O papel da matéria escura na evolução da Taxa Cósmica de Formação Estelar.

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Astrophysics and Space Science

Accretion History of Active Black Holes from Type 1 AGN

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Abstract Almost all galaxies have massive central black holes in their centers with masses typically ranging from $\sim 10^5$ to $\sim 10^9 M_\odot$. However, the origin and evolution of these objects and their connection with the hosting galaxies are not completely understood yet. In this work we analyze the supermassive black holes (SMBH's) mass accretion rate and the mean Eddington ratio (MER) of type 1 AGN using data from the Sloan Sky Survey. For this purpose we improve the method for constructing the subsample of SMBH, taking into account the survey flux limit and the bias of the sample. It was observed that the mean bolometric luminosity of the active black holes can be represented by a power law with the mean Eddington ratio and the mass accretion rate being proportional to this law.

Keywords black hole physics — galaxies: active — galaxies: evolution — galaxies: nuclei — quasars: general

not the merging of black holes is the dominant process for growing the supermassive black holes we find at the centers of present-day galaxies (Shankar et al. 2010, 2009; Bertie & Volonteri 2008; Volonteri 2005; Marconi et al. 2004).

The Eddington ratio is an important element to study the evolution of SMBHs. It is associated with both the dynamic of accretion as the balance between the gravitational force and the radiation pressure of the accretion disk. The mean Eddington ratio evolution, as a function of the redshift, has been described, for example, by Hopkins & Hernquist (2009) and Cao (2010). On the other hand, some works discuss the evidence that the evolution of the mean Eddington ratio is also a function of the mass of the central black hole (DeGraf et al. 2012; Trakhtenbrot & Netzer 2012; Kollmeier et al. 2006; Lusso et al. 2012; Kelly & Shen 2013). However, the real significance of the mean Eddington ratio is not clear yet.

New Astronomy

The Role of the Dark Matter haloes on the Cosmic Star Formation Rate.

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Abstract

The cosmic star formation rate (CSFR) represents the fraction of gas that is converted into stars within a certain comoving volume and at a given time t. However the evolution of the dark matter haloes and its relationship with the CSFR is not yet clear. In this context, we have investigated the role of the dark halo mass function - DHMF - in the process of gas conversion into stars. We observed a strong dependence between the fraction of baryons in structures, $f_{\rm b}$, and the specific mass function used for describing the dark matter haloes. In some cases, we have obtained $f_{\rm b}$ greater than one at redshift $z = 0$. This result indicates that the evolution of dark matter, described by the specific DHMF, could not trace the baryonic matter without a bias parameter. We also observed that the characteristic time-scale for star formation, τ, is strongly dependent on the considered DHMF, when the model is confronted against the observational data. Also, as part of this work it was released, under GNU general public license, a Python package called 'pycosmicstar' to study the CSFR and its relationship with the DHMF.

Keywords: (cosmology):dark matter; stars: formation; stars: general; galaxies:star formation

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Astronomy & Astrophysics

Wavelet analysis of CME, X-ray flare, and sunspot series

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ABSTRACT

Context. Coronal mass ejections (CMEs) and solar flares are the most energetic transient phenomena taking place at the Sun. Together they are principally responsible for disturbances in outer geospace. Coronal mass ejections and solar flares are believed to be correlated with the solar cycle, which is mainly characterized by sunspot numbers.
Aims. Here, we search for pattern identification in CMEs, X-ray solar flares, and sunspot number time series using a new data mining process and a quantitative procedure to correlate these series.
Methods. This new process consists of the combination of a decomposition method with the wavelet transform technique applied to the series ranging from 2000 until 2012. A simple moving average is used for the time-series decomposition as a high-pass filter. A continuous wavelet transform is applied to the series in sequence, which permits us to uncover signals previously masked by the original time series. We made use of the wavelet coherence to find some correlation between the data.
Results. The results have shown the existence of periodic and intermittent signals in the CMEs, flares, and sunspot time series. For the CME and flare series, few and relatively short time intervals without any signal were observed. Signals with an intermittent character take place during some epochs of the maximum and descending phases of the solar cycle 23 and rising phase of solar cycle 24. A comparison among X-ray flares, sunspots, and CME time series shows a stronger relation between flare and CMEs, although during some short intervals (four–eight months) and in a relatively narrow band. Yet, in contrast we have obtained a fainter or even absent relation between the X-ray flares and sunspot number series as well as between the CMEs and sunspot number series.

Key words. Sun: coronal mass ejections (CMEs) – Sun: activity – methods: data analysis

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The Black Hole Mass Function of Type 1 AGN

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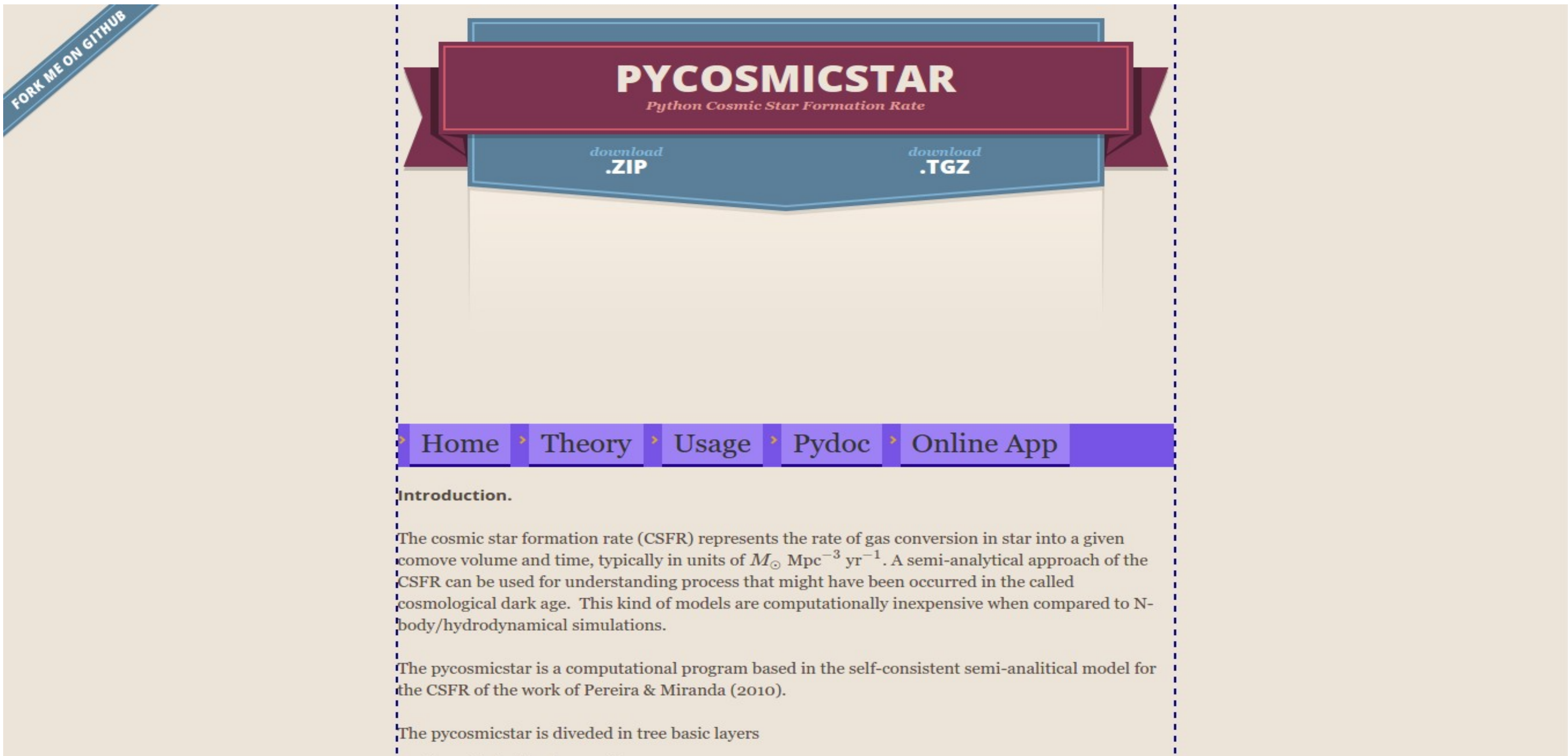
Abstract. An important question in the modern astrophysics is related to the origin and evolution of the supermassive black holes (SMBH) ubiquitous in the galaxy nucleus. In this work is shown a robust method to determine the estimator of the binned mass function of SMBH, n_{est}, hosted by type I AGN. The advantage of the method presented here is that the flux-limited of the survey was taken into account in a more accurate way. For this work it was considered data form Sload Digital Sky Survey Data Release 7. We observed that the n_{est} was obtained with relative low bias and error. Also, it was noted that the BHMF declines at high redshifts and peaks in the range of $10^{8.6}M_{\odot}$-$10^{9.3}M\odot$ shifting in the direction of high masses when z increases.

Web Site

http://duducosmos.github.io/pycosmicstar/index.html



O Cenário Hierárquico de Formação de Estruturas

- Perturbações primordiais levam ao colapso da matéria escura
- Ao colapsar, ocorre o arraste da matéria bariônica (Potencial gravitacional), iniciando o fluxo de gás para estruturas
- Halos menores se fundem formando halos maiores.
- Parte do gás será usado no processo de formação estelar.

Formalismo tipo Press-Schechter

- O cerne do formalismo está no fato de que a fração de massa em halos mais massivos que M está relacionado com a fração do volume no qual o campo de densidade inicial suavizado é maior que a densidade limite δ_c .
- Assim, halos são picos na distribuição de densidades.
- São locais naturais para a formação de galáxias.

Formalismo tipo Press-Schechter

- Abundância de Halos (Jenkins et al. 2001):

$$\frac{dn}{dM} = f(\sigma)\frac{\rho_{\rm DM}}{M}\frac{d\ln\sigma^{-1}}{dM},$$

- Densidade Numérica de halos colapsados por unidade de intervalo em $\ln(\sigma^{-1})$ (σ é a variância do campo de densidade linear)

Evolução da Matéria Escura

- Algumas funções de massa

1. Press & Schechter (1974) :

$$f(\sigma) = \sqrt{\frac{2}{\pi}}\nu \exp\left(-\frac{\nu^2}{2}\right), \quad (2)$$

2. Sheth & Tormen (1999):

$$f(\sigma) = A\sqrt{\frac{2a}{\pi}}\frac{1}{\nu}\left[1+\left(\frac{\nu^2}{a}\right)^p\right]\exp\left(-\frac{a}{2}\frac{1}{\nu^2}\right), \quad (3)$$

where $A = 0.3222$, $a = 0.707$ and $p = 0.3$,

Evolução da Matéria Escura

- Algumas funções de massa

3. Reed et al. (2007) (also known as the modified Sheth-Tormen mass function):

$$f(\sigma) = A\sqrt{\frac{2a}{\pi}}\nu\exp\left[\frac{ca\nu^2}{2} - \frac{0.03\nu^{0.6}}{(n_{eff}+3)^2}\right] \times\left[1+\left(\nu^2 a\right)^{-p} + 0.6G_1(\sigma) + 0.4G_2(\sigma)\right], \tag{4}$$

where $A = 0.3222$, $a = 0.707$, $p = 0.3$ and $c = 1.08$, with:

$$n_{eff} = 6\left(\frac{d\log\sigma^{-1}}{d\log M}\right) - 3,$$

$$G_1(\sigma) = \exp -[\ln(\sigma^{-1} - 0.4)^2]/0.72,$$

$$G_2(\sigma) = \exp -[\ln(\sigma^{-1} - 0.75)^2]/0.08,$$

Evolução da Matéria Escura

- Algumas funções de massa

4. Watson et al. (2013):

$$f(\sigma) = A\left[\left(\frac{b}{\sigma}\right)^a + 1\right]\exp(-c/\sigma^2), \qquad (5)$$

being, $A = 0.282$, $a = 2.163$, $b = 1.406$ and $c = 1.21$. Note that this is a modified version of Tinker et al. (2010) mass function for redshift range $z = [0, 30]$.

Fração de Bários.

- A matéria escura traça a matéria bariônica, em estruturas, sem viés?
- Supondo que sim:

$$f_b(z) = \frac{\int_{M_{min}}^{M_{max}} f(\sigma) M dM}{\rho_{DM}(z)},$$

Fração de Bárions em estruturas.

Taxa Cósmica de Formação Estelar

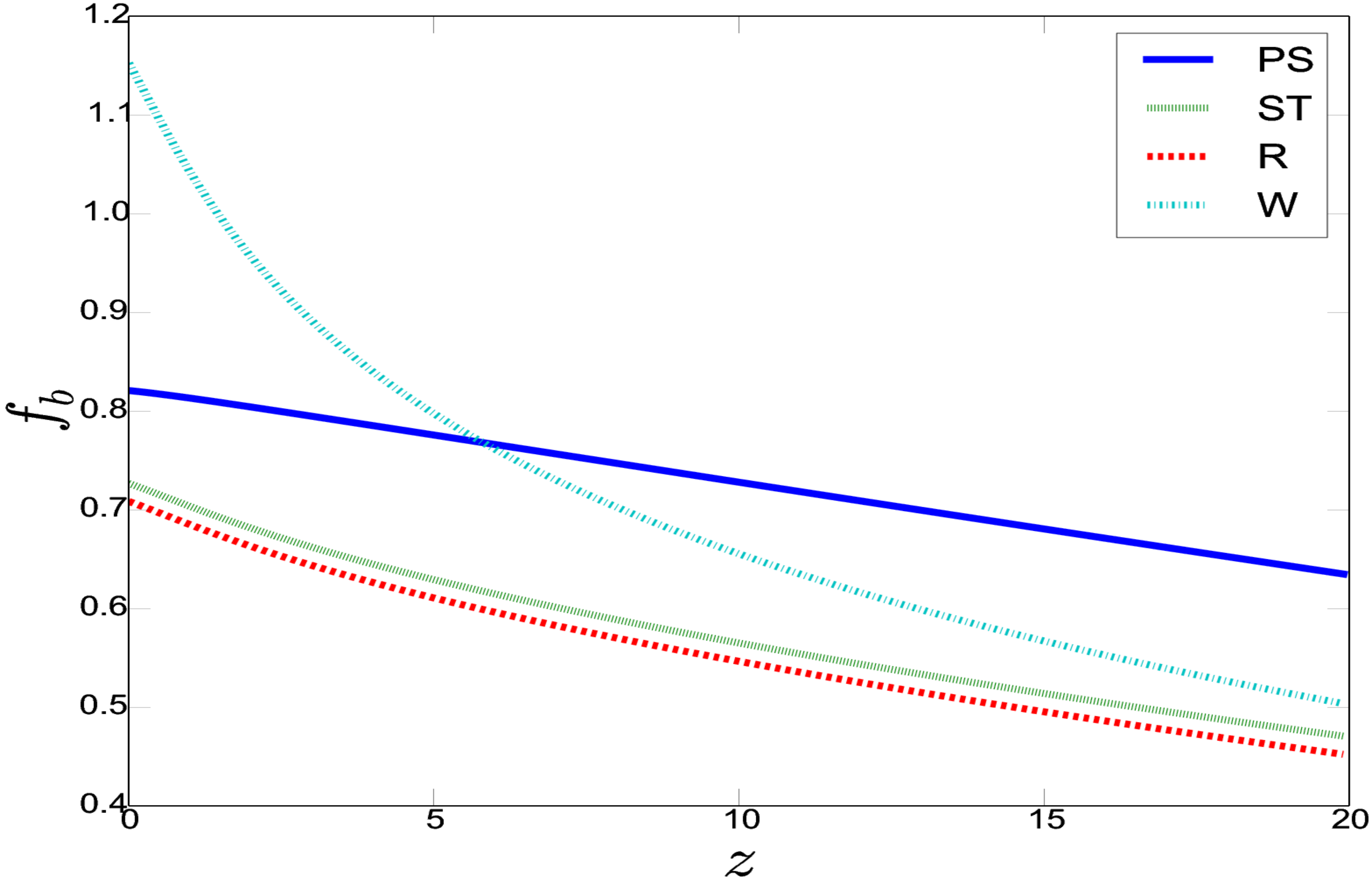
- Regida por uma lei de conservação

$$\dot{\rho}_{\rm g} = -\frac{d^2 M_\star}{dV dt} + \frac{d^2 M_{\rm ej}}{dV dt} + \epsilon a_{\rm b}(t),$$

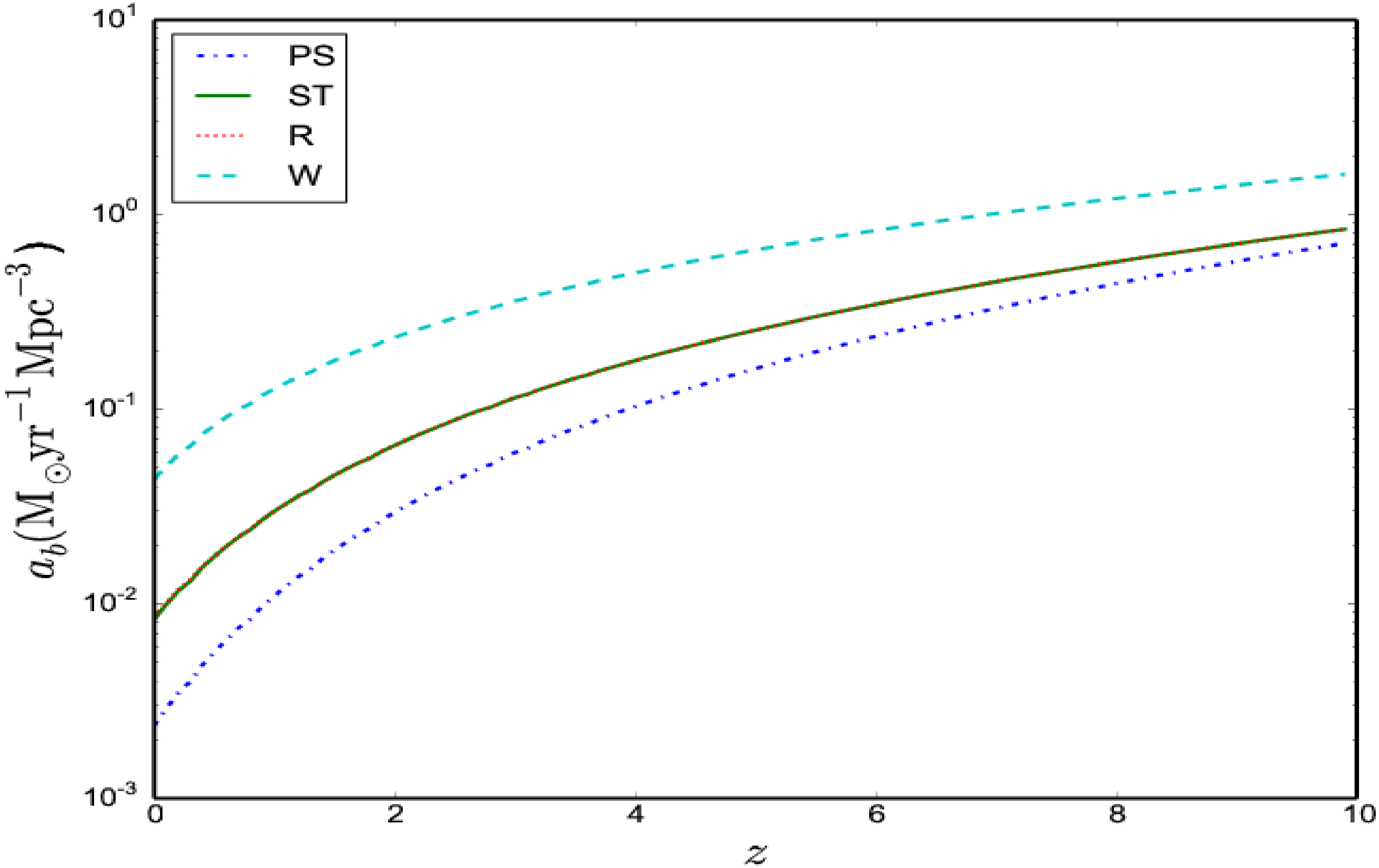
- Taxa de acrescência:

$$a_{\rm b}(t) = \Omega_{\rm b} \rho_{\rm c} \left(\frac{dt}{dz} \right)^{-1} \left| \frac{d f_{\rm b}(z)}{dz} \right|,$$

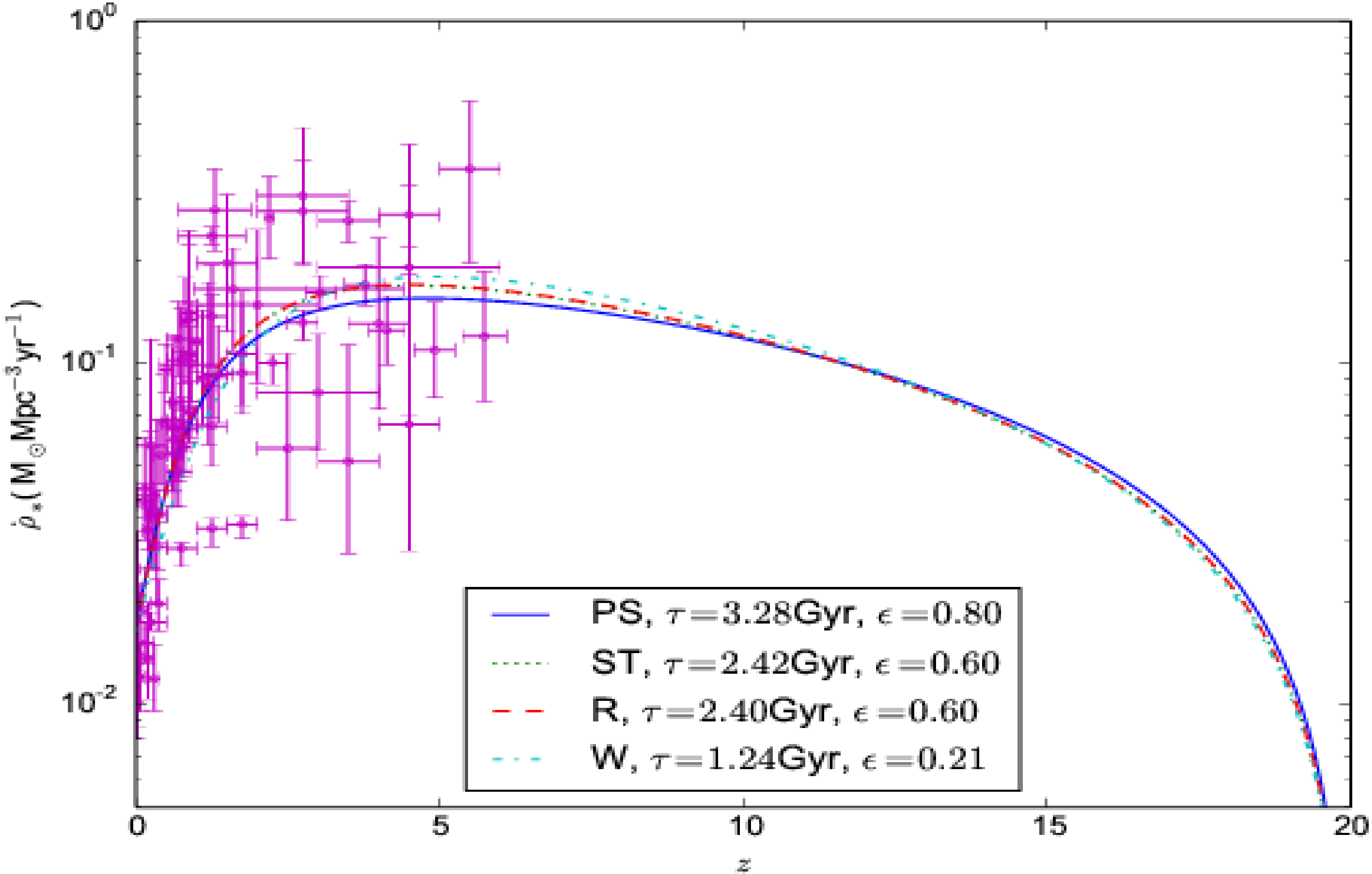
Resultados



Resultados



Resultados

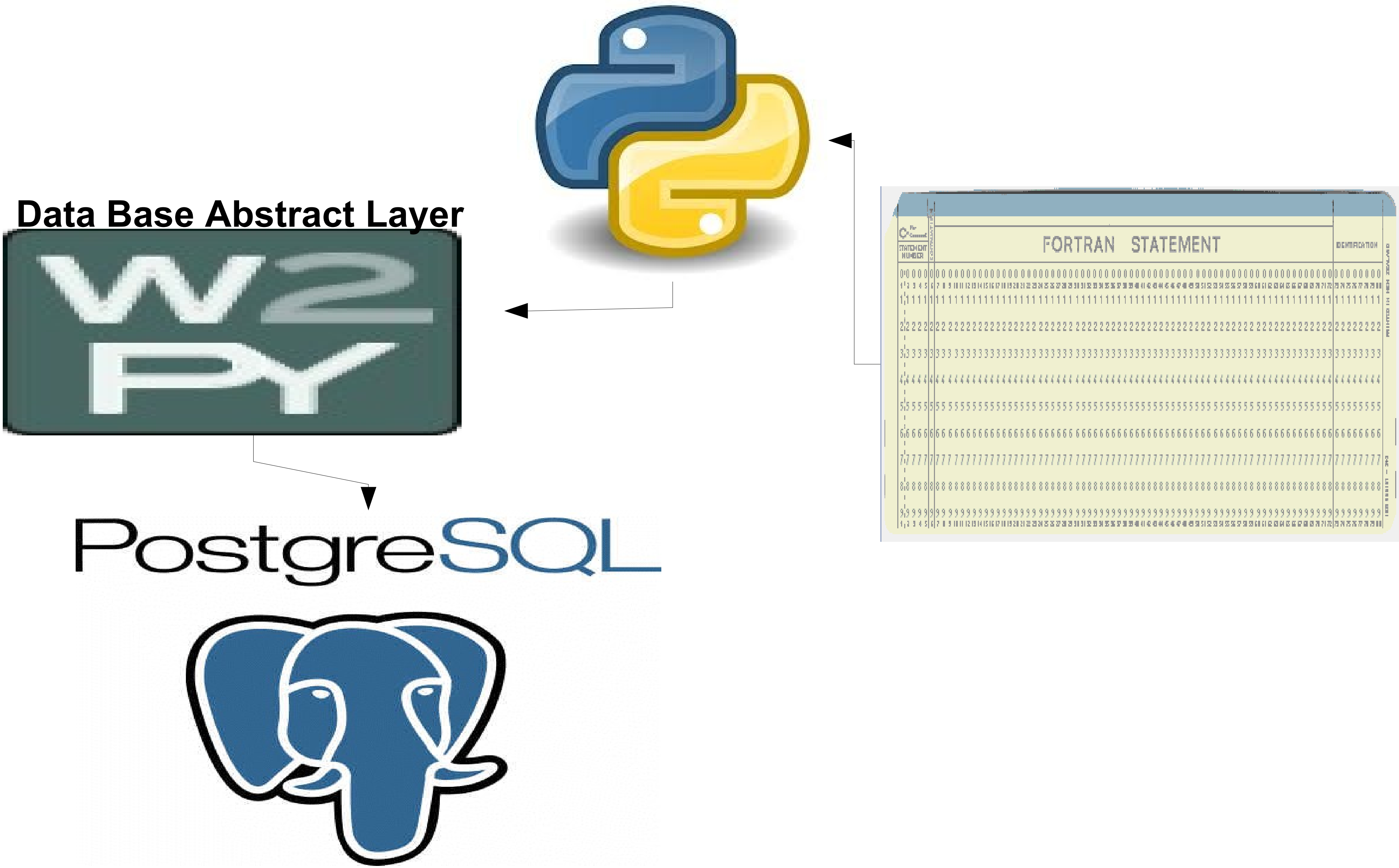


10^0
10^{-1}
10^{-2}
$\dot{\rho}_*(\mathrm{M_\odot Mpc^{-3} yr^{-1}})$
0
5
10
15
20
z
PS, $\tau = 3.28$Gyr, $\epsilon = 0.80$
ST, $\tau = 2.42$Gyr, $\epsilon = 0.60$
R, $\tau = 2.40$Gyr, $\epsilon = 0.60$
W, $\tau = 1.24$Gyr, $\epsilon = 0.21$

Conclusões

- O trabalho traz uma nova visão a analise de enviesamento da matéria escura como traçadora da matéria bariônica em estruturas.
- A escala característica de formação estelar é sensível a distribuição de matéria escura no Universo.
- O reservatório de gás que não é usado no processo de formação estelar é fortemente dependente da distribuição de matéria escura.

Ferramentas Computacionais

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