Reconstruindo a história dos Buracos Negros Supermassivos e da Taxa Cósmica de Formação Estelar.

Dr. Eduardo dos Santos Pereira.
Supervisor: Dr. Oswaldo Duarte Miranda

Divisão de Astrofísca
DAS/INPE

ILLUSTRATION: NASA, DANA BERRY / SKYWORKS DIGITAL

Artigos Submetidos

Astrophysics and Space Science

Accretion History of Active Black Holes from Type 1 AGN

Eduardo S. Pereira[1] and Oswaldo D. Miranda[1]

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.

Artigos Submetidos

New Astronomy

pycosmicstar: A semi-analytical model and Web-Based Application to the Study the Cosmic Star Formation Rate

Eduardo S. Pereira[1]

Divisão de Astrofísica, Instituto Nacional de Pesquisas Espaciais, Brazil, SP 12227-010

Abstract

The Cosmic Star Formation Rate (CSFR) represents the rate of gas conversion in star into a given comove volume and time. Understanding the CSFR has an important role in the modern astrophysics. A semi-analytical form of the CSFR can be used to test alternative cosmological models and to study process that might have been occurred in the called cosmological dark age. The main objective of this work is to detail the pycosmicstar (PYthon COSMIC STar formAtion Rate), which is a new computational package and a web-based application used for exploring the influences of the cosmological parameters and the Initial Mass Function in the CSFR. The main given contribution of this work is to release this package for the scientific community under the GNU General Public License version 3. Moreover, was developed a web-based application **www.cosmicstarformation.com** under responsive design principles.

Keywords: stars: evolution; stars: formation; stars: general; galaxies: evolution

Artigos em Finalização

Astronomy & Astrophysics manuscript no. guedes_pereira_Cecatto_v4
April 4, 2014

Wavelet analysis of solar transients phenomena and sunspots

M. R. G. Guedes[1], E. S. Pereira[1], and J.R. Cecatto[1]

Astrophysics Division - National Institute for Space Research, São José dos Campos - SP, Brazil
e-mail: mrgguedes@das.inpe.br e-mail: pereira.somoza@gmail.com e-mail: jrc@das.inpe.br

Received ; accepted

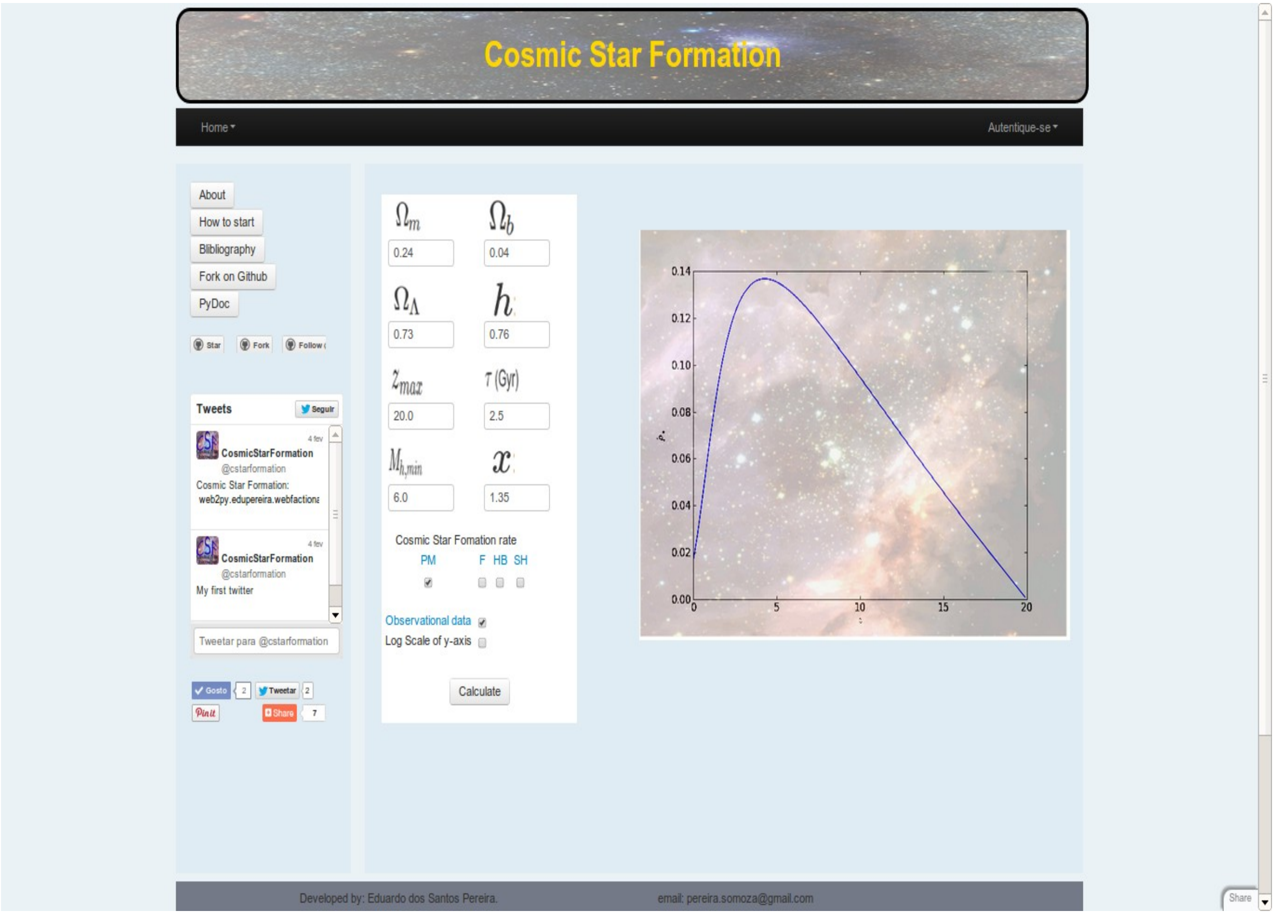
ABSTRACT

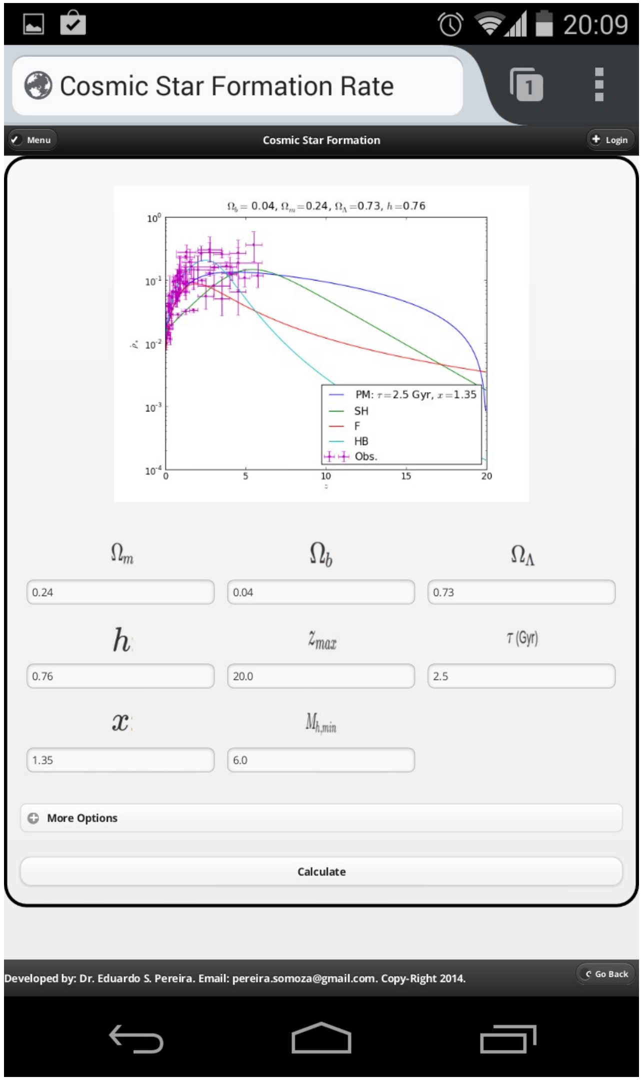
Context. Solar flares and Coronal Mass Ejections (CMEs hereafter) are the most energetic transient phenomena taking place at the Sun, and together, they are the primarily responsible for disturbance at the earth outer space. It has taken several decades that pioneering experiments detected CMEs. However, only recently CMEs daily rate has been introduced as a solar activity indicator closely correlated to the geomagnetic activity. The sunspots in turn are the main indicators of solar activity and evolution of a solar cycle.
Aims. Here, we pursue the identification of patterns in the infra annual scale into the CMEs, solar flares and sunspot number time series using a new data mining process.
Methods. This process consists in the combination of a decomposition method and the wavelet transform technique applied to a complete solar cycle period. A time series decomposition using the simple moving average as a high band pass filtering signals. After that a continuous wavelet transform is applied to the series which permit us to uncover signals previously masked by the original time series.
Results. The results have showed the existence of periodic and intermittent signals in the CMEs, flares and sunspot time series. For the CME and flare series it was observed few and relatively short time intervals without any signal. Those signal with a intermittent character taking place during some epochs of the maximum and descending phases of the solar cycle 23 and rising phase of solar cycle 24.

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

Web Site

www.cosmicstarformation.com





Trabalhos em Finalização

Astronomy & Astrophysics manuscript no. guedes_pereira_Cecatto_v4
April 1, 2014

Wavelet analysis of solar transients phenomena and sunspots

M. R. G. Guedes[1], E. S. Pereira[1], and J.R. Cecatto[1]

Astrophysics Division - National Institute for Space Research, São José dos Campos - SP, Brazil
e-mail: mrgguedes@das.inpe.br e-mail: pereira.somoza@gmail.com e-mail: jrc@das.inpe.br

Received ; accepted

ABSTRACT

Context. Solar flares and Coronal Mass Ejections (CMEs hereafter) are the most energetic transient phenomena taking place at the Sun, and together, they are the primarily responsible for disturbance at the earth outer space. It has taken several decades that pioneering experiments detected CMEs. However, only recently CMEs daily rate has been introduced as a solar activity indicator closely correlated to the geomagnetic activity. The sunspots in turn are the main indicators of solar activity and evolution of a solar cycle.
Aims. Here, we pursue the identification of patterns in the infra annual scale into the CMEs, solar flares and sunspot number time series using a new data mining process.
Methods. This process consists in the combination of a decomposition method and the wavelet transform technique applied to a complete solar cycle period. A time series decomposition using the simple moving average as a high band pass filtering signals. After that a continuous wavelet transform is applied to the series which permit us to uncover signals previously masked by the original time series.
Results. The results have showed the existence of intermittent signals in the CMEs and flares time series for periods less than 128 and 256 days respectively. Those signal with a intermittent character taking place during some epochs of the maximum and descending phases of the solar cycle 23 and rising phase of solar cycle 24.

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

Taxa de Acrescência

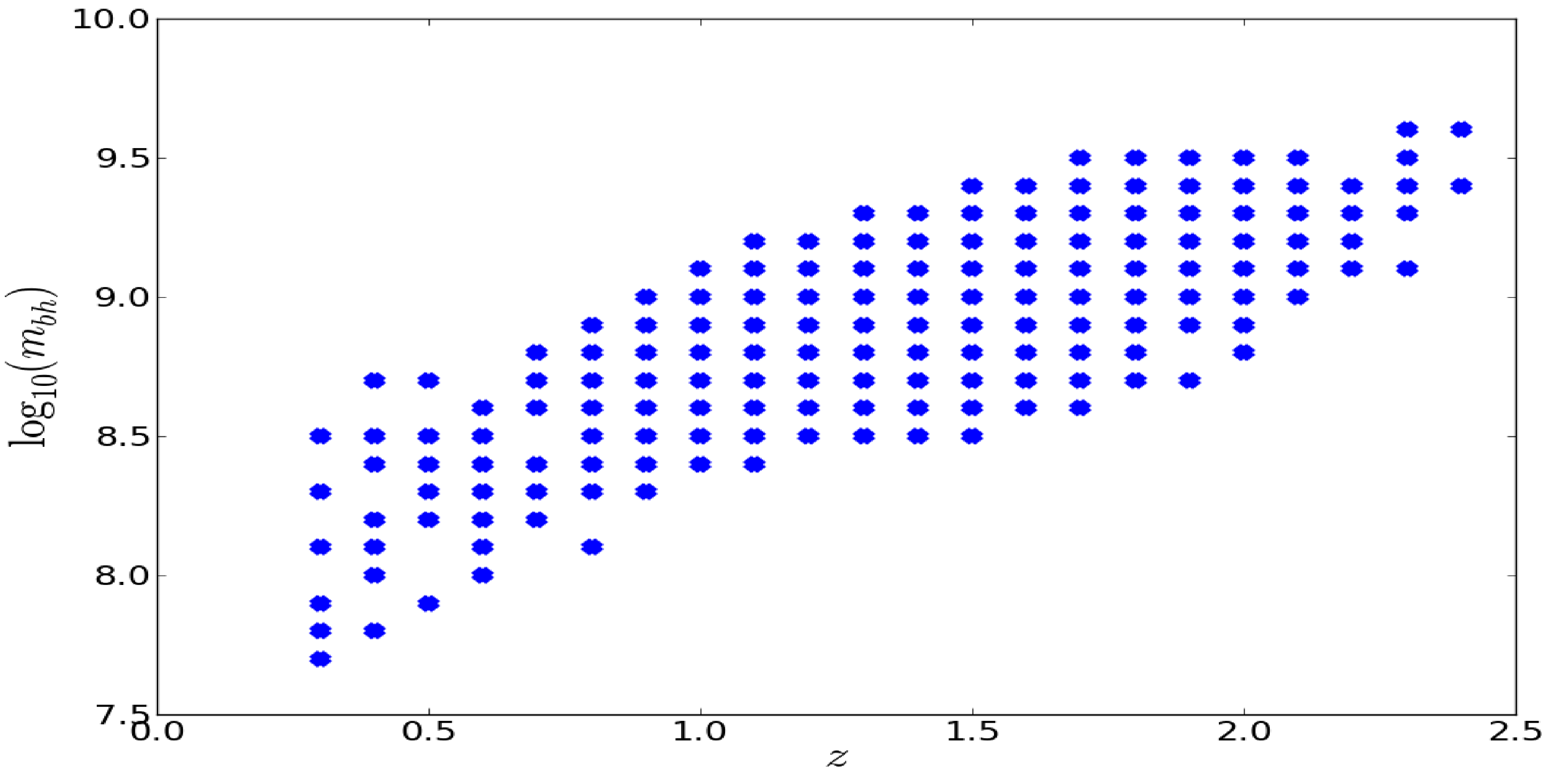
- Dados de quasares do Sloan Digital Sky Survey Data Release 7.
- Catálogo de propriedades complementares de quasares do Sloan Digital Sky Survey Data Release 7 de Shen et al. (2011)

Método de Binagem.
Avaliando a função de probabilidade de distribuição de luminosidade.

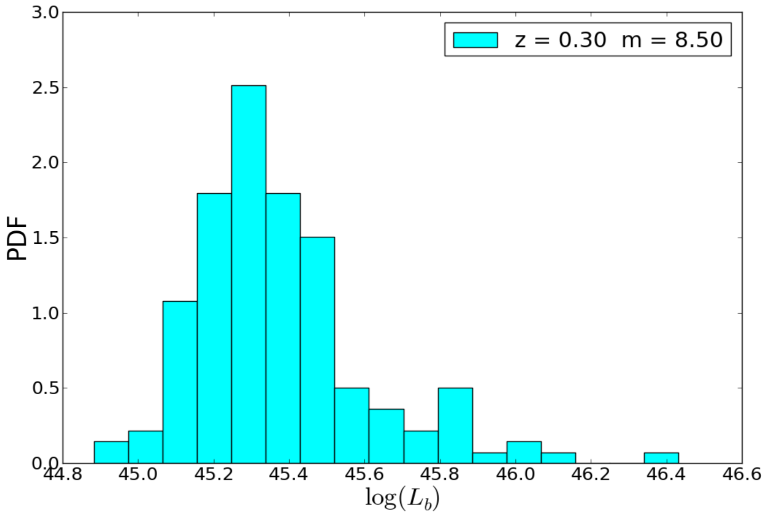
Largura ideal do Histograma. Regra de Friedmon-Diacones:

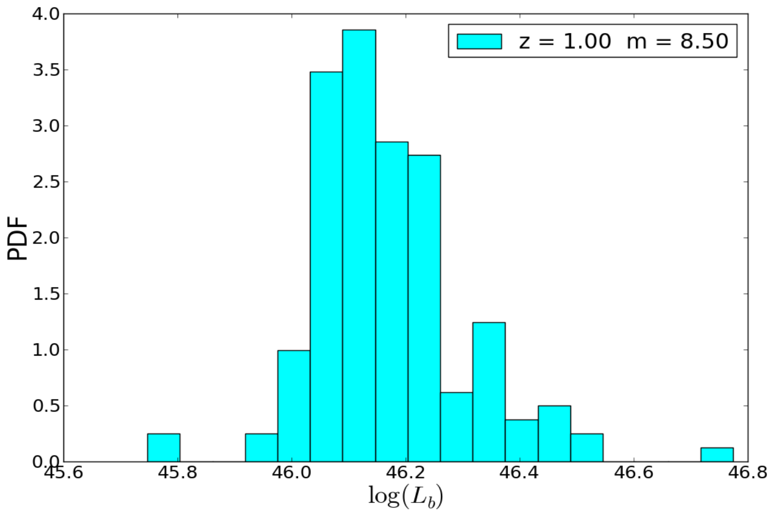
$$w = 2\frac{IQR}{\sqrt[3]{N_{tot}}},$$

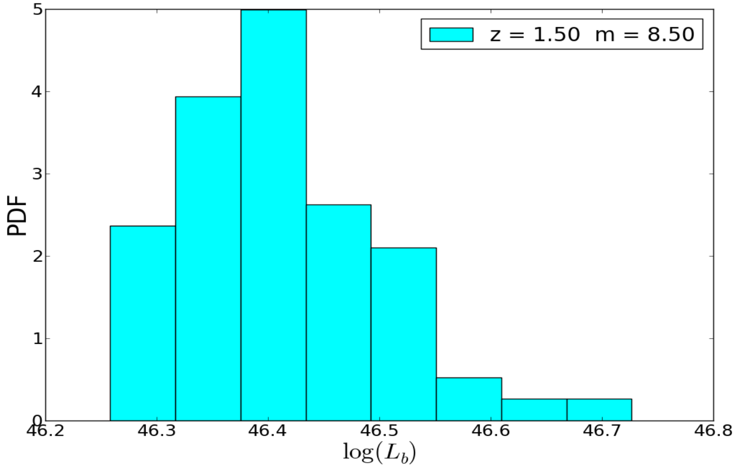
Método de Binagem. Avaliando a função de probabilidade de distribuição de luminosidade.



Método de Binagem.
Avaliando a função de probabilidade de distribuição de luminosidade.

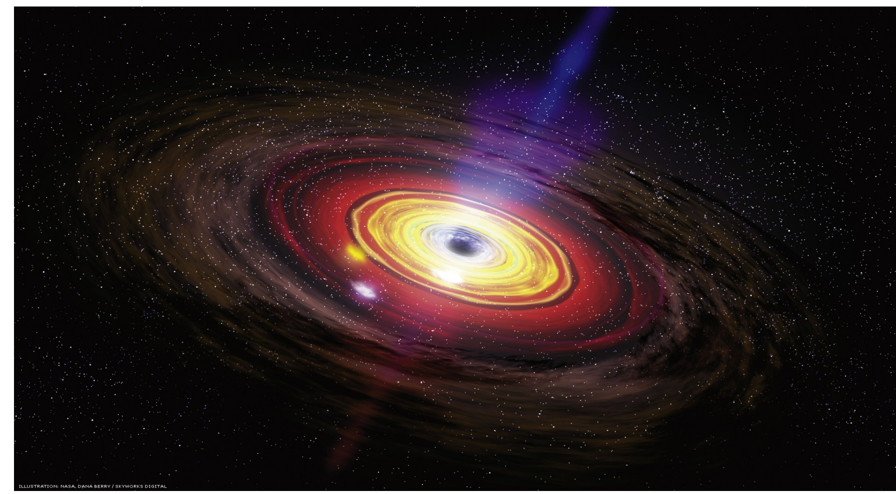






Luminosidade

$$L_b = \bar{\eta} \dot{M}_a c^2$$

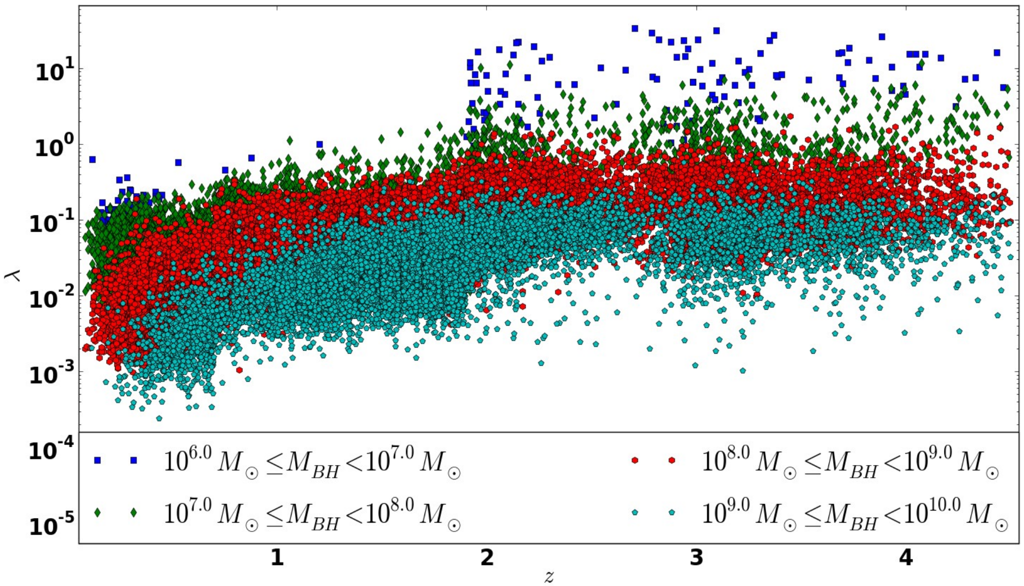


$$\dot{M}_a = \dot{m}_{bh} / (1 - \bar{\eta})$$

$$\bar{L}_b(m_{bh}, z) = \bar{L}_b^* \left(\frac{m_{bh}}{m_{bh}^*} \right)^{\alpha} \left(\frac{\tau_*}{t_u(z)} \right) \exp\left(- \frac{t_u(z)}{\tau_*} \right)$$

Razão de Eddington

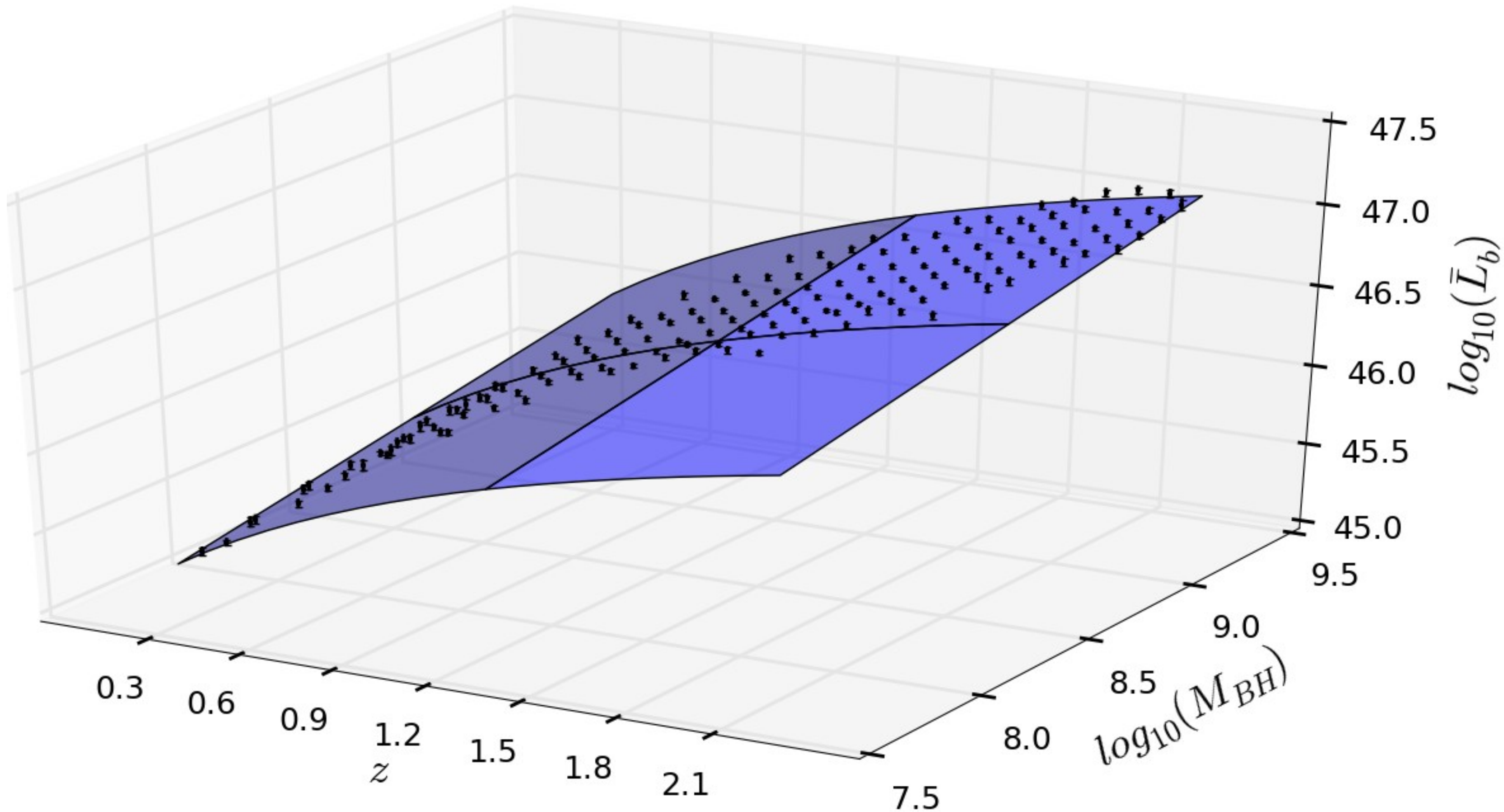
$$L_{edd} = \frac{c^2}{\tau_s} m_{bh}$$



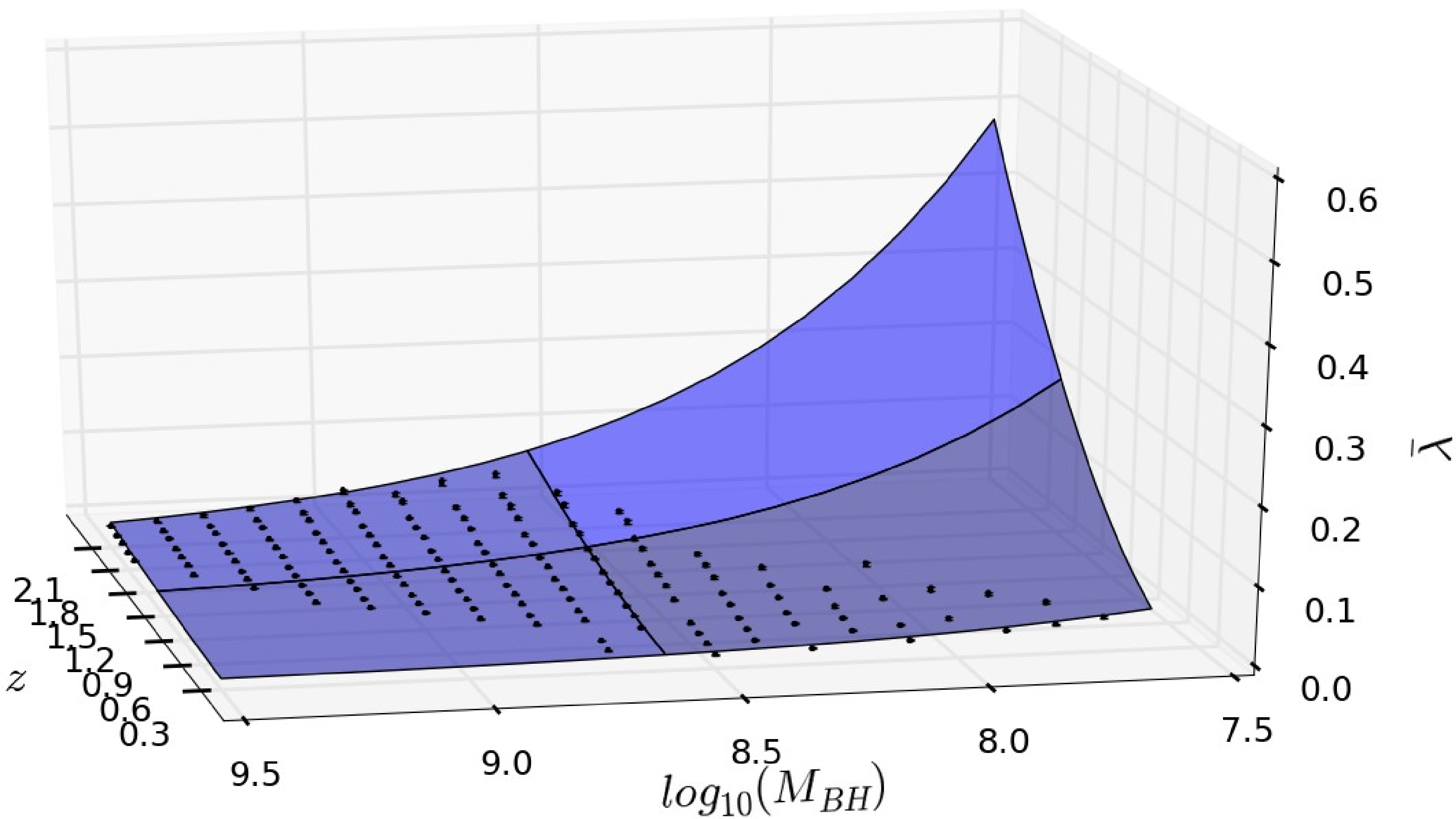
$$\lambda = \frac{L_b}{L_{edd}} = \frac{\tau_s}{c^2} \frac{L_b}{m_{bh}} = \tau_s \frac{\bar{\eta}}{1-\bar{\eta}} \frac{\dot{m}_{bh}}{m_{bh}},$$

$$< \dot{m}_{bh} > = \frac{1}{c^2} \frac{1-\bar{\eta}}{\bar{\eta}} \bar{L}_b(z, m_{bh}).$$

Luminosidade Bolométrica Média



Razão de Eddington Média



Taxa de Acrescência Média

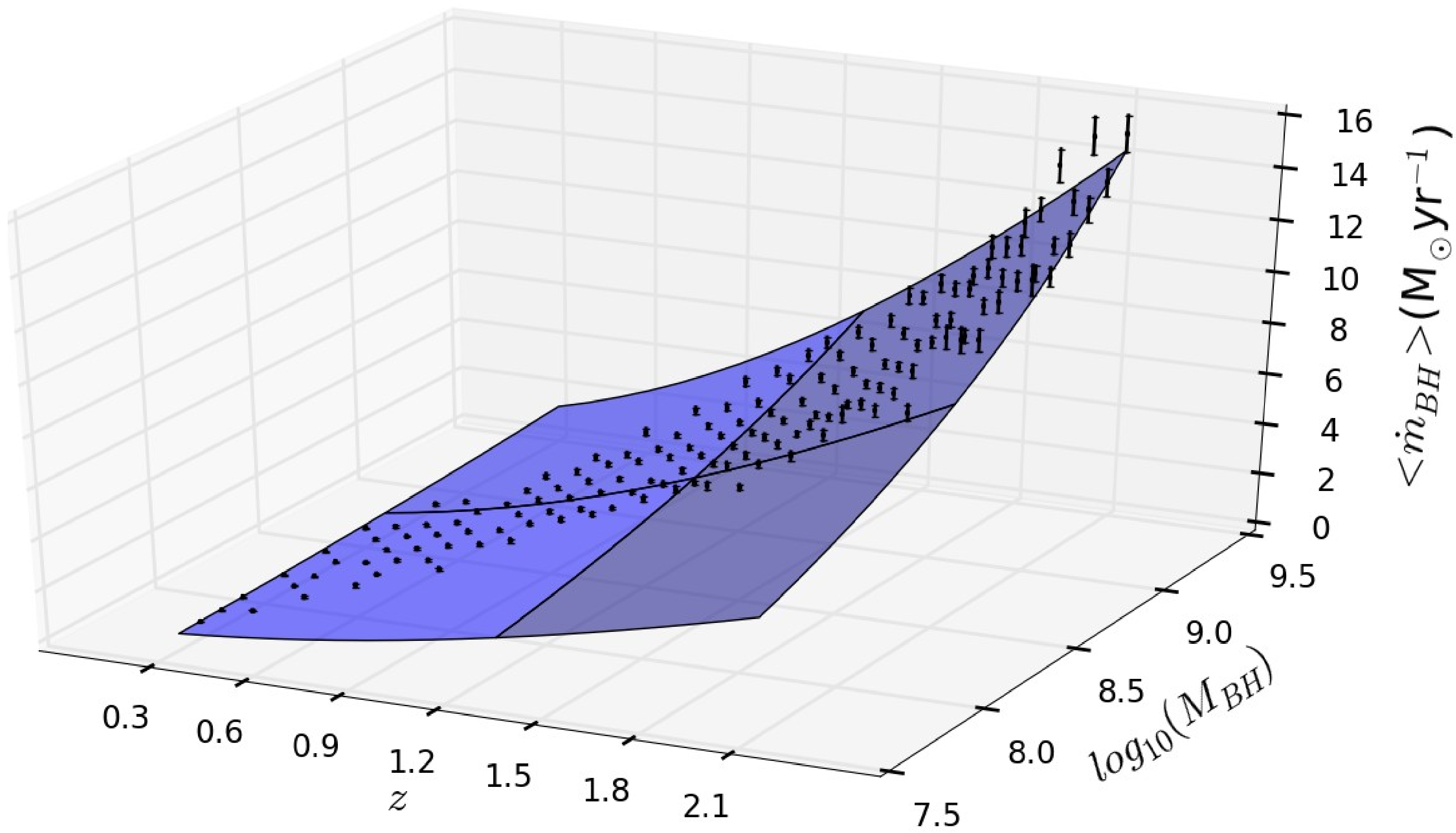
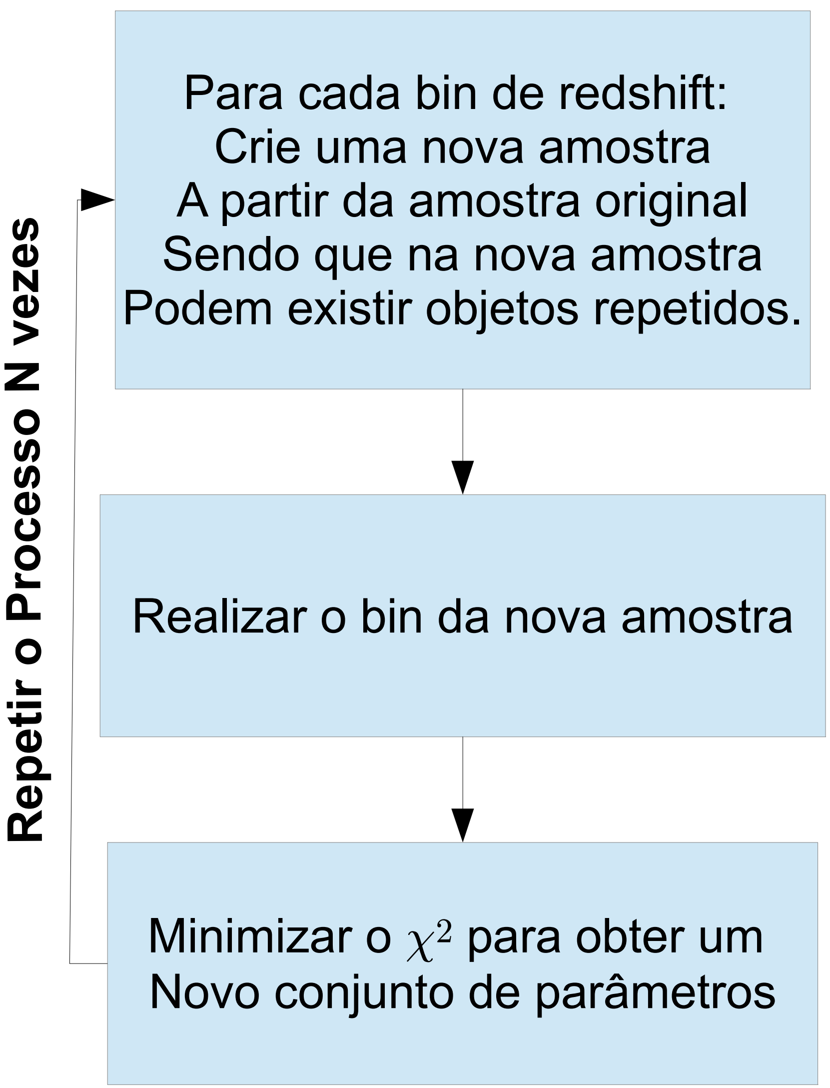


Table 1 Best fit parameter: standard error, bias. All parameters are within 95% of confidence intervals. The values were obtained from 10000 Simulations.

	best fit	bias	error
L_b^*	3.05×10^{47}	6.65×10^{45}	3.14×10^{46}
m_{bh}^*	2.19×10^{11}	1.88×10^{10}	4.88×10^{10}
α	2.71×10^{-1}	-1.29×10^{-4}	1.18×10^{-2}
τ_*	4.81×10^{9}	1.05×10^{7}	1.69×10^{8}

Testes Estatísticos

- Bootstrap NÃO Paramétrico (Wehrens et al. 2000):



- Significância:

$$r^*_{(B+1)\alpha_p/2} \leq \theta \leq r^*_{(B+1)(1-\alpha/2)}$$

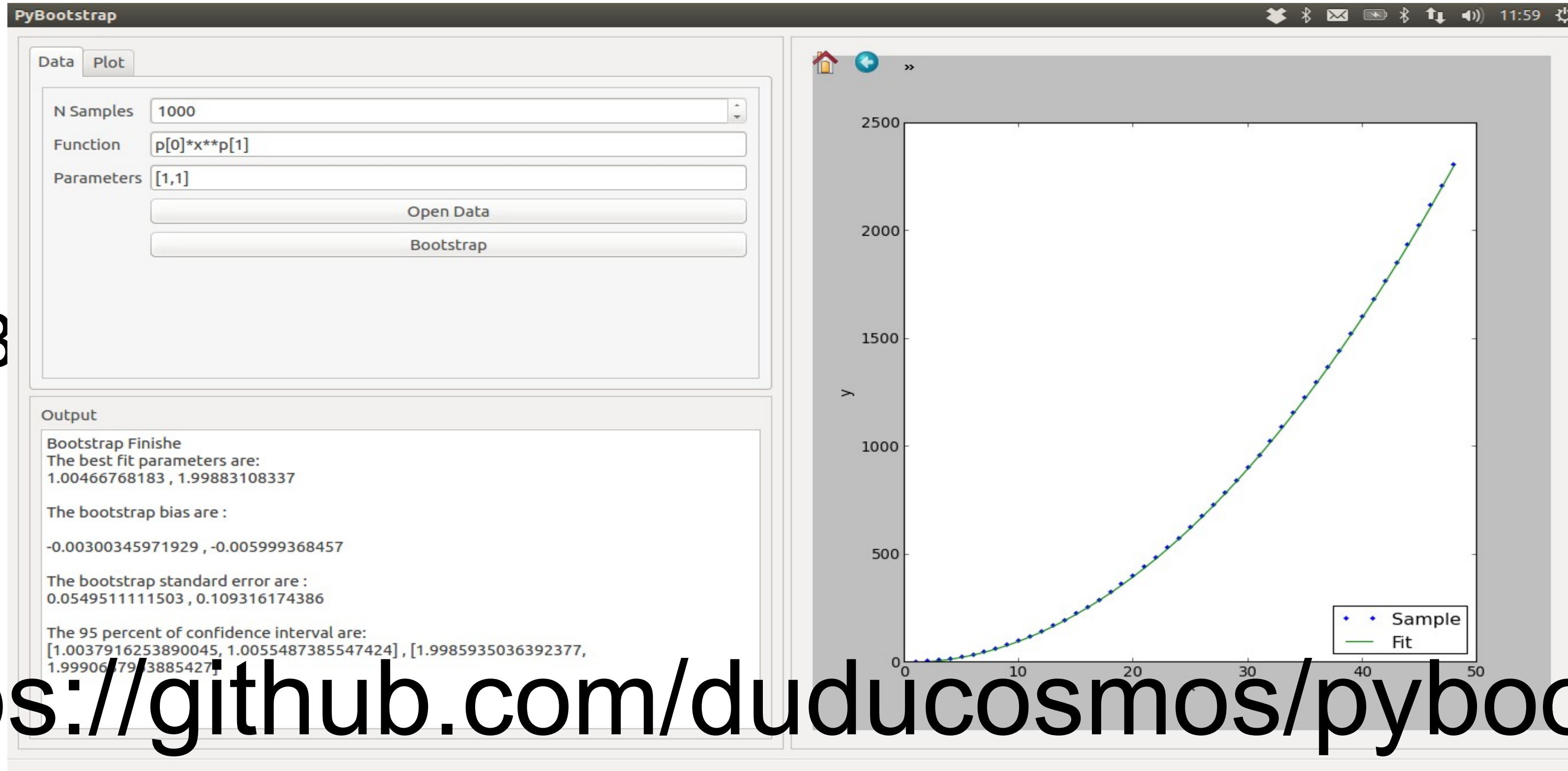
- Desvio Padra:

$$\sigma_B = \sqrt{\frac{1}{B-1}\sum_i \left(\hat{\theta}_i^* \theta^*\right)}$$

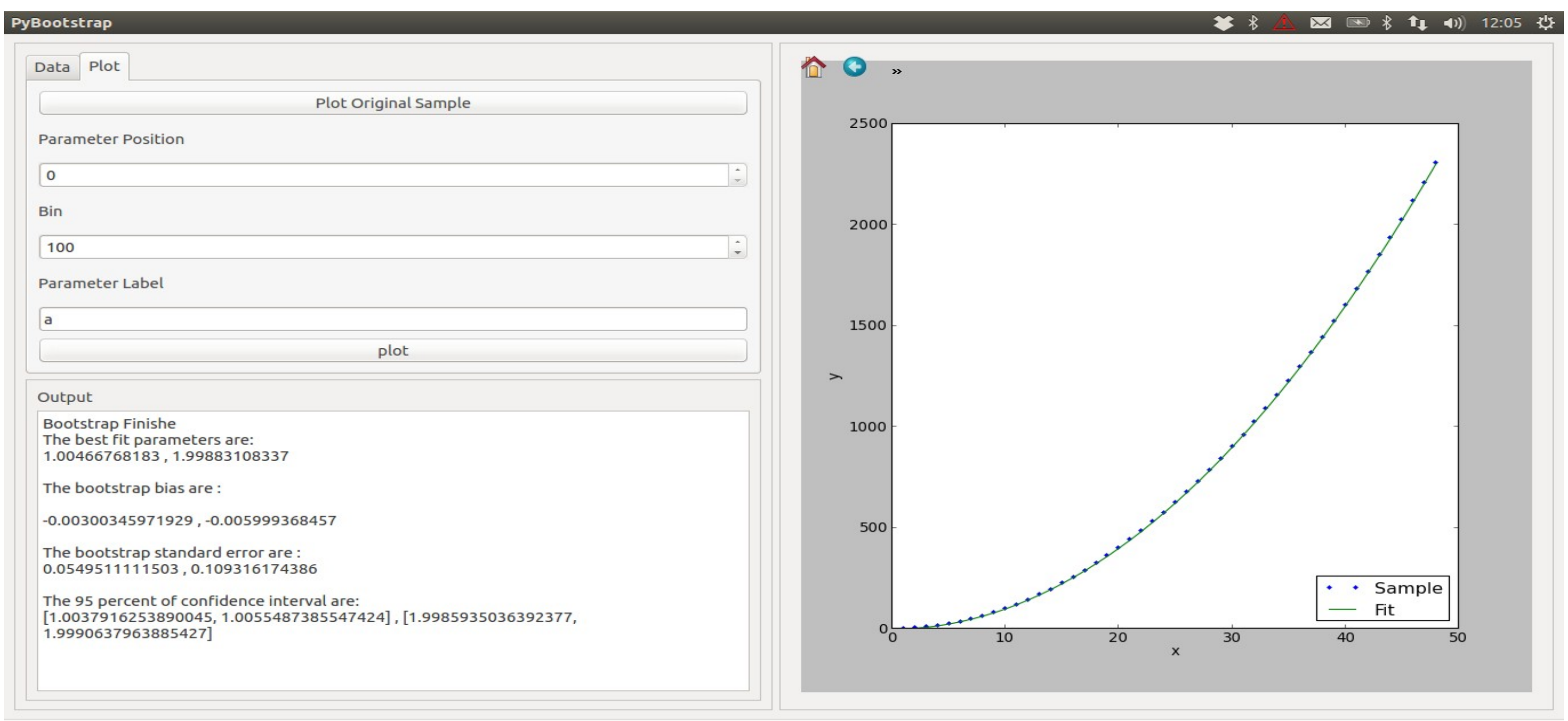
- Vies:

$$bias_B = 100\% \frac{abs(\hat{\theta}^* - \theta)}{abs(\theta)}$$

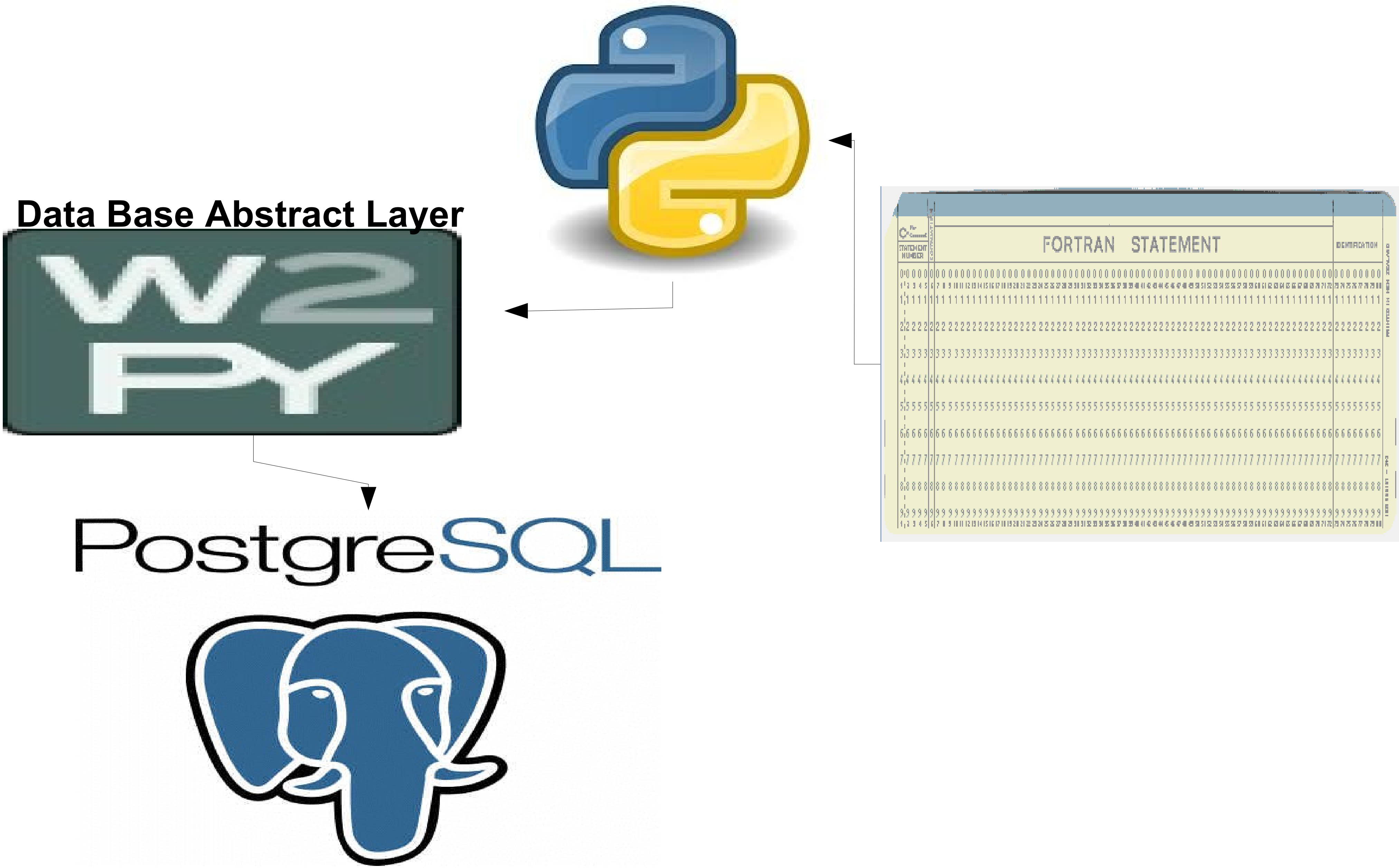
- B … 00):



https://github.com/duducosmos/pyboostrap



Ferramentas Computacionais




MUITO OBRIGADO
ILLUSTRATION: NASA, DANA BERRY / SKYWORKS DIGITAL