Bilan Voyage 2050
&
Gauss.

Voyage 2050 :
AO ESA :

The science themes that should be covered during the Voyage 2050 planning cycle.

– Senior Committee
–Topical teams
–White papers (<~100)

https://www.cosmos.esa.int/web/voyage-2050/white-papers

Meeting ESA :
- >~ 30 présentations

https://www.cosmos.esa.int/web/voyage-2050/workshop-progran

Une remarque…

Très peu de white papers orientés cosmologie « fondamentale »

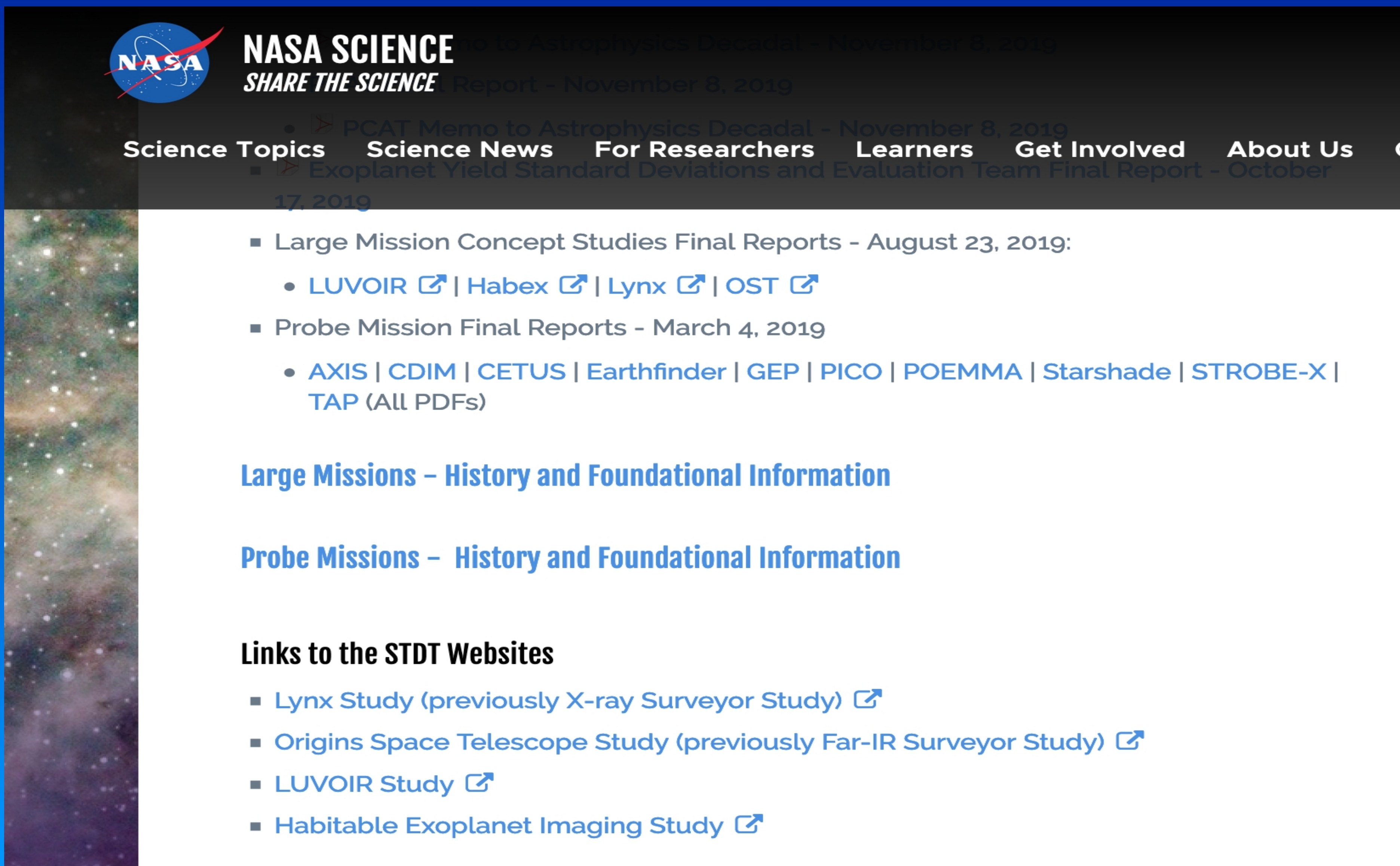
Même constat coté US

Mais un concept intéressant :

LUVOIR :
https://asd.gsfc.nasa.gov/luvoir/
https://www.youtube.com/watch?v=F7h7fe4XmcU

Decadal survey planning

https://science.nasa.gov/astrophysics/2020-decadal-survey-planning



Ce que GAUSS n'est pas...

Ce que GAUSS n'est pas...

GAUSS -- A Sample Return Mission to Ceres

Xian Shi, Julie Castillo-Rogez, Henry Hsieh, Hejiu Hui, Wing-Huen Ip, Hanlun Lei, Jian-Yang Li, Federico Tosi, Liyong Zhou, Jessica Agarwal, Antonella Barucci, Pierre Beck, Adriano Campo Bagatin, Fabrizio Capaccioni, Andrew Coates, Gabriele Cremonese, Rene Duffard, Ralf Jaumann, Geraint Jones, Manuel Grande, Esa Kallio, Yangting Lin, Olivier Mousis, Andreas Nathues, Jürgen Oberst, Adam Showman, Holger Sierks, Stephan Ulamec, Mingyuan Wang

(Submitted on 21 Aug 2019)

The goal of Project GAUSS is to return samples from the dwarf planet Ceres. Ceres is the most accessible ocean world candidate and the largest reservoir of water in the inner solar system. It shows active cryovolcanism and hydrothermal activities in recent history that resulted in minerals not found in any other planets to date except for Earth's upper crust. The possible occurrence of recent subsurface ocean on Ceres and the complex geochemistry suggest possible past habitability and even the potential for ongoing habitability. Aiming to answer a broad spectrum of questions about the origin and evolution of Ceres and its potential habitability, GAUSS will return samples from this possible ocean world for the first time. The project will address the following top-level scientific questions: 1) What is the origin of Ceres and the origin and transfer of water and other volatiles in the inner solar system? 2) What are the physical properties and internal structure of Ceres? What do they tell us about the evolutionary and aqueous alteration history of icy dwarf planets? 3) What are the astrobiological implications of Ceres? Was it habitable in the past and is it still today? 4) What are the mineralogical connections between Ceres and our current collections of primitive meteorites? GAUSS will first perform a high-resolution global remote sensing investigation, characterizing the geophysical and geochemical properties of Ceres. Candidate sampling sites will then be identified, and observation campaigns will be run for an in-depth assessment of the candidate sites. Once the sampling site is selected, a lander will be deployed on the surface to collect samples and return them to Earth in cryogenic conditions that preserves the volatile and organic composition as well as the original physical status as much as possible.

GAUSS

Cosmology and the Early Universe

Eiichiro Komatsu
(Max Planck Institute for Astrophysics)
Voyage 2050 Workshop, October 30, 2019

- **How did the Universe begin?**
    - What is physics of the early Universe? Has inflation happened?
- **What is the Universe made of?**
    - Is ΛCDM right? (What is going on with the “tensions”?)
    - What is nature of Dark Matter and Dark Energy?
    - What is the mass of neutrinos? Were there extra light particles?
- **How did the structure in the Universe form and evolve?**
    - When and how did the first stars form?
    - Where are baryons?

Gravitational Waves from the Early Universe

Dark Matter

Surveying the Universe

Cosmic Microwave Background

- K. Basu, A space mission to map the entire observable Universe using the CMB as a backlight
- J. Chluba, New horizons in cosmology with spectral distortions of the cosmic microwave background
- J. Delabrouille, Microwave spectro-polarimetry of matter and radiation across space and time

Surveying the Universe

- **A. Blanchard, Gravitation and the Universe from large-scale structures**
- L. Koopmans, Peering into the Dark (Ages) with low-frequency space interferometers
- M.B. Silva, Mapping large-scale-structure evolution over cosmic times

Gravitational Waves

- **C.P.L. Berry, The missing link in gravitational-wave astronomy: Discoveries waiting in the decihertz range**
- I. Dvorkin, High angular resolution gravitational wave astronomy
- A. Sesana, Unveiling the gravitational Universe at μ-Hz frequencies

Soft X-ray (Structure Formation)

- A. Simionescu, Voyage through the hidden physics of the cosmic web

Optical-Near IR Camera (H_0)

- K. Jahnke, The need for a multi-purpose, optical-NIR space facility after HST and JWST

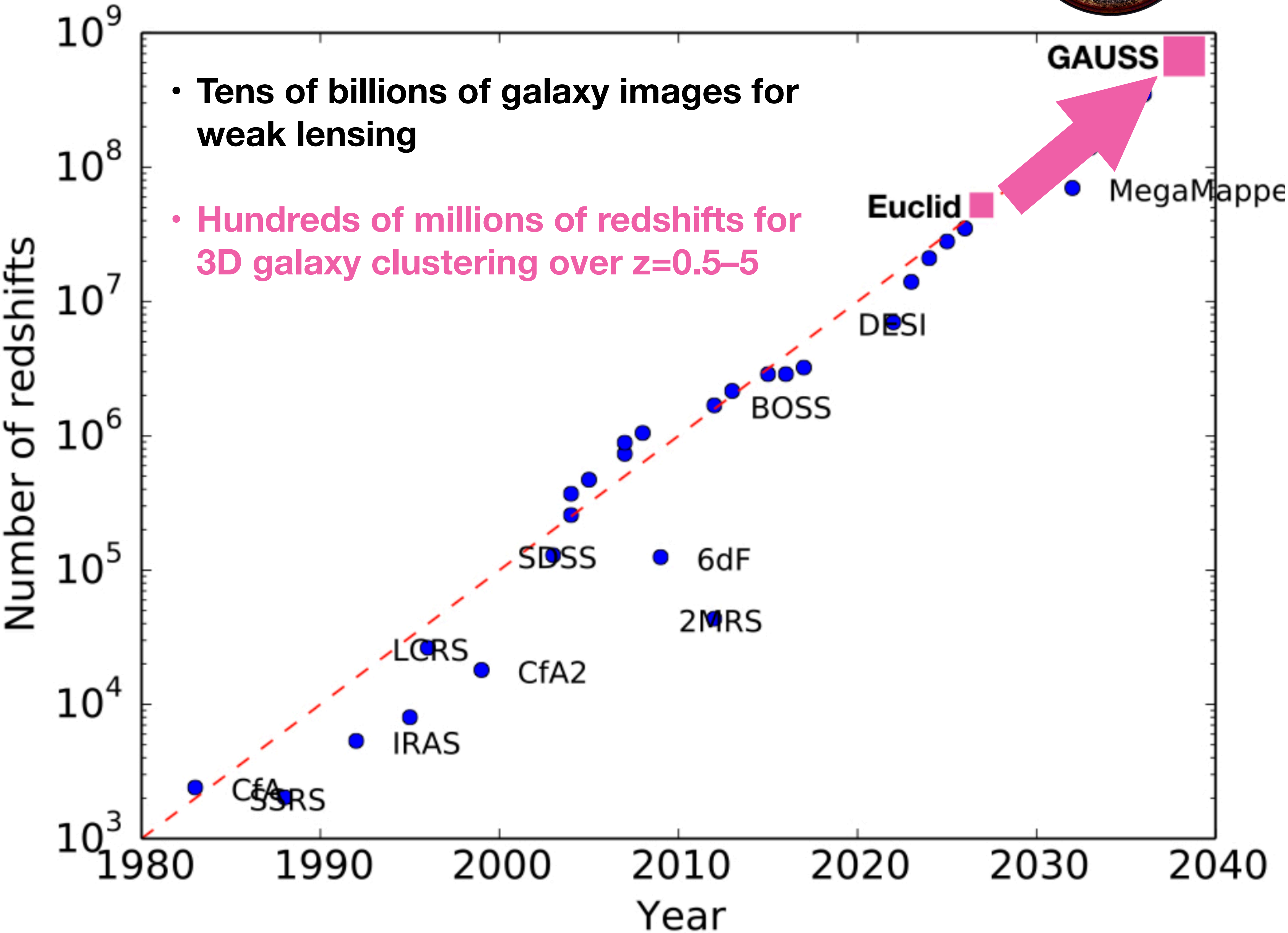
Dark Matter

- **A. De Angelis, Gamma-ray astrophysics in the MeV range: The ASTROGAM concept and beyond**

- **F. Malbet, Faint objects in motion: the new frontier of high precision astrometry**

- O. Buchmueller, AEDGE: Atomic experiment for dark matter and gravity exploration

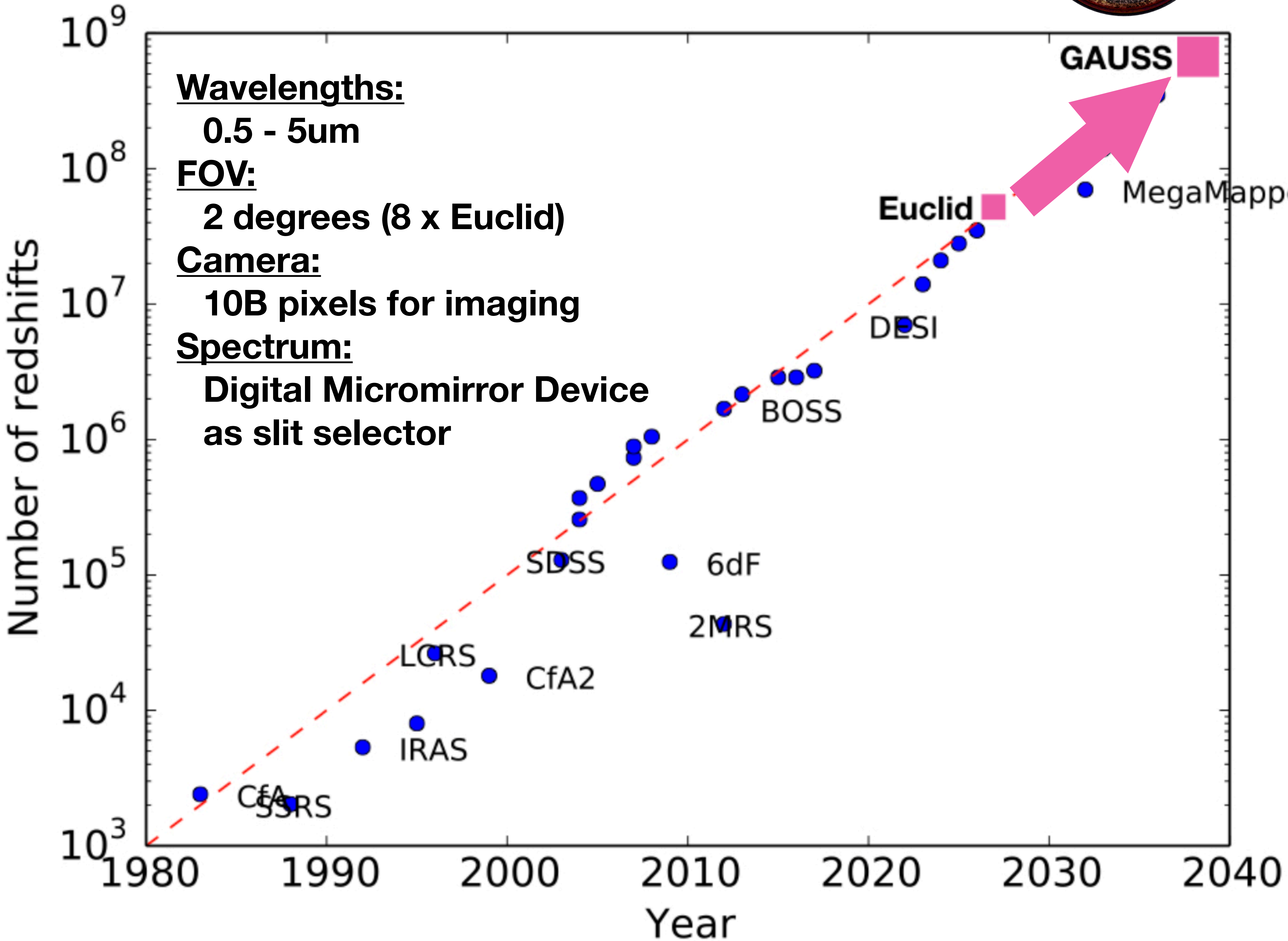
GAUSS



GAUSS
• Tens of billions of galaxy images for weak lensing
• Hundreds of millions of redshifts for 3D galaxy clustering over z=0.5–5
Euclid
MegaMappe
DESI
BOSS
SDSS
6dF
2MRS
LCRS
CfA2
IRAS
CfA
SSRS
Number of redshifts
Year
10^3
10^4
10^5
10^6
10^7
10^8
10^9
1980
1990
2000
2010
2020
2030
2040

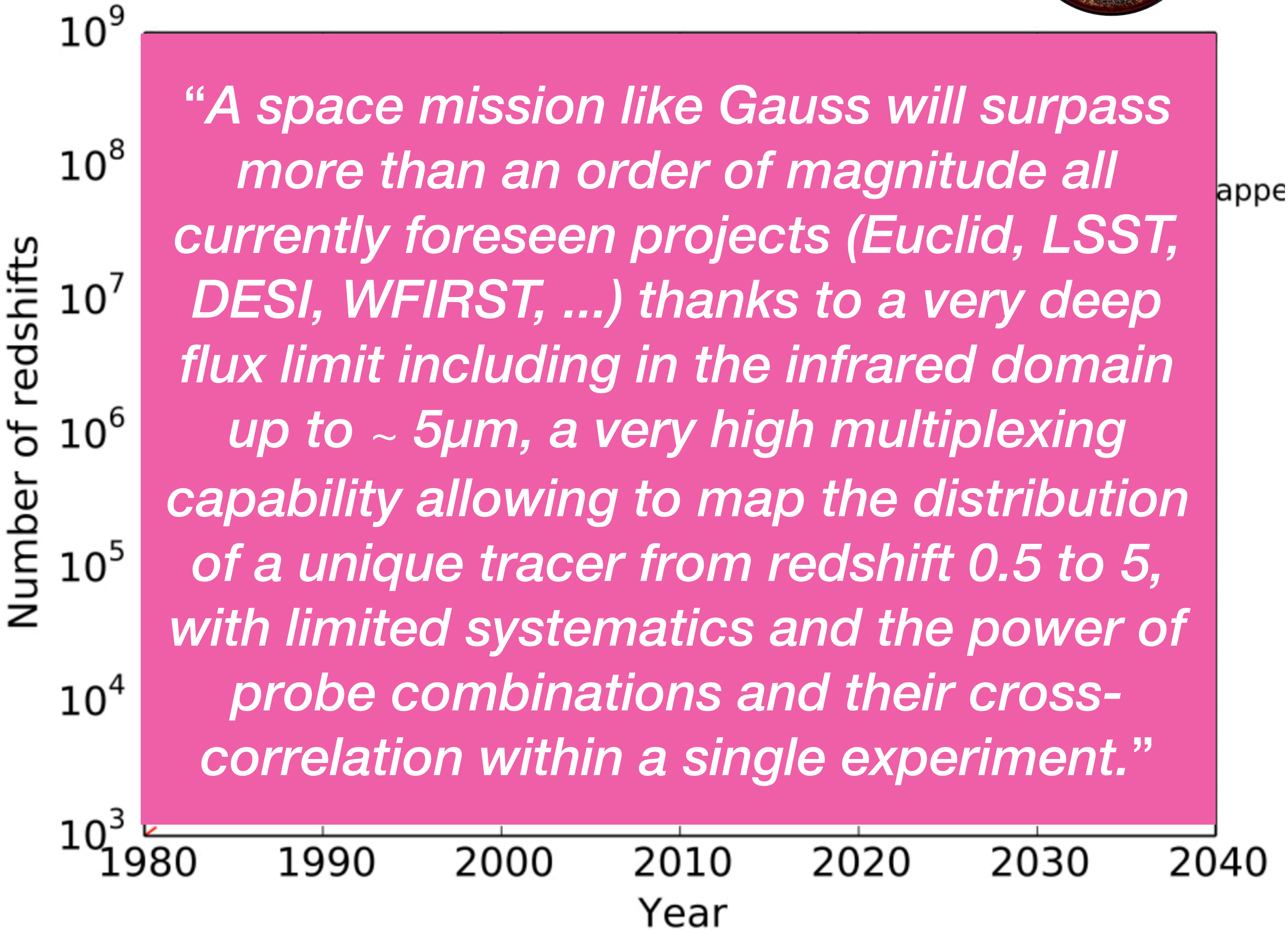
GAUSS

Wavelengths:
0.5 - 5um
FOV:
2 degrees (8 x Euclid)
Camera:
10B pixels for imaging
Spectrum:
Digital Micromirror Device as slit selector



GAUSS

"A space mission like Gauss will surpass more than an order of magnitude all currently foreseen projects (Euclid, LSST, DESI, WFIRST, ...) thanks to a very deep flux limit including in the infrared domain up to ~ 5μm, a very high multiplexing capability allowing to map the distribution of a unique tracer from redshift 0.5 to 5, with limited systematics and the power of probe combinations and their cross-correlation within a single experiment."



Améliorations de GAUSS

Prendre en compte le rôle de la lumière zodiacale

Voies d'amélioration

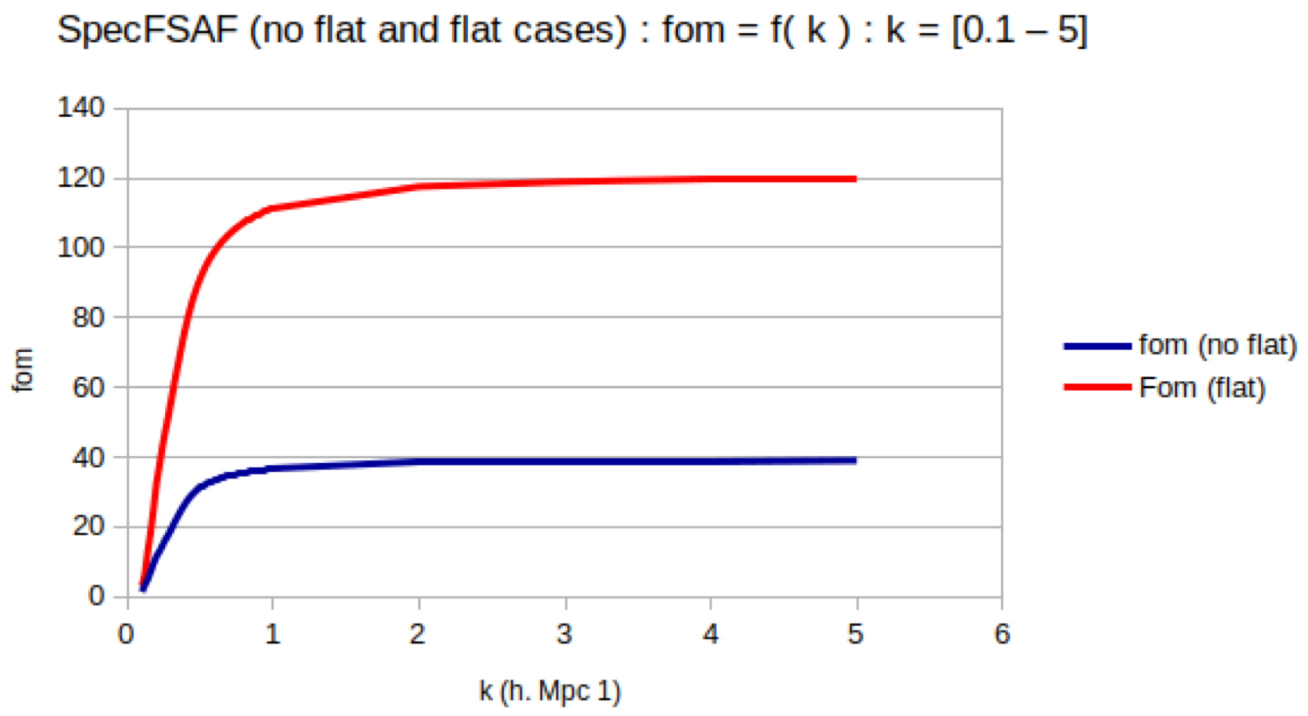
Table ronde Ecole d’été EUCLID 2019 - sujet 4 :

Conception des relevés de génération IV et forecasts W-FIRST

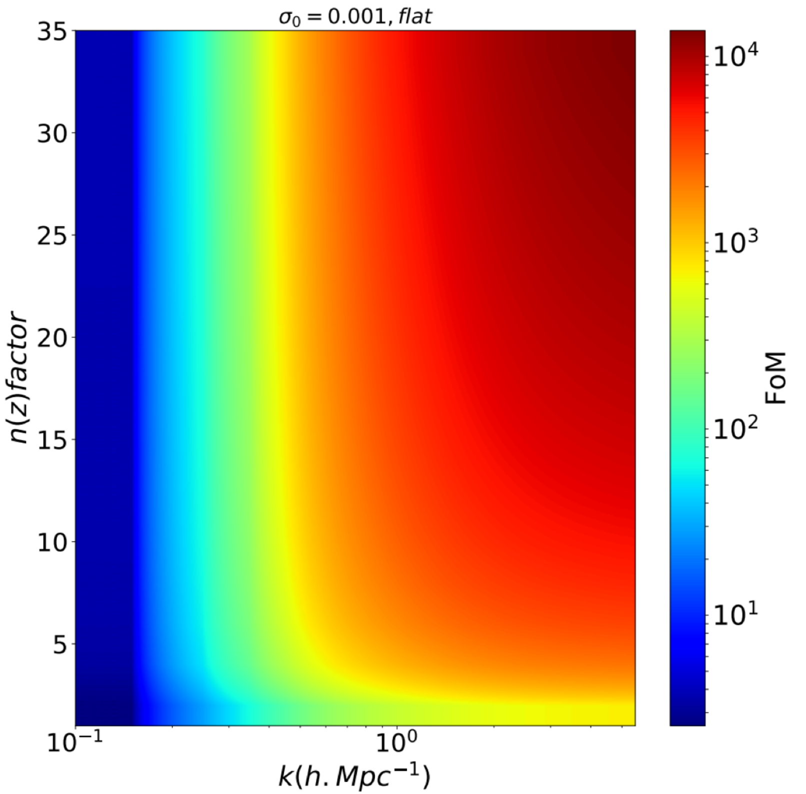
Miguel Delaire, Fabien Dournac, Ziad Sakr

Supervisés par Safir Yahia-Cherif et Alain Blanchard

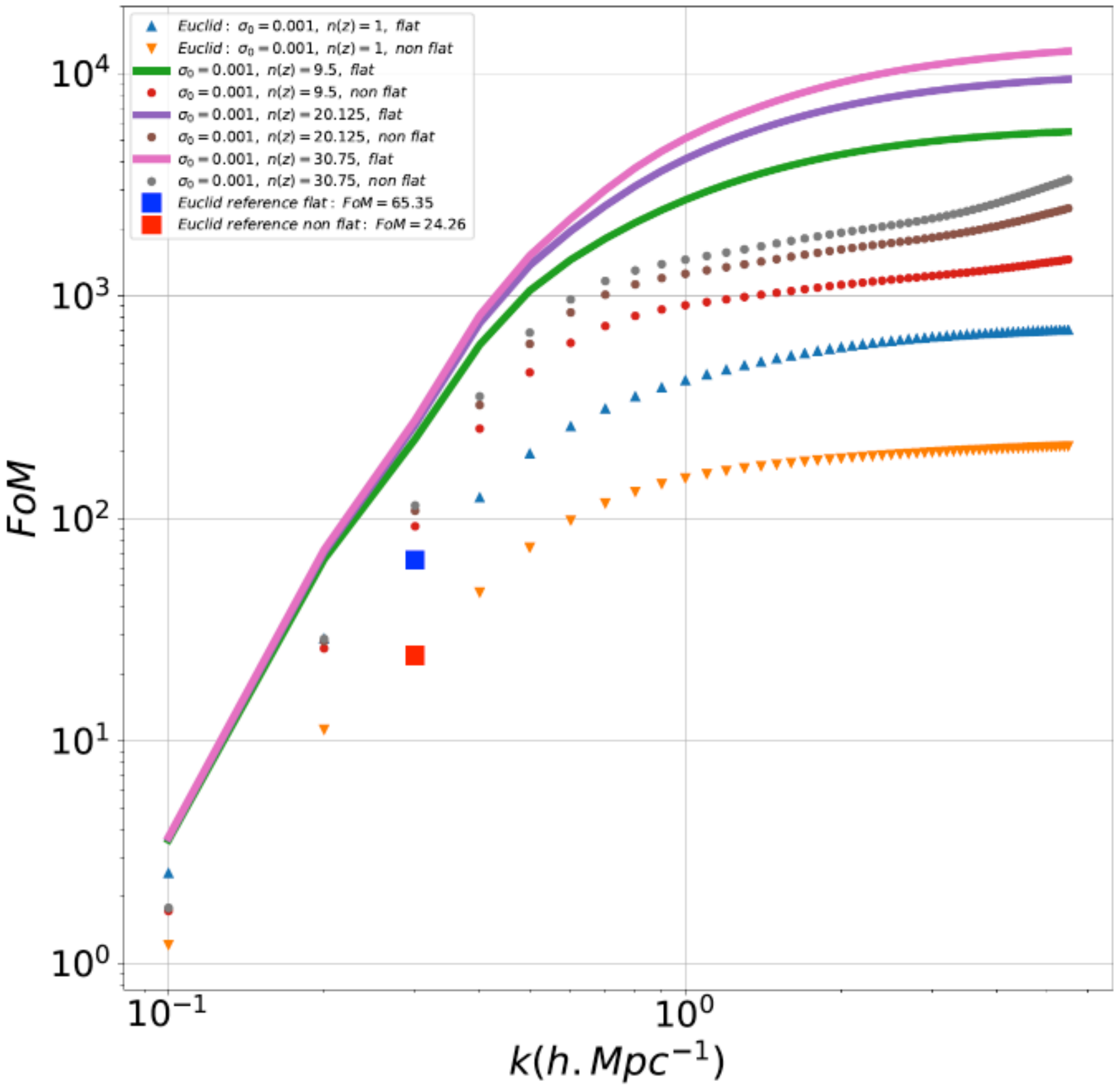
Impact du k sur la Fom
Cas Pk Linéaire + Wiggles



Impact de n(z) et k sur la Fom
Cas Pk Non Linéaire + Flat



Impact de n(z) et k sur la FoM



Conclusions :

Élargir le soutien à un téléscope spatial grand champ

Publication d'un article type revue