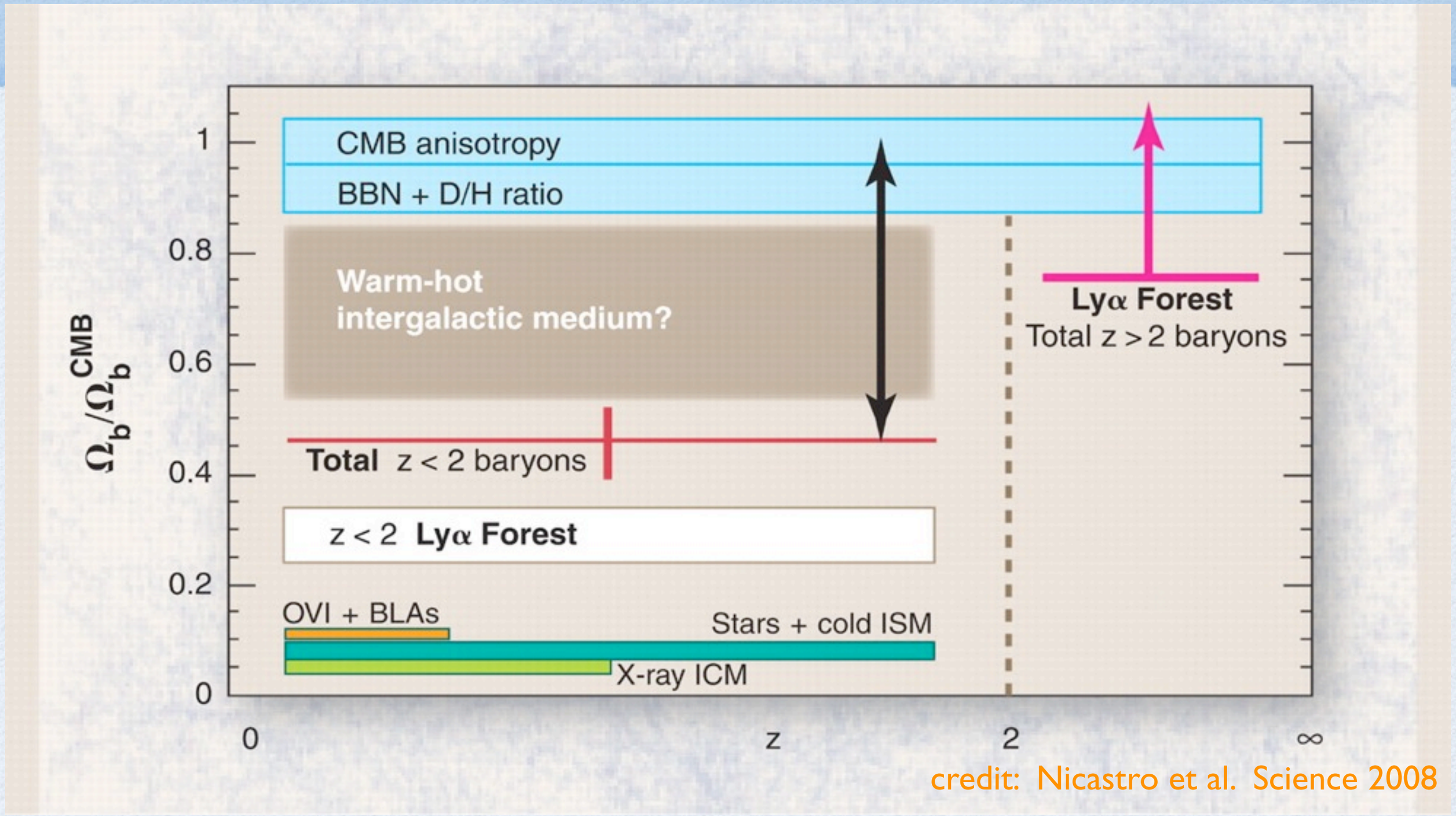
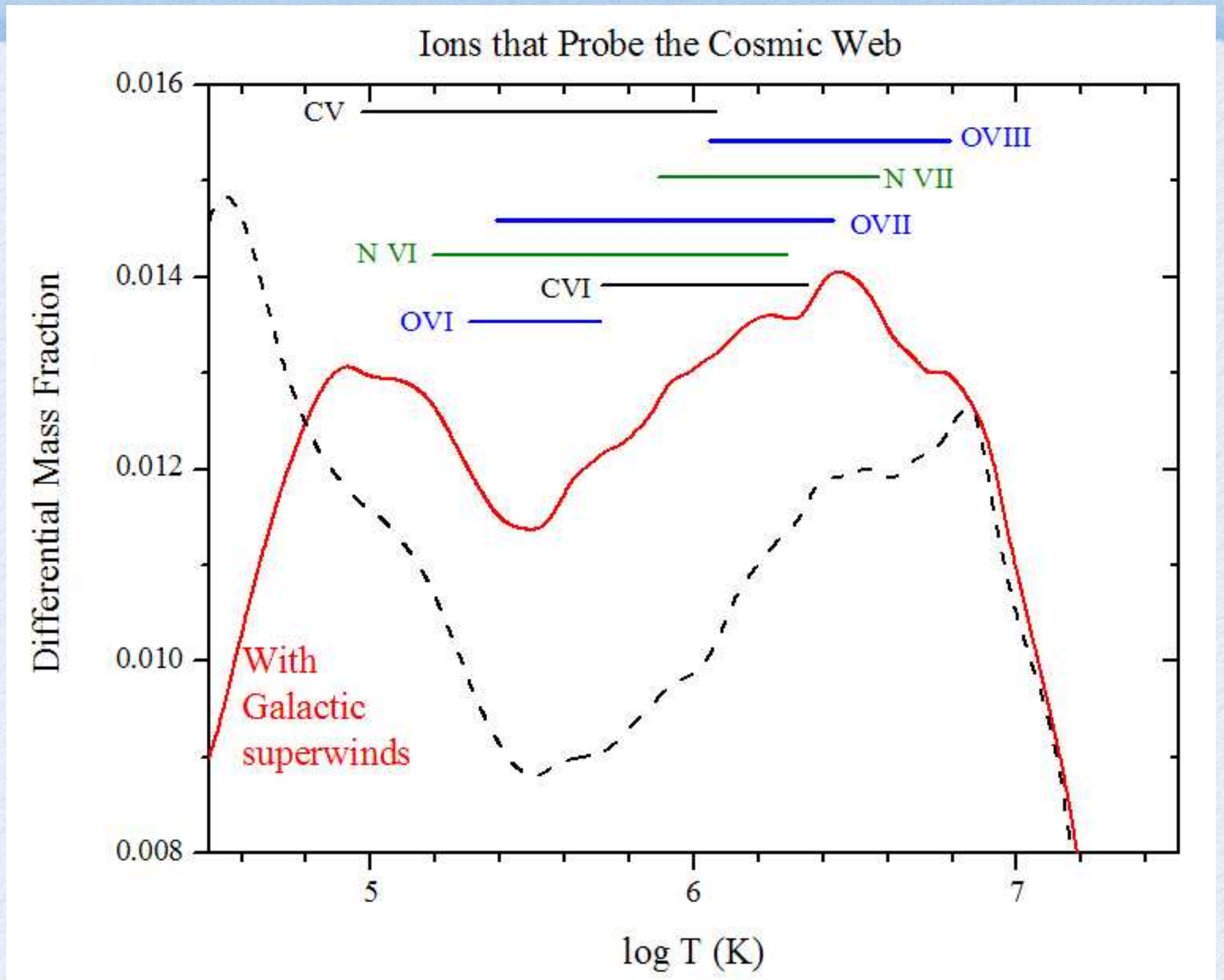


Fig. 1. Baryon density in the universe, at all redshifts, normalized to the cosmological mass density of baryons derived from cosmic microwave background (CMB) anisotropy measurements.

Measuring "Cosmic Web"



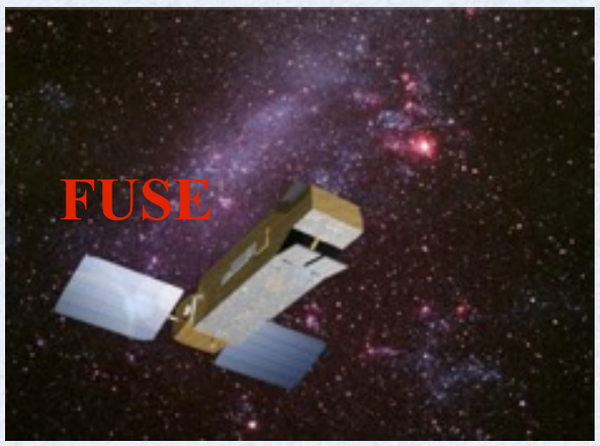
credit: Cen & Ostriker (2006)

Existing Detections

credit: Sembach et al. 2010

Table 1: Components of the IGM

		T (K)	Primary Metal-Line Tracers	Waveband
Cool Photoionized Lyα forest		$< 3x10^4$	C II, C III, Si II, Si III	UV
Warm Photoionized Lyα forest		$3x10^4$ - 10^5	C III, CIV, O III, O IV, O VI	UV
Warm-Hot IGM (WHIM)	Warm	10^5 - 10^6	O VI, O VII, Ne VIII	UV, X-ray
	Hot	10^6 – 10^7	O VII, O VIII	X-ray



930-1180 Å

1140-1800 Å

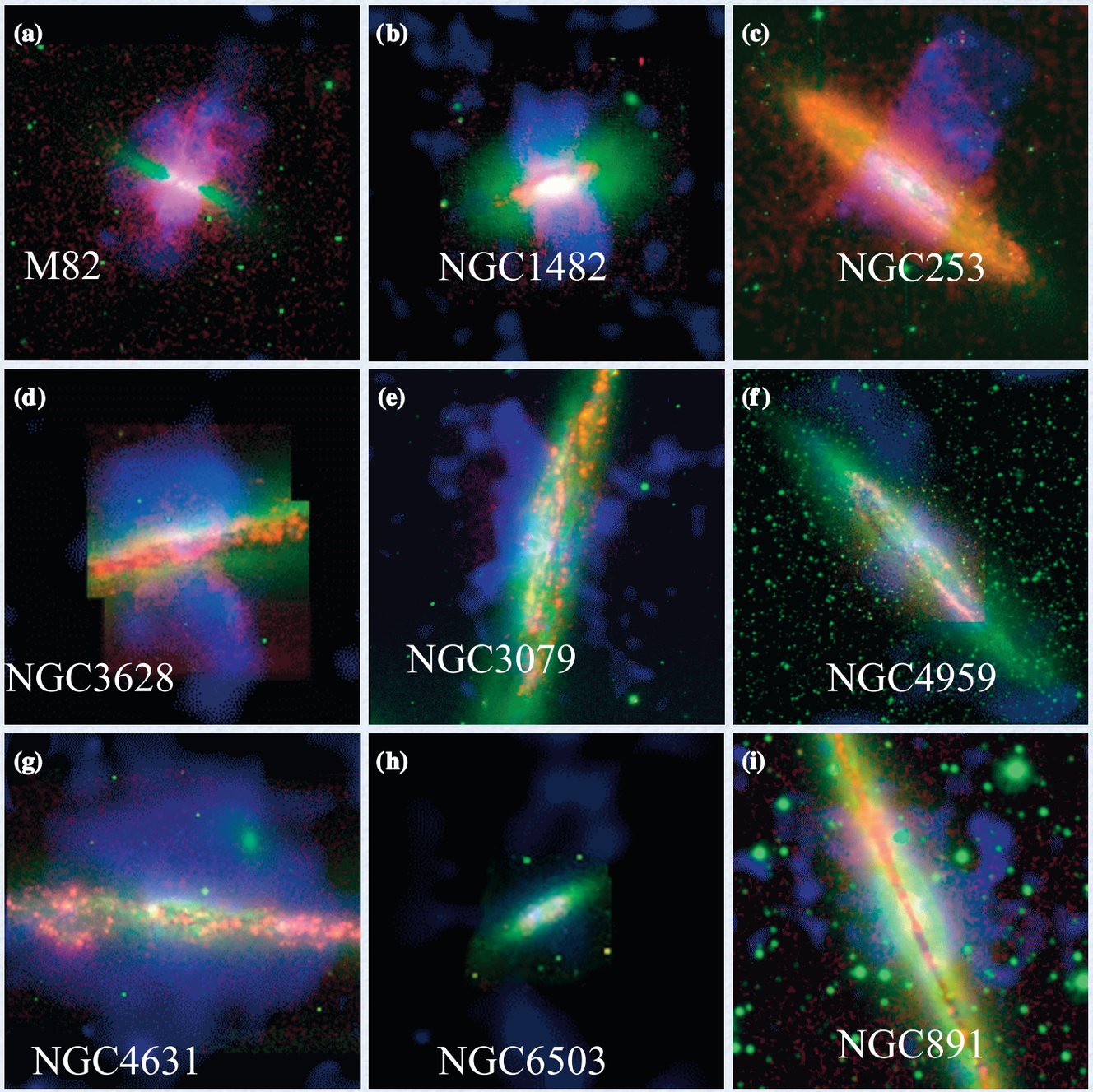
1.5-170 Å

7-35 Å

WHIM has to be detected in UV

- Only absorption detections (FUSE, HST/COS)
- Emission: Directly 3D (x,y,v) mapping

Nearby Galaxies



edge-on galaxies with a range of star-formation rates: (Strickland et al. 2004)

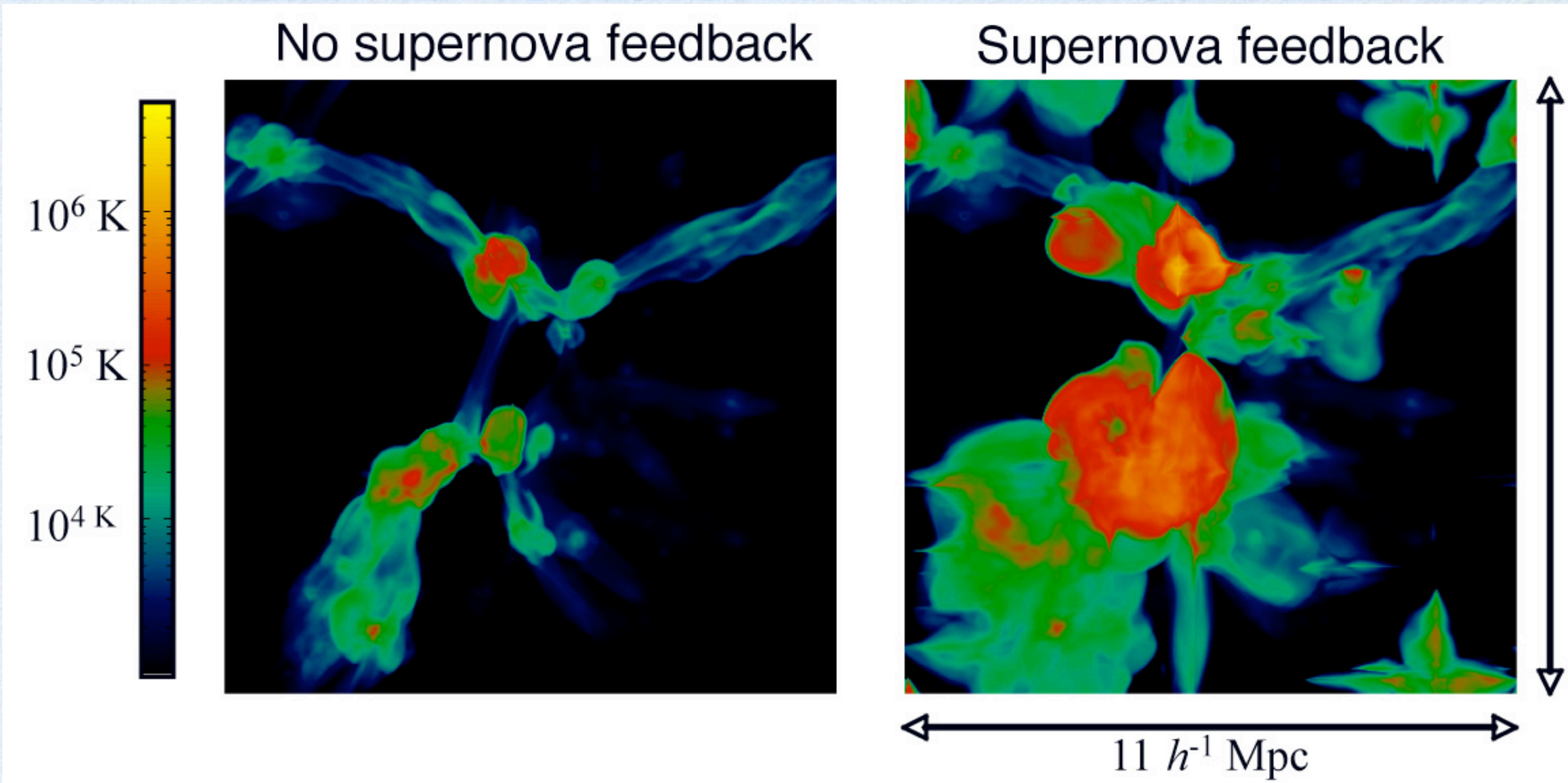
- red: Hα
- green: optical R band
- blue: 0.3-2keV (soft X-ray)

- Hot gas extending perpendicular to the major axes of the galaxies

- No emission data for 1e5 K gas !

credit: Strickland et al. 2004

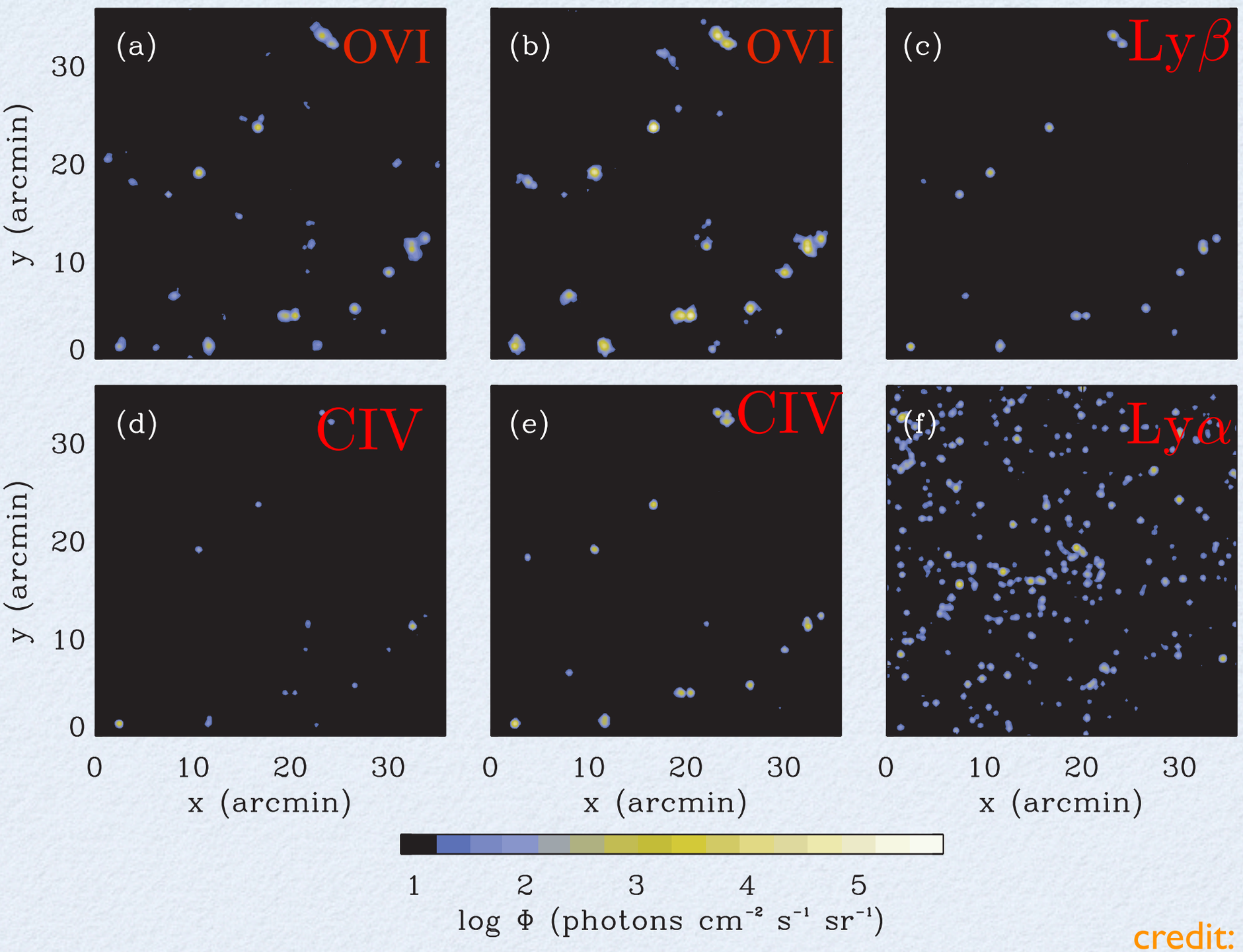
Scientific Examples



credit: Cen & Ostriker 2006

Understand the galactic feedback is essential to the study of the galaxy formation & evolution

Simulations Predicts



$$z = 0.15$$
$$\Delta z = 0.01$$

a physical size $\approx 25\ h^{-1}$ kpc

credit: Furlanetto et al. 2004

Scientific Objectives

Goal:

first time 3D(x,y, v)-Mapping the vicinities of nearby galaxies in 1e5 K

- connections with cosmic web
- feedback and accretions between galaxies & IGM

- How WIHM distributed in Cosmic Web? filament? halo?
- How does the outflow/inflow of hot gas affect the evolution of galaxies?
- How does gas cool?

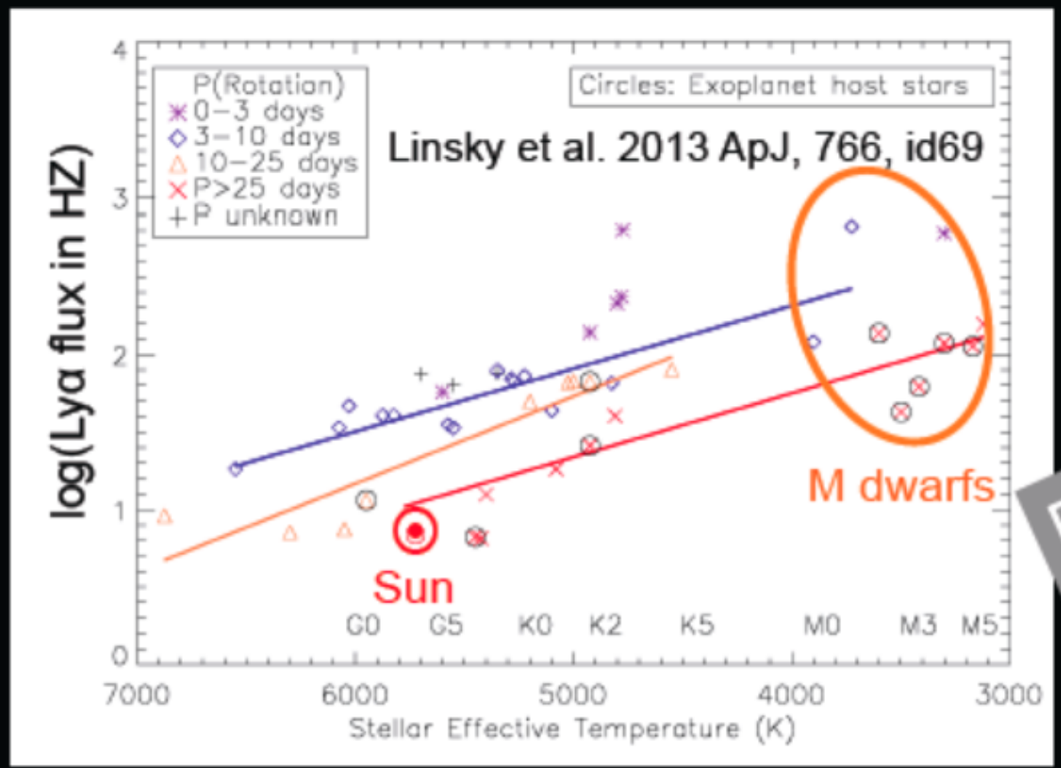
Other Possible Science Objectives

- Atmospheres of (exo)planets e.g. Habitable exo-planets (Tian et al. 2013)

Ultraviolet Matters: M Dwarfs

M dwarfs photospherically NUV faint, but magneticlly FUV strong:

large f(FUV)/f(NUV) ratio (France+ 2013), **strong Lyα** (Linsky+ 2013)



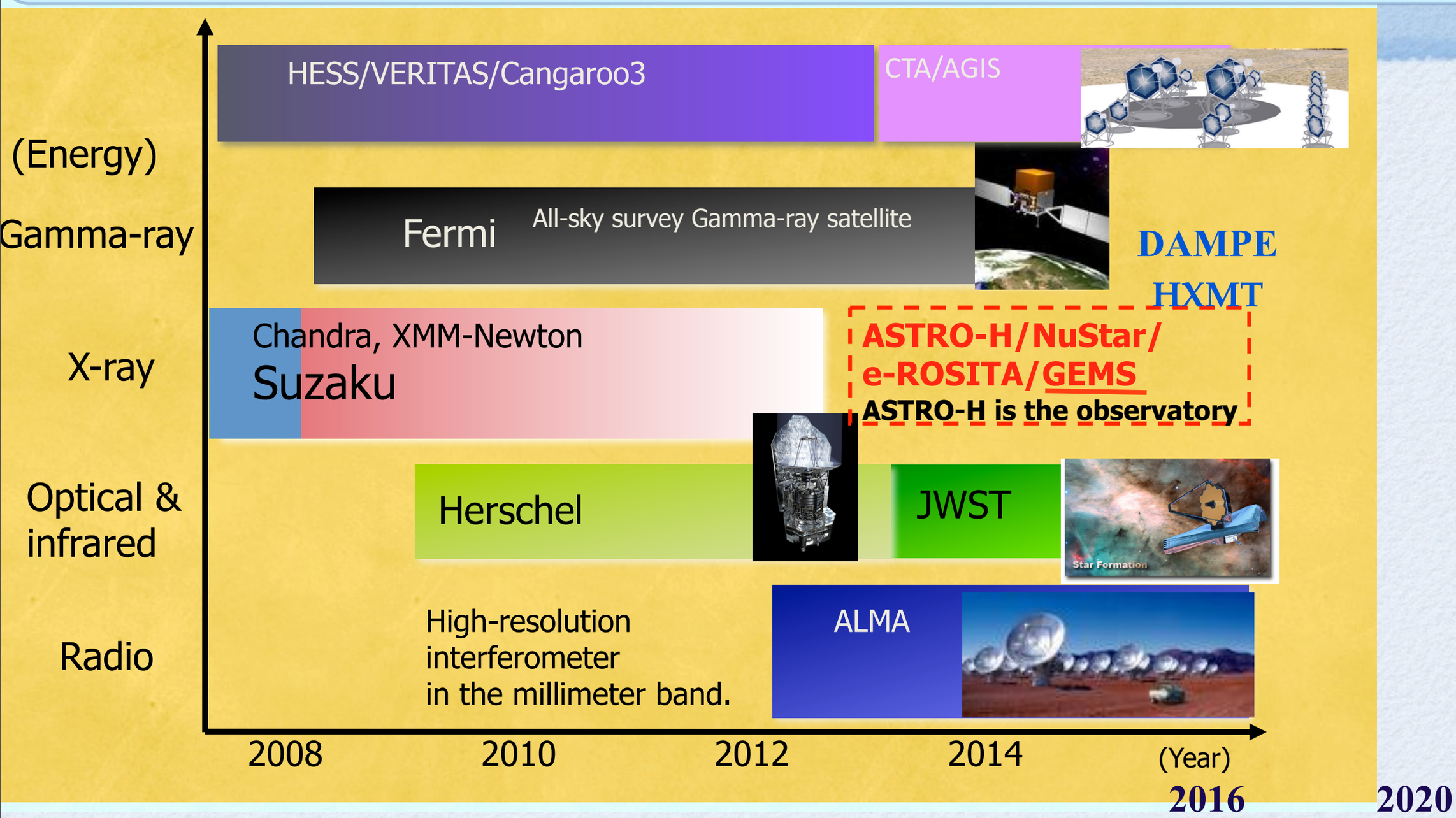
Poster 2G017
Feng Tian

CO_2 photodissociation → abiotic O_2 (+O_3) atmospheres in HZ (Tian+ 2012)

→ *O_2, O_3 dubious biomarkers for HZ planets!* (France+ 2013)

Credit: Gudel, M.

UV in multi wavelength programs



Credit: Ohashi, T 2010, in Netherlands

What do we have in China

- **PMO**: Key Laboratory of Dark Matter & Space Astronomy
  DAMPE (Launch in 2015)

- **NAO**: Long Slit Spectrograph (prototype, 3M USD, PI Sen Wang)

- **Team**:
  - **CAS:** PMO，NAO，Xi'an Institute of Optics & Precision Mechanics
  - **Universities:** USTC、NJU、XMU、Tsinghua Univ. ...

- **International Collaborations**

  we anticipate collaborations from (e.g. University of Leicester, UK ; De Paris Observatory, France etc.)

Team Members in China

	姓　名	年龄	专业技术职务	学历	投入人年	课题中的分工	工作单位
课题主要参加人员	高煜	50	研究员	博士	0.1	科学目标	紫金山天文台
	冯珑珑	50	研究员	博士	0.1	科学目标 数值模拟	紫金山天文台
	蔡明生	47	研究员	博士	0.2	探测器	紫金山天文台
	单文磊	41	研究员	博士	0.2	探测器	紫金山天文台
	程景全	66	研究员	博士	0.2	望远镜设计	紫金山天文台
	郭建华	33	副研究员	博士	0.2	控制系统	紫金山天文台
	雷仕俊	38	助理研究员	博士	0.3	科学目标 模拟	紫金山天文台
	张水乃	30	助理研究员	博士	0.3	科学目标 模拟	紫金山天文台
	周鑫	31	助理研究员	博士	0.3	科学目标 模拟	紫金山天文台
	王森	59	研究员	博士	0.2	光学工程	国家天文台
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	程福臻	71	教授	博士	0.1	科学目标	中国科技大学
	王挺贵	48	教授	博士	0.2	科学目标	中国科技大学
	顾秋生	45	教授	博士	0.2	科学目标	南京大学
	李志远	36	教授	博士	0.2	科学目标	南京大学
	姜冰	33	讲师	博士	0.3	科学目标	南京大学
	方陶陶	43	教授	博士	0.2	科学目标 数值模拟	厦门大学

— Science

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Q. Wang, Q. Gu, Z. Li, B. Jiang (NJU)
T. Fang (XMU)
J. Liu (NAO), F. Tian (Tsinghua Univ.)
de Grijs, R. (KIAA-PKU)

— Simulations

L. Feng, S. Lei, X., Zhou (PMO)

— Optics design

S. Wang (NAO), J. Cheng (PMO), P. Ruan (XIOPM)

— Detector design

W. Shan (PMO), Z. Wu (NUST), Q. Song (NAO)

— Electronic System

M. Cai, J. Guo, J. Chang (PMO)

UV Emission Mapping for IGM & Nearby Galaxies

First look at accretion, feedback & WHIM

Welcome you to join us !

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