Low and high resolution galaxy libraries for Gaia and Galaxy counts

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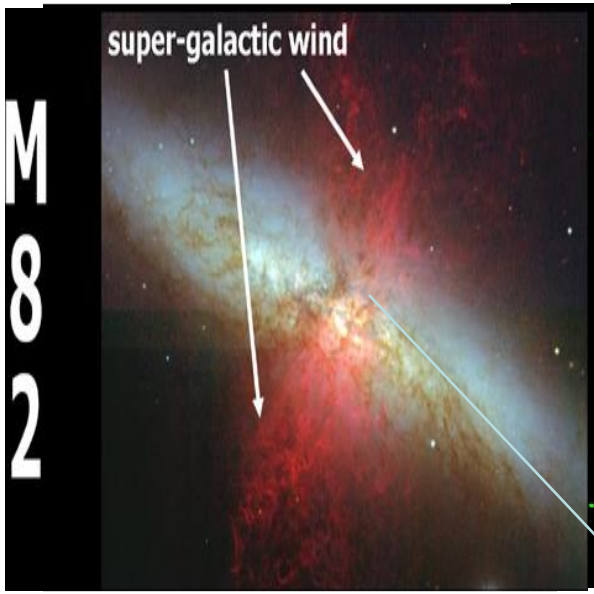
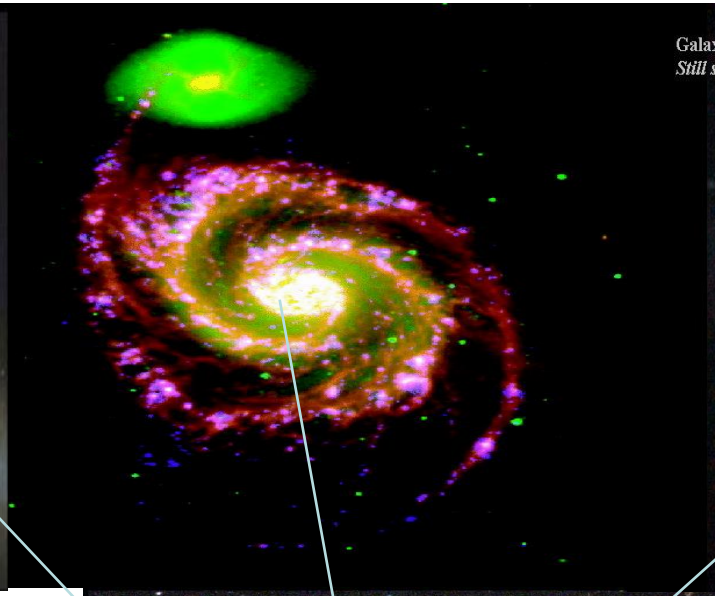
@ **Low resolution**: CU8, Mary Kontizas, A. Karampelas (U. Athens) R. Sordo, A. Vallenari (Padova) P. Tsalmantza, C. Bayler-Jones (Heidelberg)

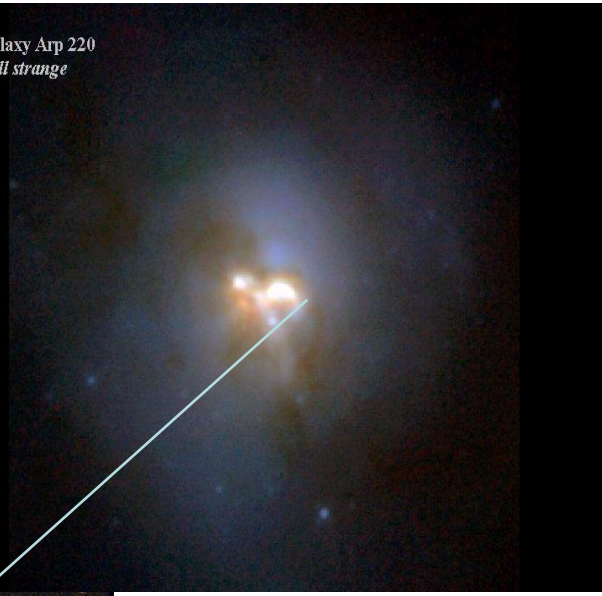
@ **Galaxy counts**

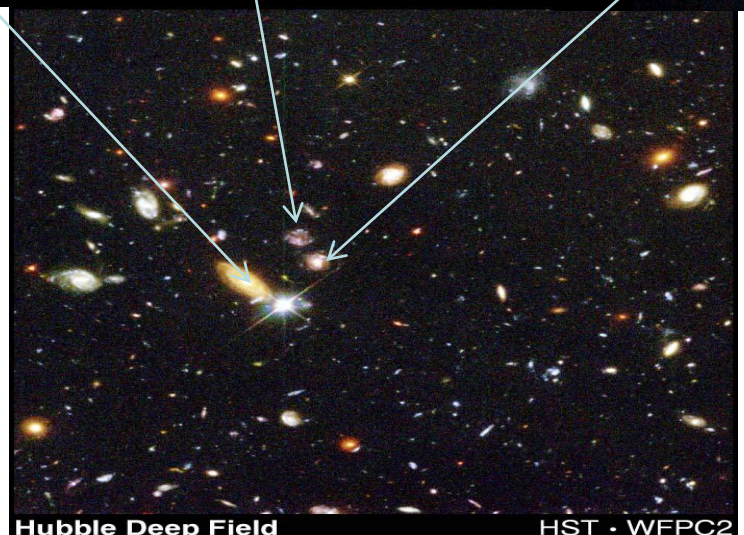
@ **High resolution**: current developments with PéGASE

Gaia will detect millions of non resolved galaxies
Properties of giant Spirals, Ellipticals and AGNs
and populations of blue dwarf galaxies?









AND also BP/RP surveys to galaxy count , color , redshift distributions?

Main questions on Galaxy evolution

Statistics to solve the basic principles of evolution

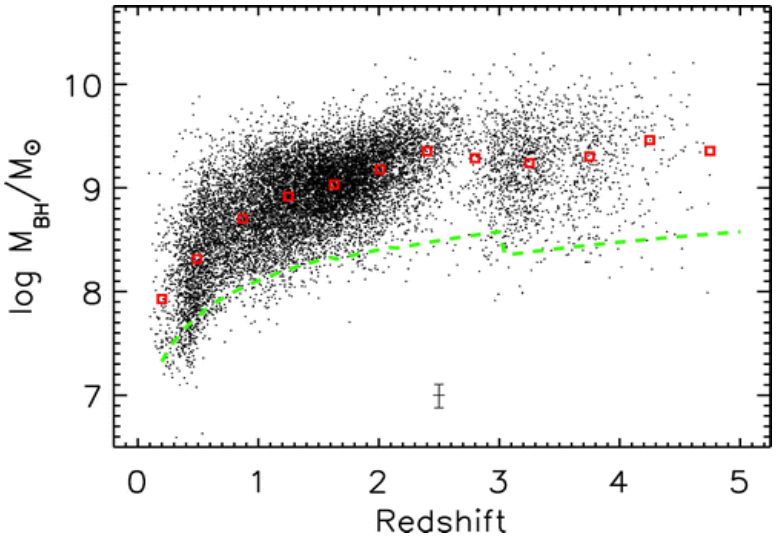
- red sequence , **mass-metallicity relation ,The Fondamental plane**
- **Early-type color-magnitude , Luminosity and mass functions by types**

Comparable to SDSS with better accuracy, less filters and less deep.

Where Astrometric accuracy will be successful:

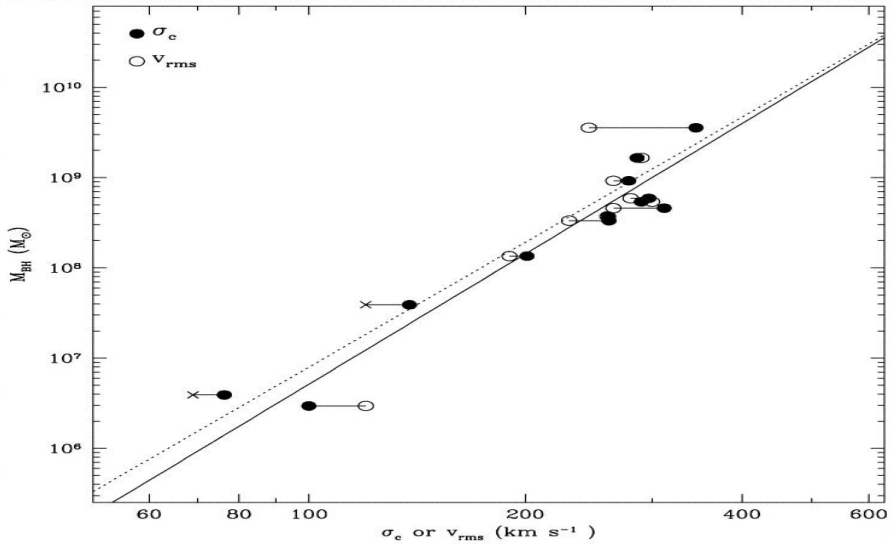
- Binary galaxies and Nucleated galaxies
- Blue quenched star forming galaxies
- Luminosity functions of galaxy dwarfs
- Radio galaxies/quasars

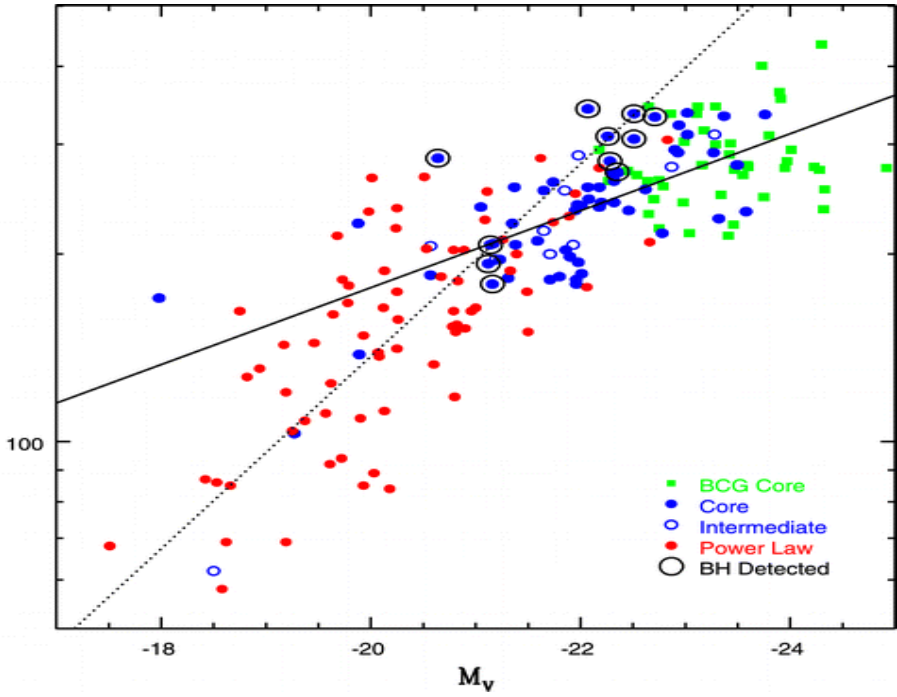
Relation of massive(10**9MΘ) black holes at z>4 With their massive galaxy hosts



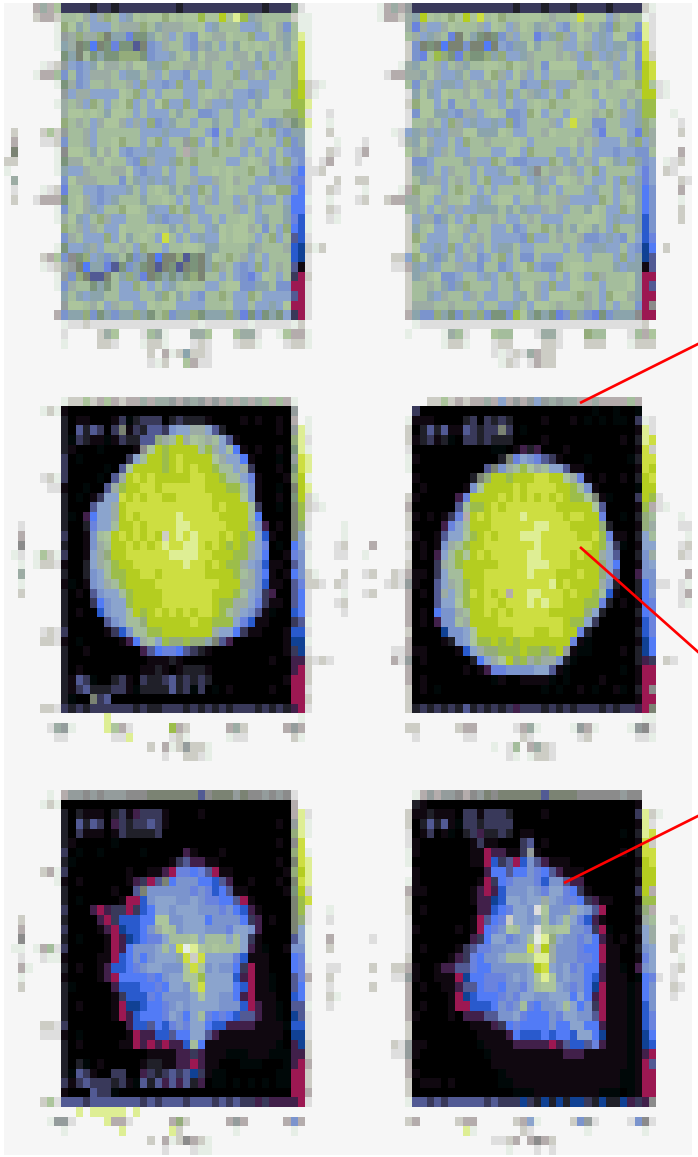
Redshift distribution of the black hole masses
Of the QSOs sample from SDSS DR3
Vestergaard et al. 2008, ApJ, 674, L1

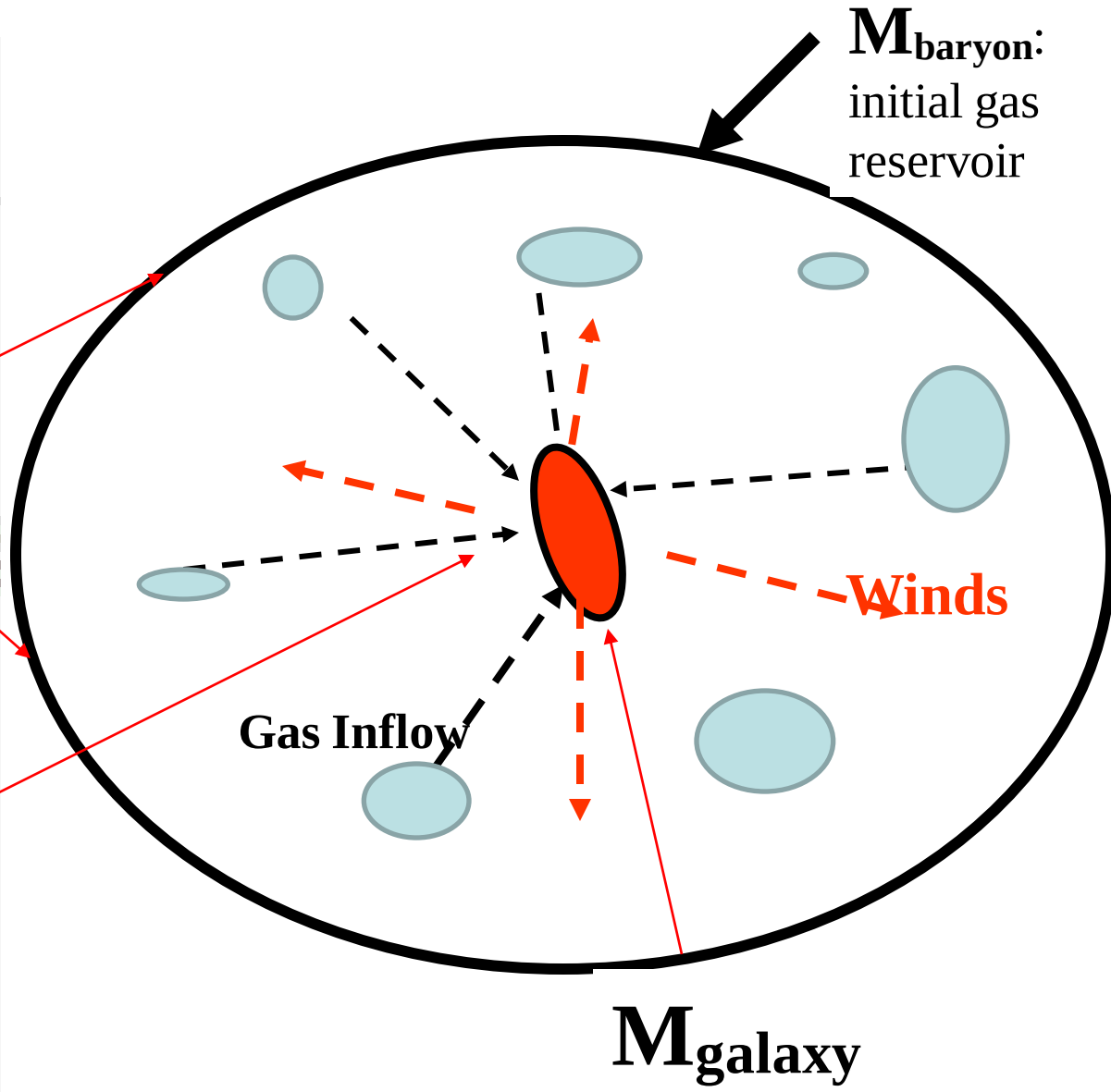
Relation with the Galaxy properties
Merritt et al, 2006, Margorrian et al, 2004





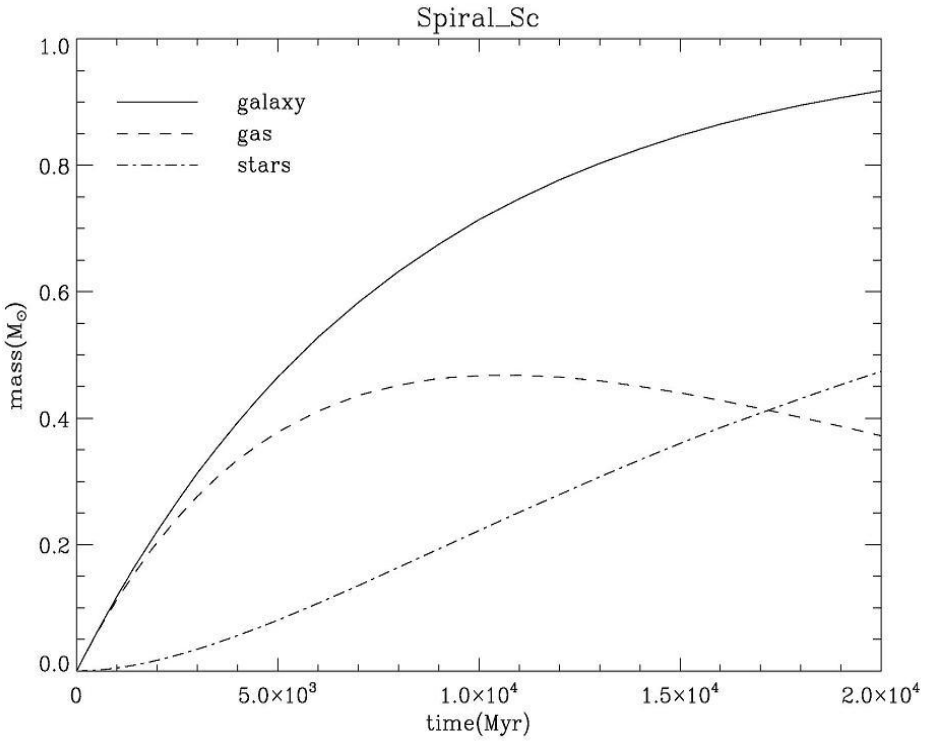
Evolutionary model PEGASE (www.iap.fr/pegase) with environment effects
4 parameters: IMF, star formation law , infall and winds
➔ Galaxy templates for Gaia_BP/RP

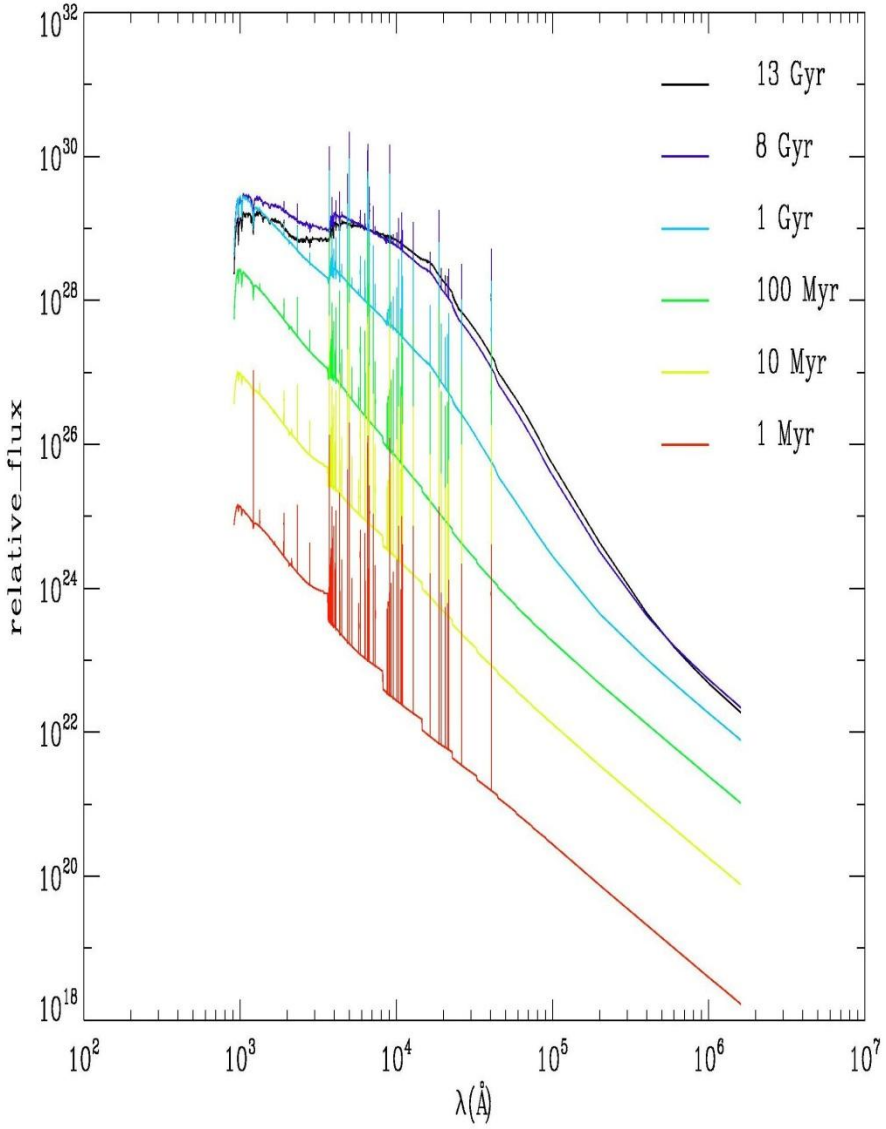




Star Formation Law and SEDS for our **Galaxy (Sc)**

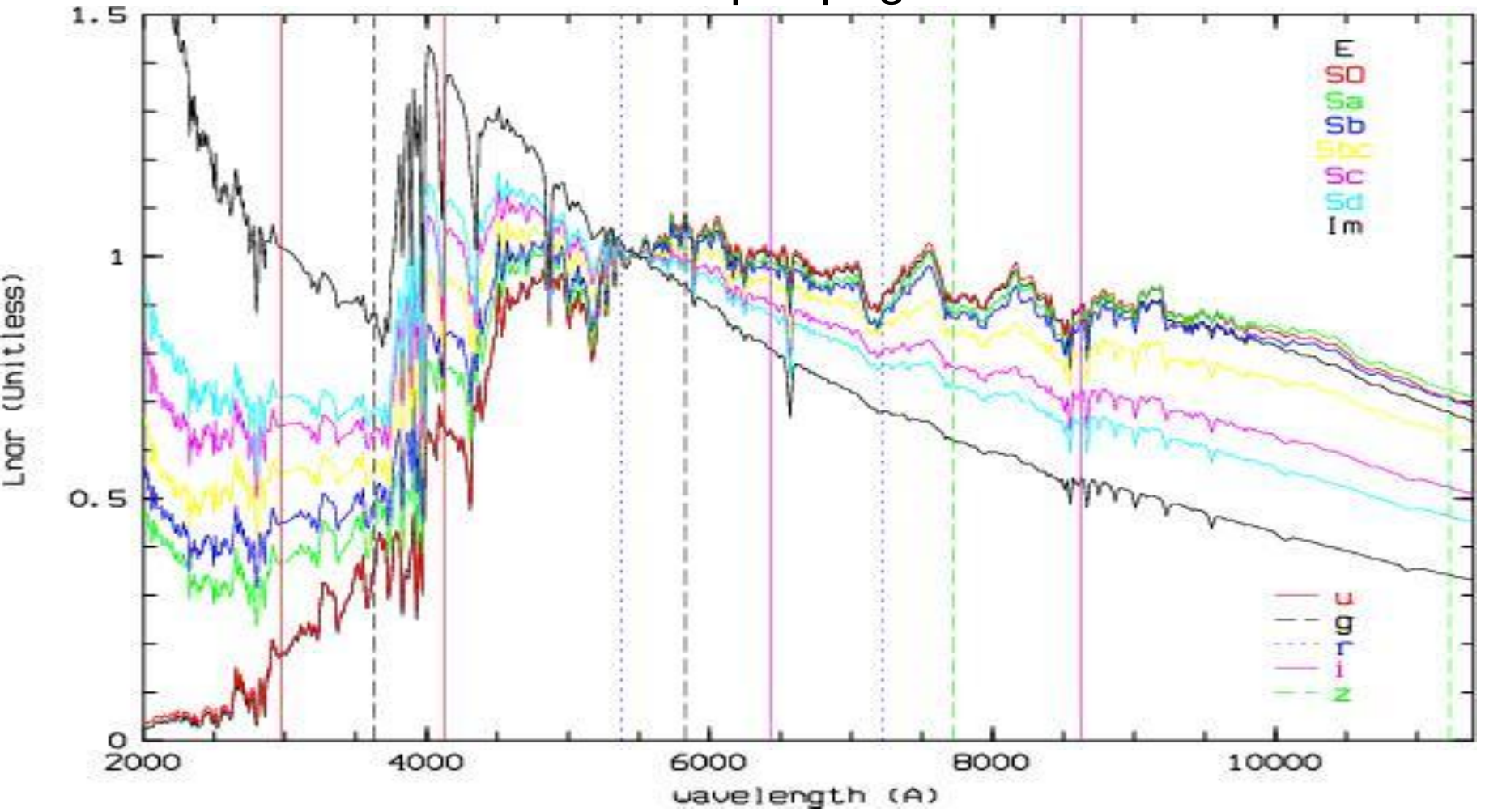
SFR α 1/p2 Mgas ^p1
Environnemental effects (infall)
1/p2= 0.1 Gyr-1, p1 = 1, infall 8Gyrs





7 SED Templates by types from PEGASE

www.iap.fr/pegase



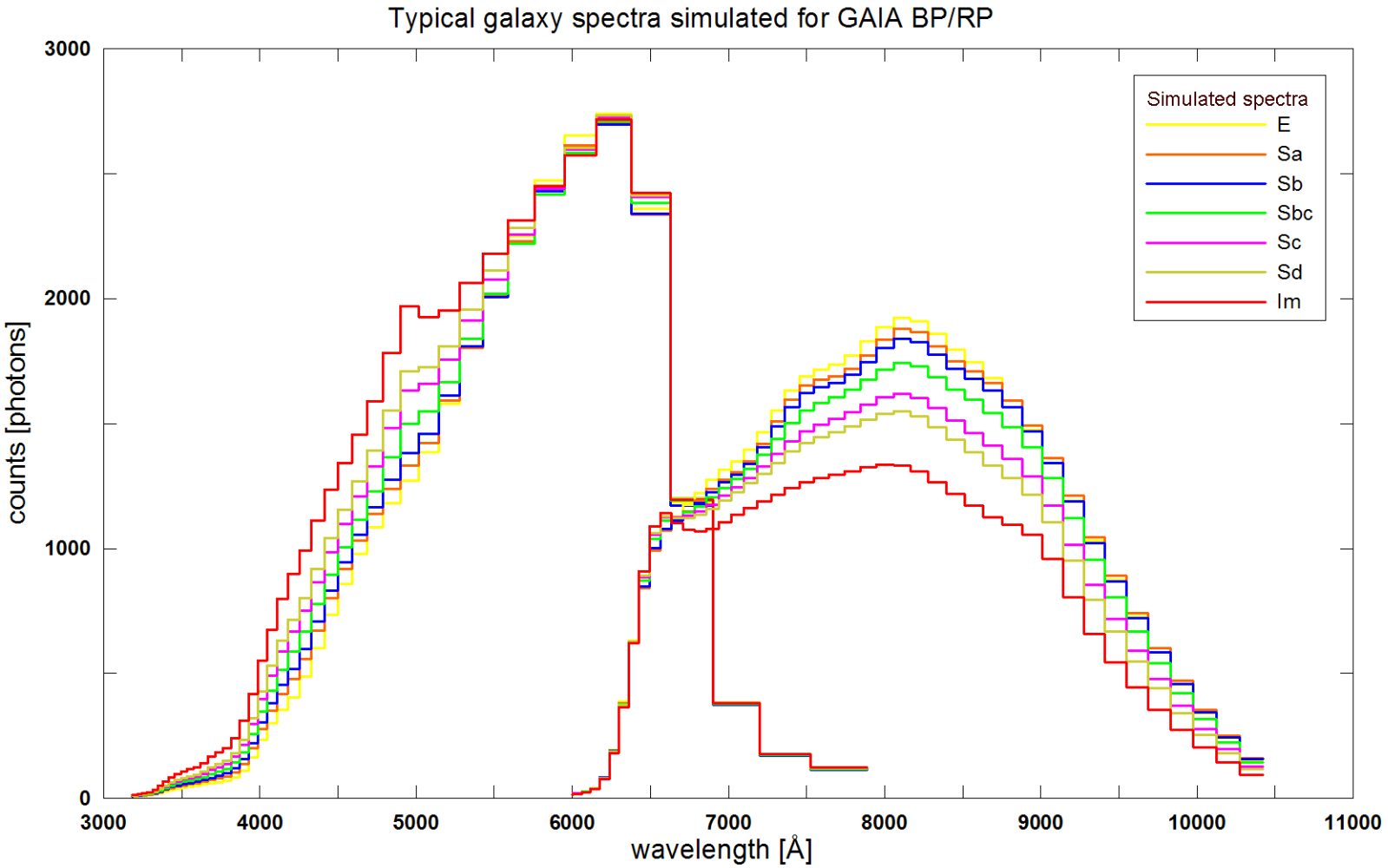
PEGASE.2 evolution SCENARIOS by types ARE ROBUST (up to z<4) IN THE UV/OPTICAL/NIR

@ z=0, PEGASE templates fits observed SED/colors by type **(Fioc&Rocca-Volmerange 1997**

@ z<2 Multi-λ faint galaxy counts (Fioc & Rocca-Volmerange, 1999)

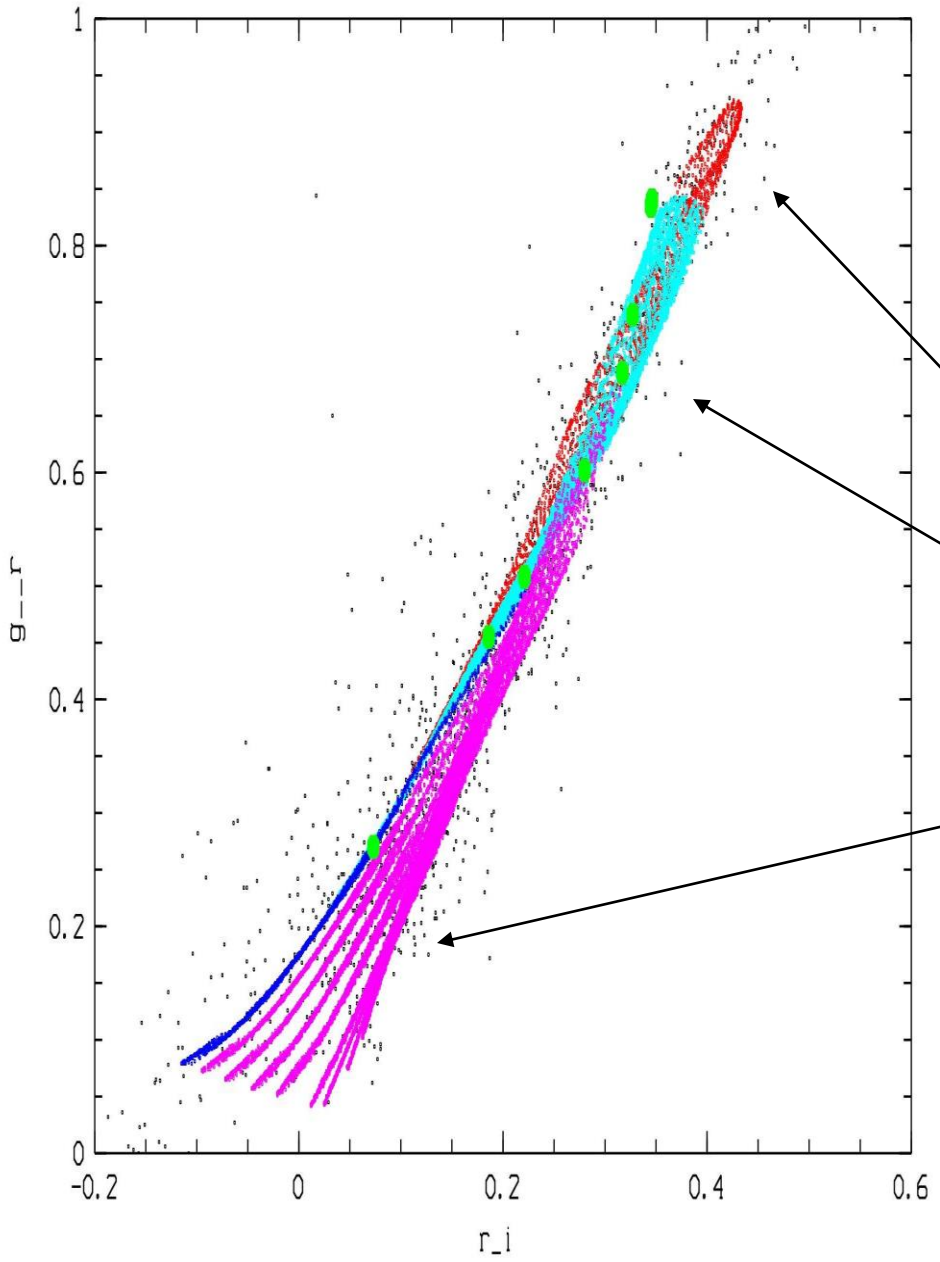
GWP-S-832 BP/RP Libraries

BP/RP Libraries: UgcLib2a GaiaGOG Simulated Spectra



GREAT/Gaia Mock Catalogue

29_02/02_03_2012



Comparison of Pegase predictions by types with observed SDSS color-color distribution of galaxies (black dots)

Tsalmantza et al, 2007, 2009

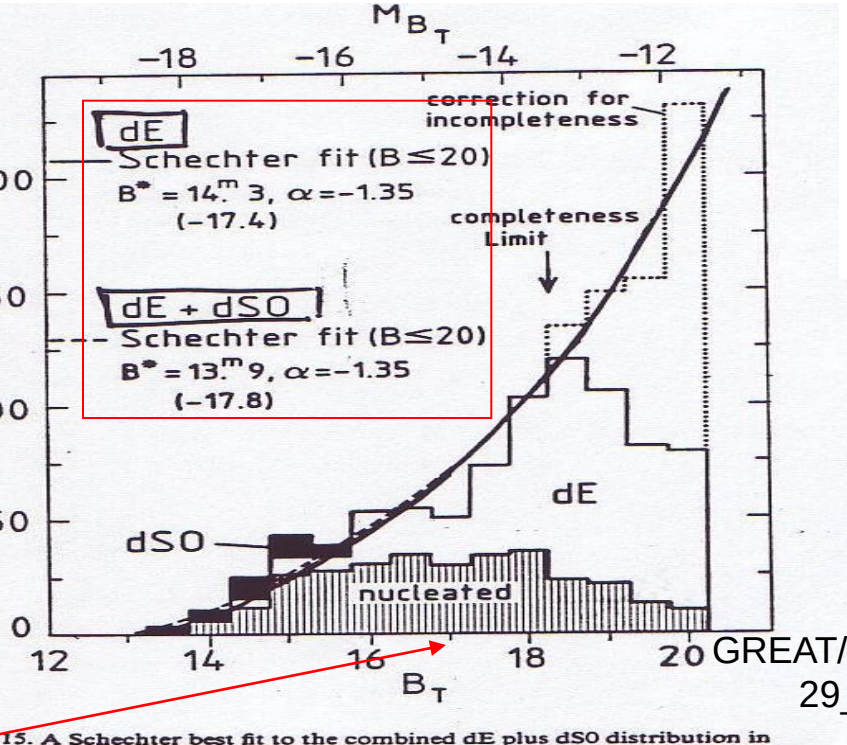
Ellipticals
(Short time scales)

Spirals + irregulars
(light + dark blue)

- Blue galaxies
- Quenched ? (magenta)
-

(B_T) by types (Bingelli et al)

E + dSO



15. A Schechter best fit to the combined dE plus dSO distribution in

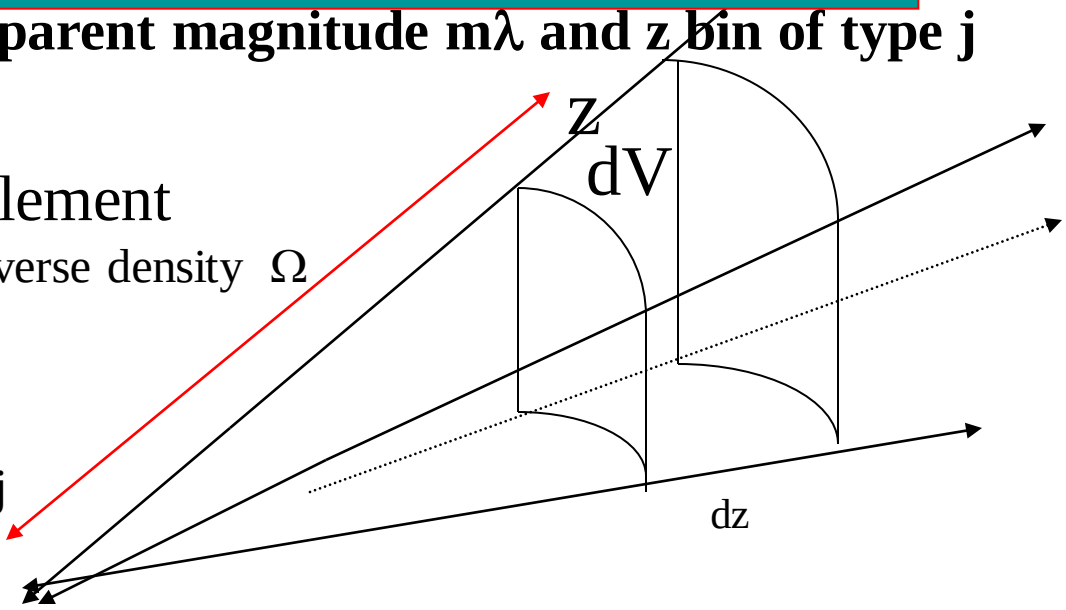
Galaxy counts

$$d^2 A_j(m_\lambda, z) = \Phi_j(M^j{}_\lambda(z))(1+z)^3 \frac{dV}{dz} dm_\lambda dz$$

Galaxy Number density by apparent magnitude mλ and z bin of type j

$\frac{dV}{dz}(z)$ Comoving volume element

Highly sensitive to the Universe density Ω



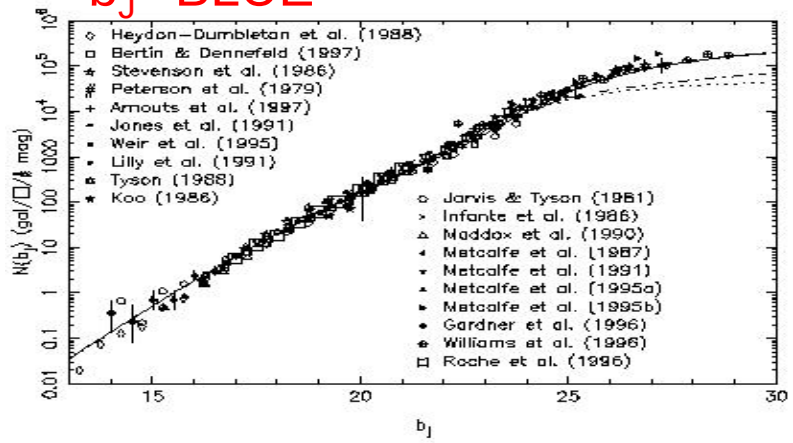
$\Phi_j(M^j{}_\lambda(z))$ z=0 luminosity function by type j for filter λ

$$m^j{}_\lambda(z) = M^j{}_\lambda(z=0, t_0) + k^j{}_\lambda(z) + e^j{}_\lambda(z) + (m-M)_{bol} + A_\lambda$$

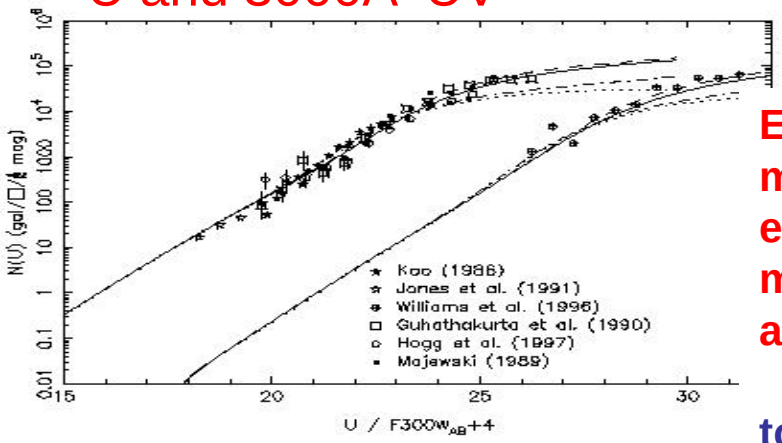
k- and e- corrections are computed from synthetic spectra for all scenarii and all z

RESULTS FROM UV—OPTICAL--NIR (UBVIRJHK) COUNTS

b_J BLUE

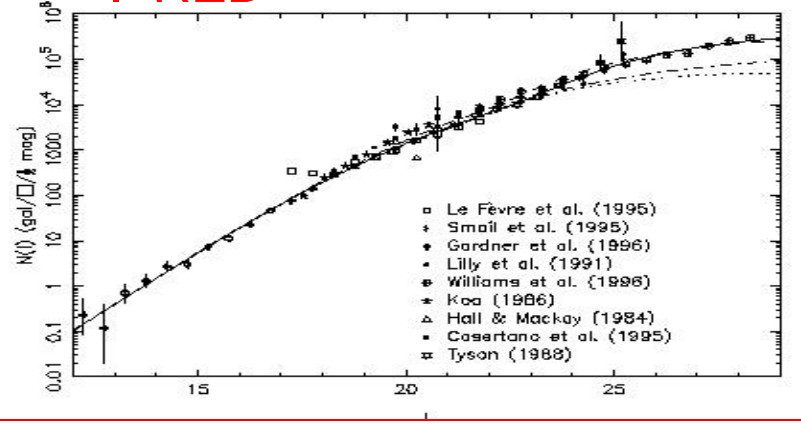


U and 3000A UV

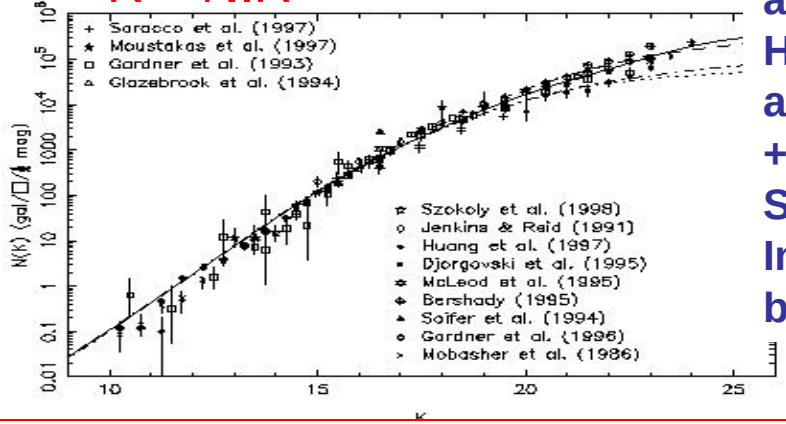


Early massive ellipticals models are needed

I RED



K NIR



to constrain all surveys: Hawaiian and +HDF-N Surveys In B, I and K bands

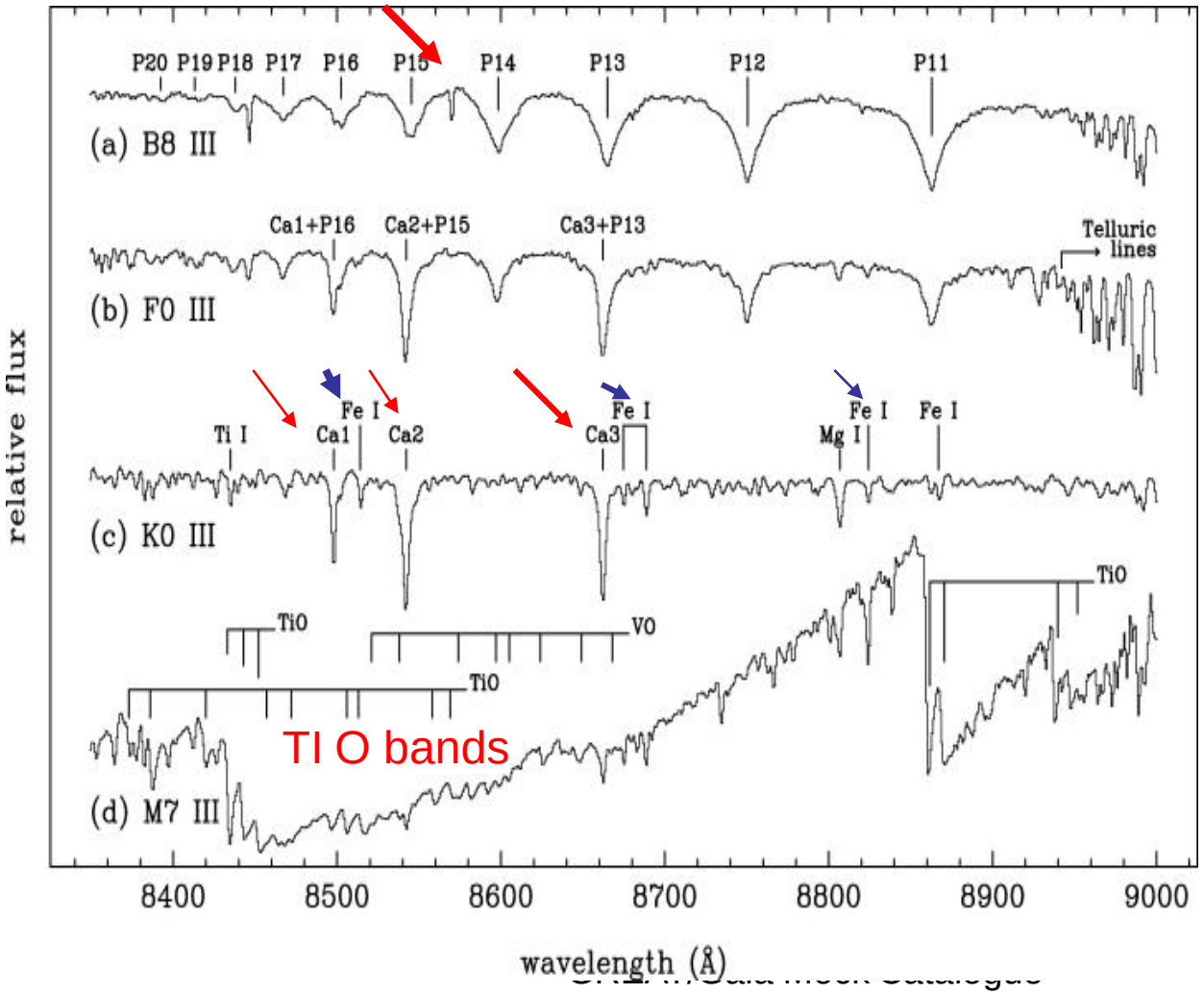
One distribution fits galaxy counts with evolution scenarios by type

ELLIPTICAL (26%) Sa+Sb+Sbc (24%) Sc+Sd+Im (50%)

GREAT/Gaia Mock Catalogue

(Fioc and Rocca-Volmerange, 1999, AA,344,393)

3. To solve the degeneracy age-metallicity with the RVS: Tracers of Ca, H and Fe lines



TI O bands

Cenarro et al, 2001, 2003

Pashen lines = f(age)

Ca, Mg , TiO = f(metal)

An extensive library of 2500-10500 Ang synthetic spectra

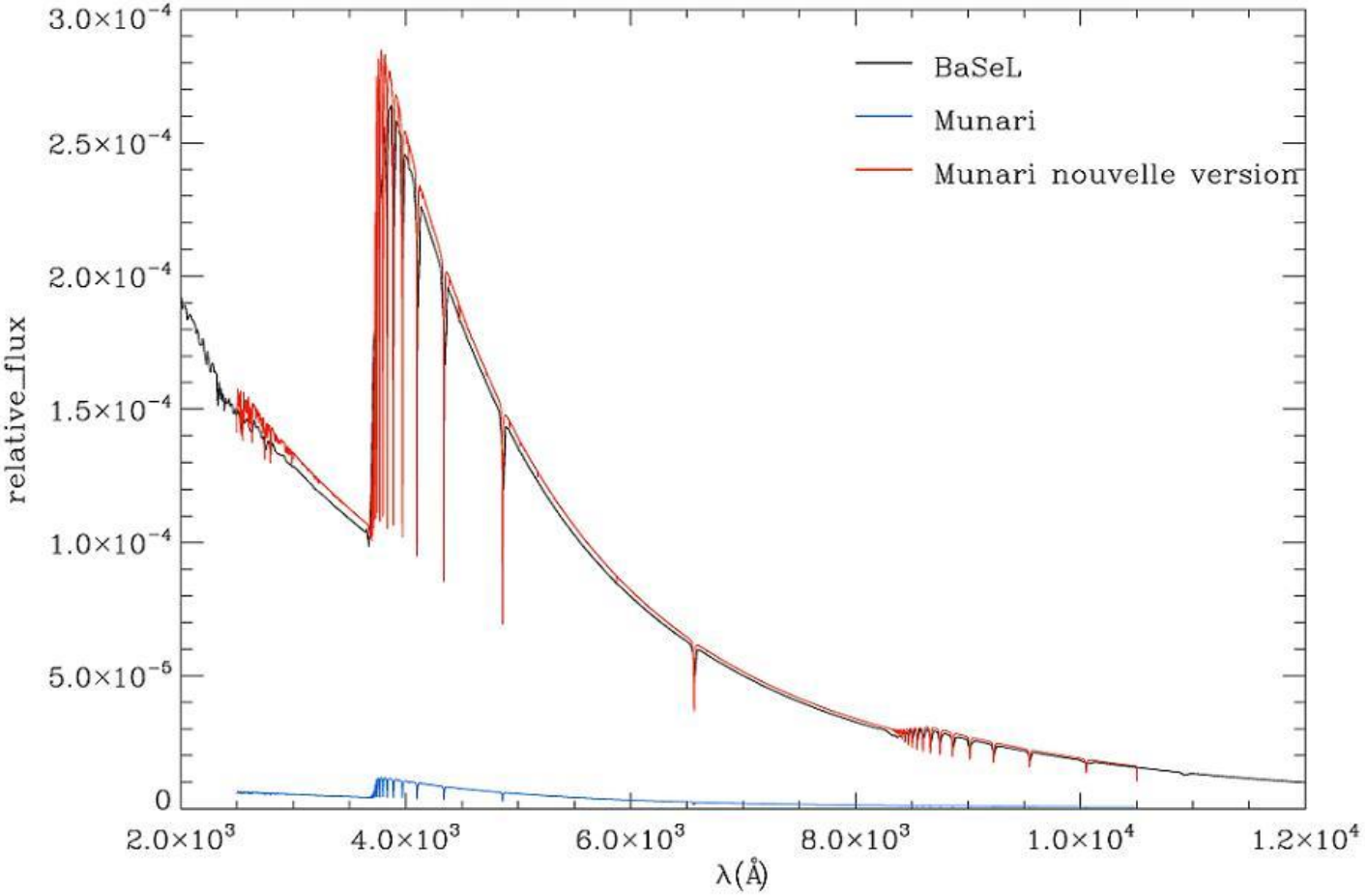
- Authors: U. Munari, R. Sordo, F. Castelli, T. Zwitter, AA, 2005

- Abstract: Based on Kurucz's codes
- With resolving power 11,500 (GAIA), 8500 (RAVE), 2000 (SLOAN) and uniform dispersions of 1 and 10 Ang/pix.

- The library maps the whole HR diagram, exploring 51,288 combinations of atmospheric parameters spanning the ranges: 3500 <= Teff <= 47500 K, 0.0 <= log g <= 5.0, -2.5 <= [M/H] <= 0.5, [alpha/Fe] = 0.0,+0.4, xi =1,2,4 km/sec, 0 <= Vrot <= 500 km/sec.

- The spectra are available both as absolute fluxes as well as continuum normalized

Recalibration of HR (Munari et al) spectra computed by Pegase and compared to LR (BaSel) spectra with the same code



Elliptical 13GYRS

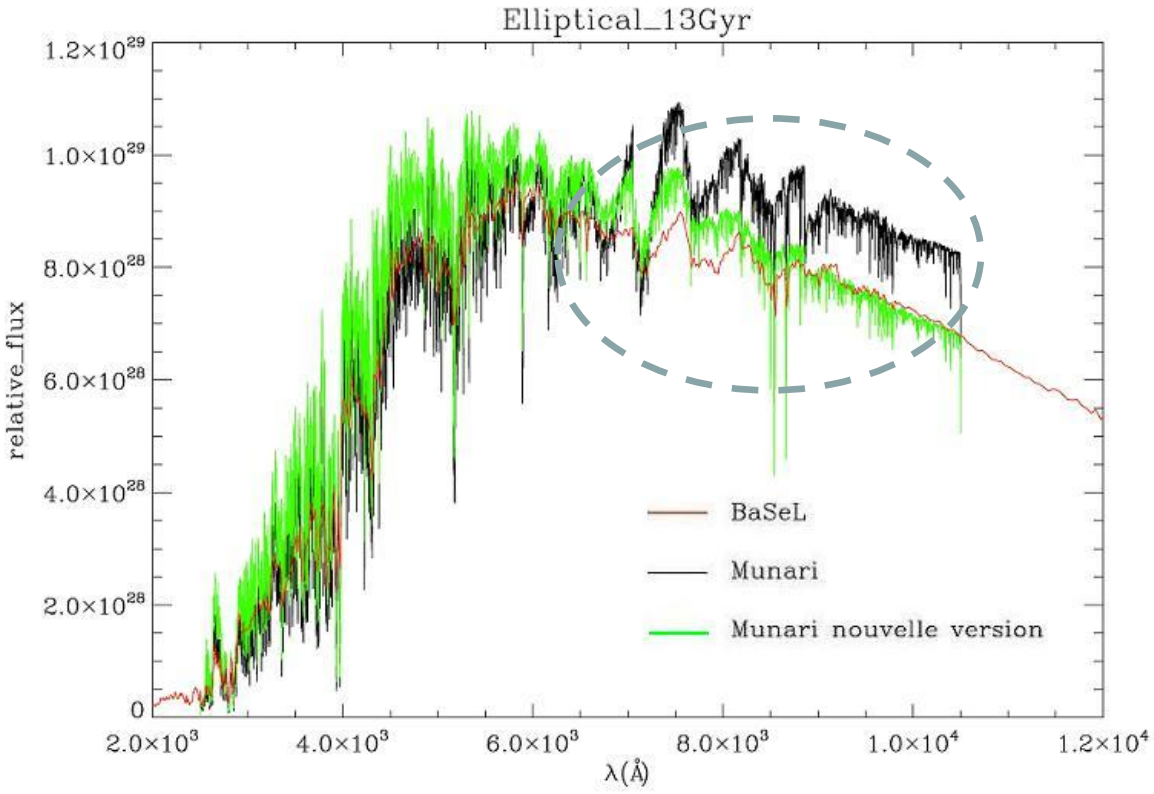
Before correction (black)

New version (green)

Low resolution version (red)

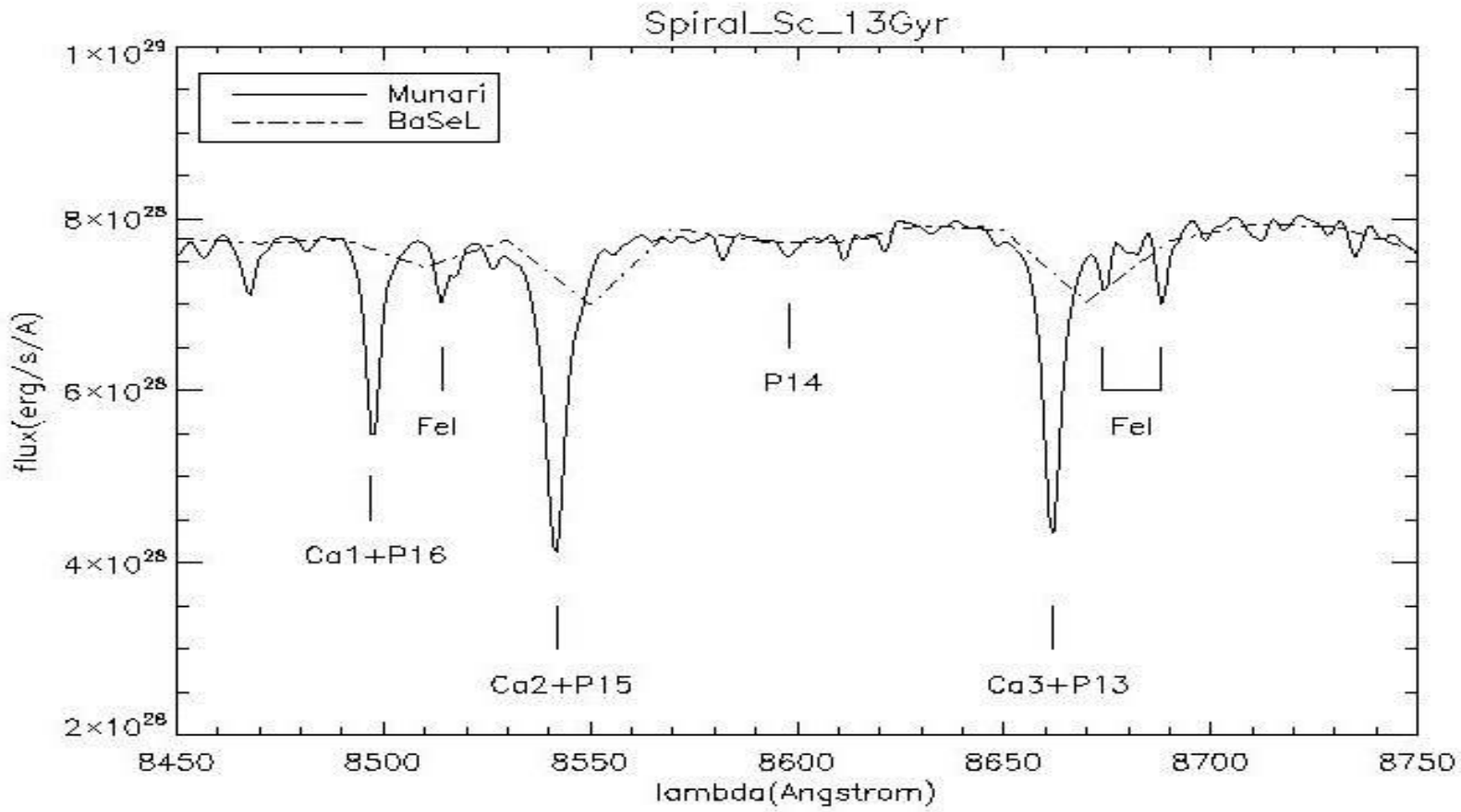
Differences around 8000A

As Basel library,
Munary library
is being corrected
For red star populations

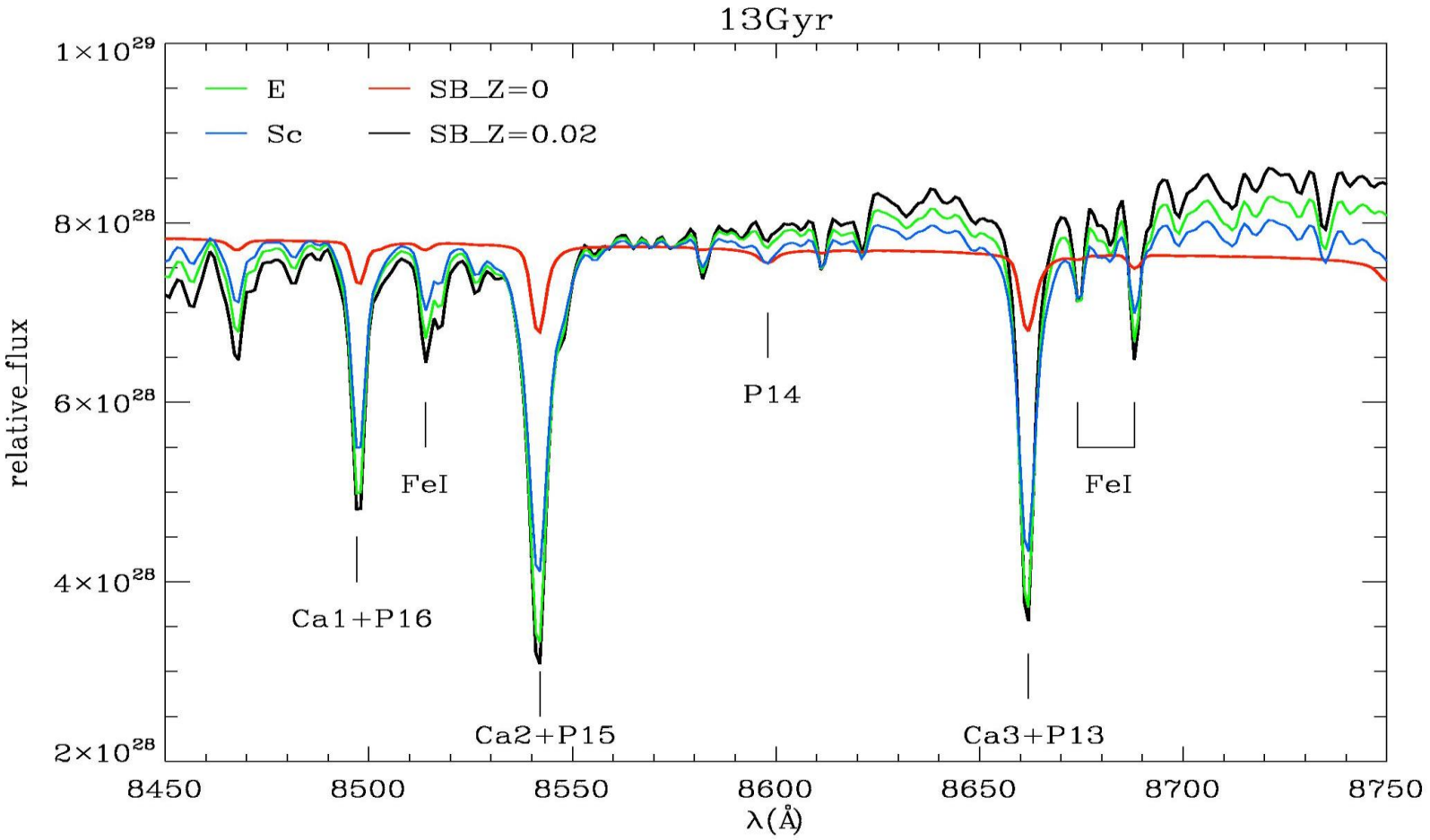


The CaT of Our Galaxy (Spiral) with Pegase.2 +Munari.al, 2005

low/high spectral resolution



Type effect :Elliptical, Spiral Sc and Starbursts



Conclusions with Gaia

- low resolution BP/RP library
  statistics on galaxy population

- Evolution of blue dwarfs and galaxy counts

- High resolution with RVS
- Degeneracy age-metallicity if galaxies detected):

Low metallicity : Paschen lines (P14)

High metallicity➔ evidence of Ca lines