Radio Properties of extremely-accreting quasars

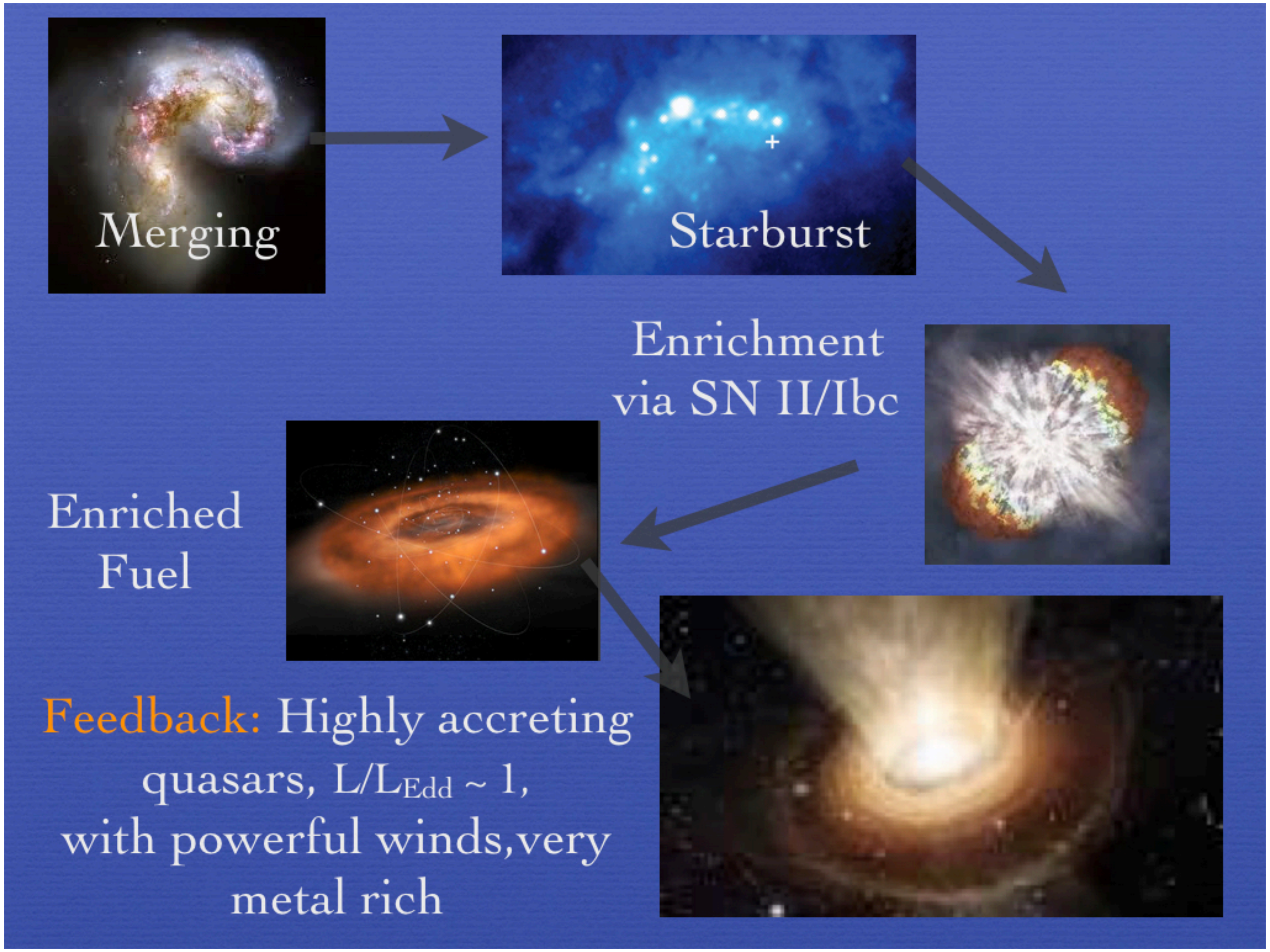
Thesis project for the “Laurea Magistrale”
with the Department of Physics & Astronomy of the University of Padova

Supervisors: Mauro D’Onofrio (Università di Padova)
Paola Marziani (INAF)

	Radio Properties of extremely-accreting quasars
Committment	6 months
Background	astronomical spectroscopy, accretion and non thermal processes around compact objects, elementary programming ability (python or c++)
Methods	observational (interpretation of quasar optical and UV spectra, of radio data), statistical (multivariate correlation analysis)
Activity	Reading of the most recent and pertinent literature on quasars
	Analysis of the radio/optical/FIR/sub-mm data starting from samples of optically selected extremely accreting quasars
	Writing of the thesis: critical analysis of literature, research activity
Outcome	Degree; collaboration to a research paper

Extremely accreting quasars (xAs) are the quasars with the highest radiative output per unit black-hole mass, close to their Eddington limit.

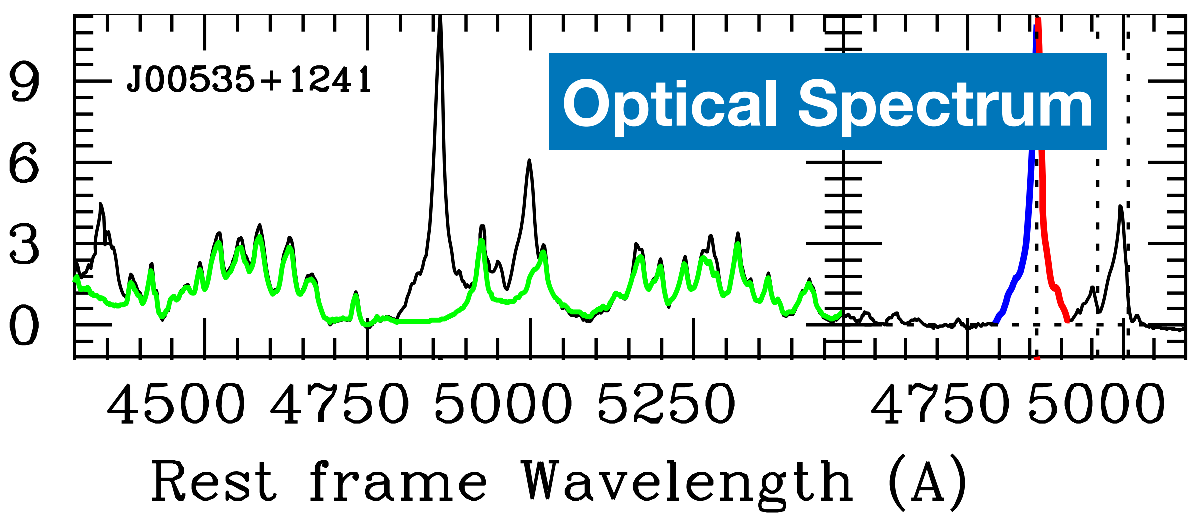
- The feedback effects of xA quasars on the host galaxies can be extreme.
- xA quasars have been proposed as distance indicators.
- **Their properties are poorly known.**

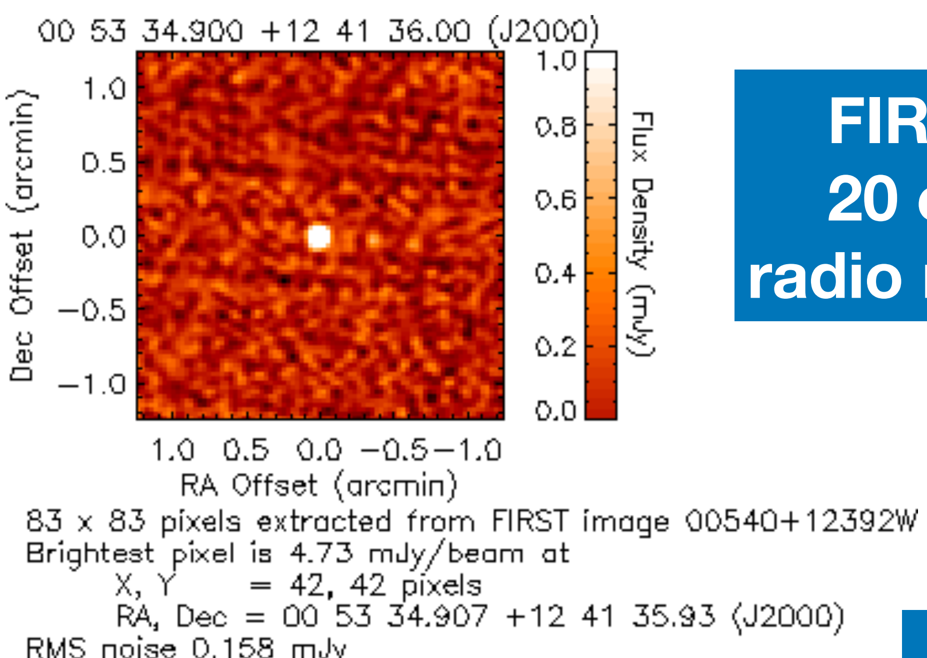


Two well-focused questions:

- which is the fraction of radio-loud xAs?
- what is the origin of their radio power? A relativistic jet of thermal emission?

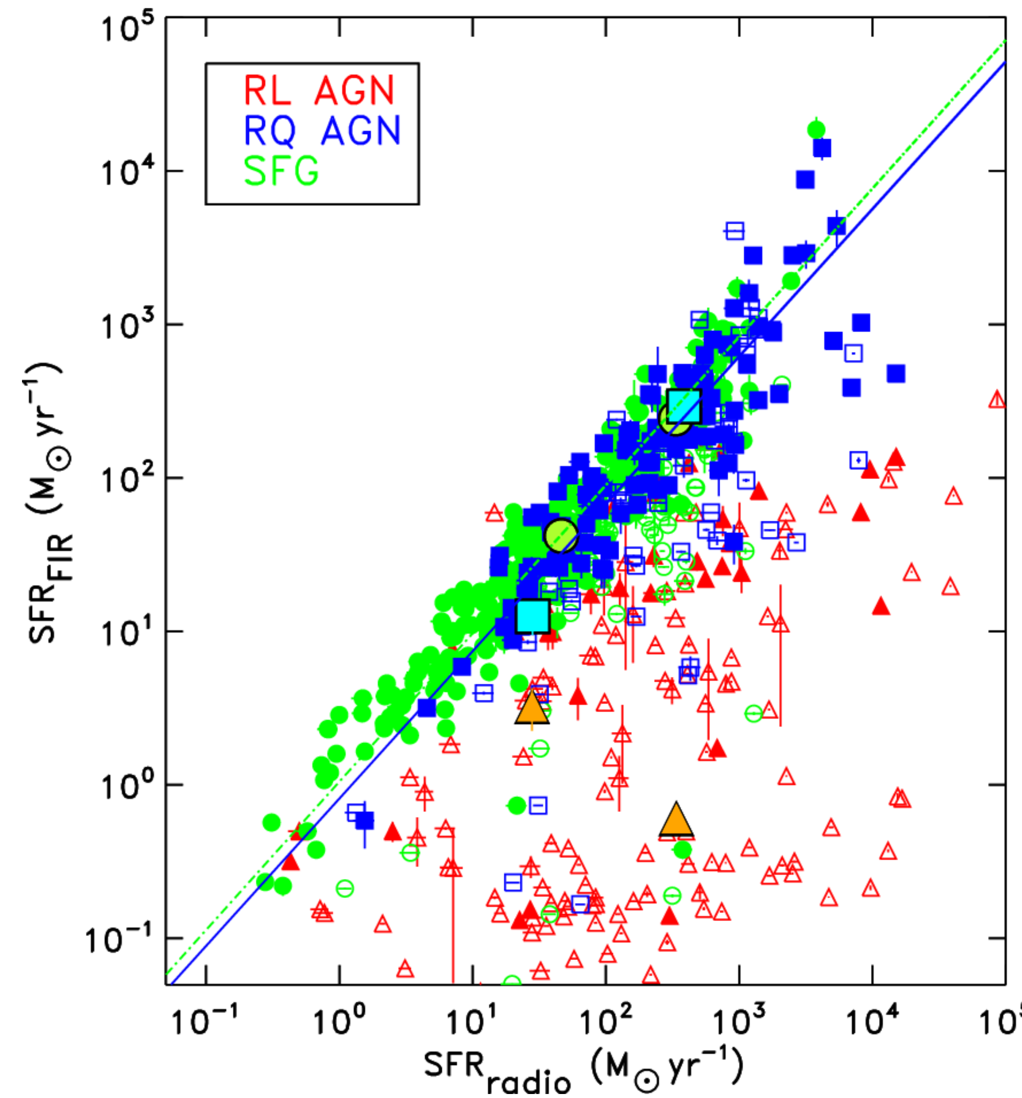
- Analysis of samples of optically selected xA quasars (SDSS; proprietary data; 100-200 sources), classification as radio quiet, intermediate or loud, using several criteria.
- Analysis of their radio properties (morphology and radio spectrum), sub-mm, IR, and relation to their optical spectroscopic properties.
- Implications: radio power from SF processes, relativistic ejections at high accretion rate?





FIRST 20 cm radio maps

Bonzini et al. 2015



Identification of RL/RI/RQ: ratio radio-to-optical power, diagram SFR FIR vs SFR radio

Quasars as distance indicators for cosmology

Thesis project for the "Laurea Magistrale"
with the Department of Physics & Astronomy of the University of Padova

Supervisors: Mauro D'Onofrio (Università di Padova)
Paola Marziani (INAF)

	Extremely accreting quasars as distance indicators
Committment	6 months
Background	astronomical spectroscopy, accretion around compact objects, elementary programming ability (python or c++), cosmology
Methods	observational (analysis of quasar optical and UV spectra), statistical (multivariate correlation analysis)
Activity	Reading of the most recent and pertinent literature
	Analysis of random and systematic effects on luminosity from samples of optically selected extremely accreting quasars
	Writing of the thesis: critical analysis of literature, research activity
Outcome	Degree; collaboration to a research paper

Quasars as distance indicators for cosmology

Thesis project for the "Laurea Magistrale"
with the Department of Physics & Astronomy of the University of Padova

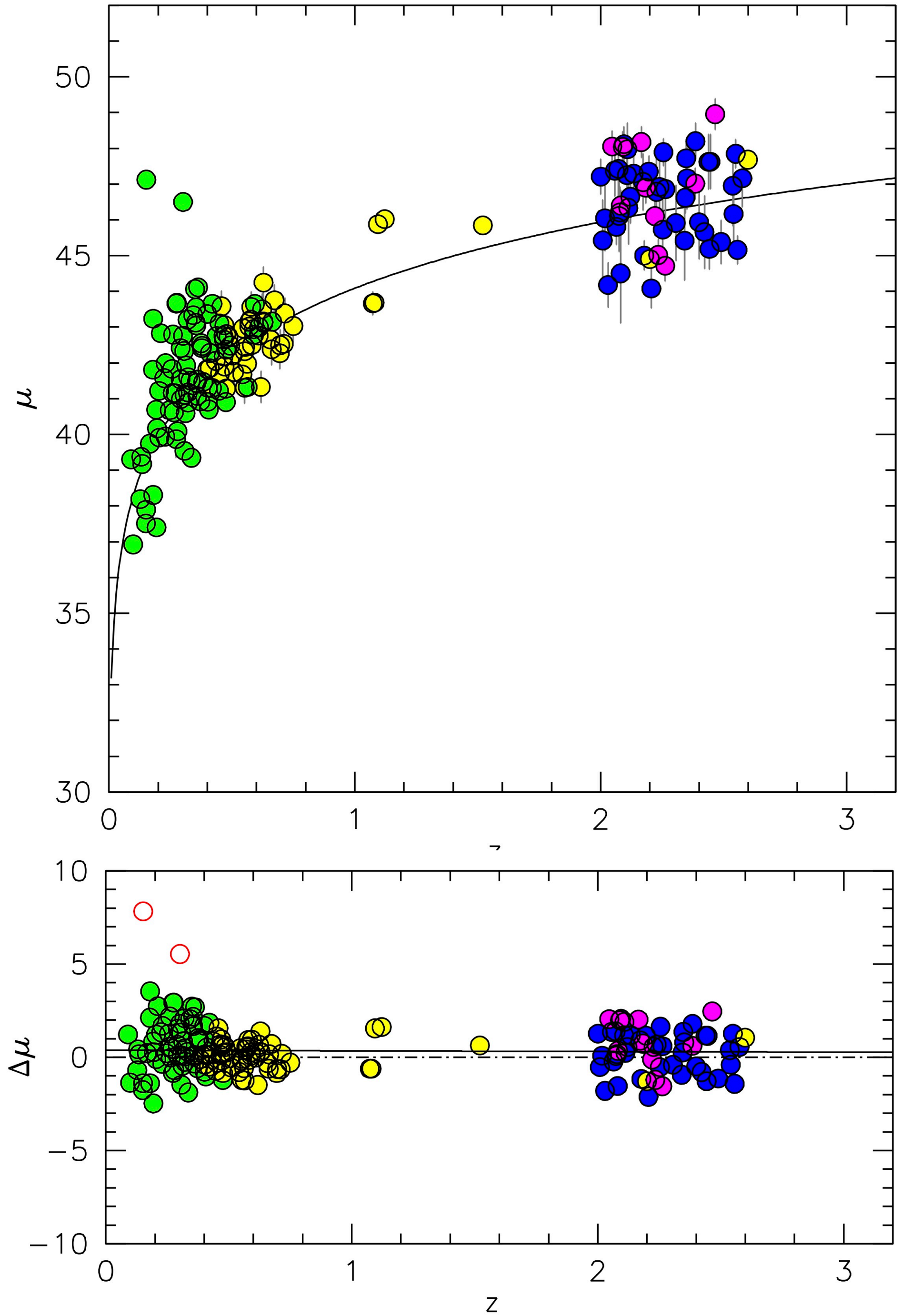
Supervisors: Mauro D'Onofrio (Università di Padova)
Paola Marziani (INAF)

Sources	Parameters	Basic equation	Reference	Virial
extremely accreting quasars (xA)	Hard X-ray slope, velocity dispersion	$\mathcal{D}_\bullet = \frac{1}{\sqrt{4\pi}}\left[\frac{\ell_0\left(1+a\ln\dot{m}_{15}\right)f_{\rm BLR}R_0}{G\kappa_{\rm B}}\right]^{1/2(1-\alpha)}\frac{V_{\rm FWHM}^{1/(1-\alpha)}}{F_{5100}^{1/2}}.$	Wang et al.2013	V
extremely accreting quasars (xA)	virial velocity dispersion: FWHM(Hβ) Eddington ratio = const	$L \propto \mathrm{FWHM(H\beta)}^4$	Marziani & Sulentic 2014	V
general quasar populations	X-ray variability, velocity dispersion	$\log\frac{L}{\mathrm{erg\,s^{-1}}} + 4\log\frac{\mathrm{FWHM}}{10^3\,\mathrm{km\,s^{-1}}} = \alpha\log\sigma^2_{\rm rms} + \beta,$	La Franca et al. 2014	V
mainly quasars at z<1	Reverberation mapping time delay τ	$\tau/\sqrt{F} \propto d_L$	Watson et al 2011, 2013; Czerny et al.	
general quasar populations	non linear relation between soft X and UV	$\log(F_X) = \Phi(F_{UV}, D_L) = \beta' + \gamma\log(F_{UV}) + 2(\gamma-1)\log(D_L),$	Risalti & Lusso 2016	

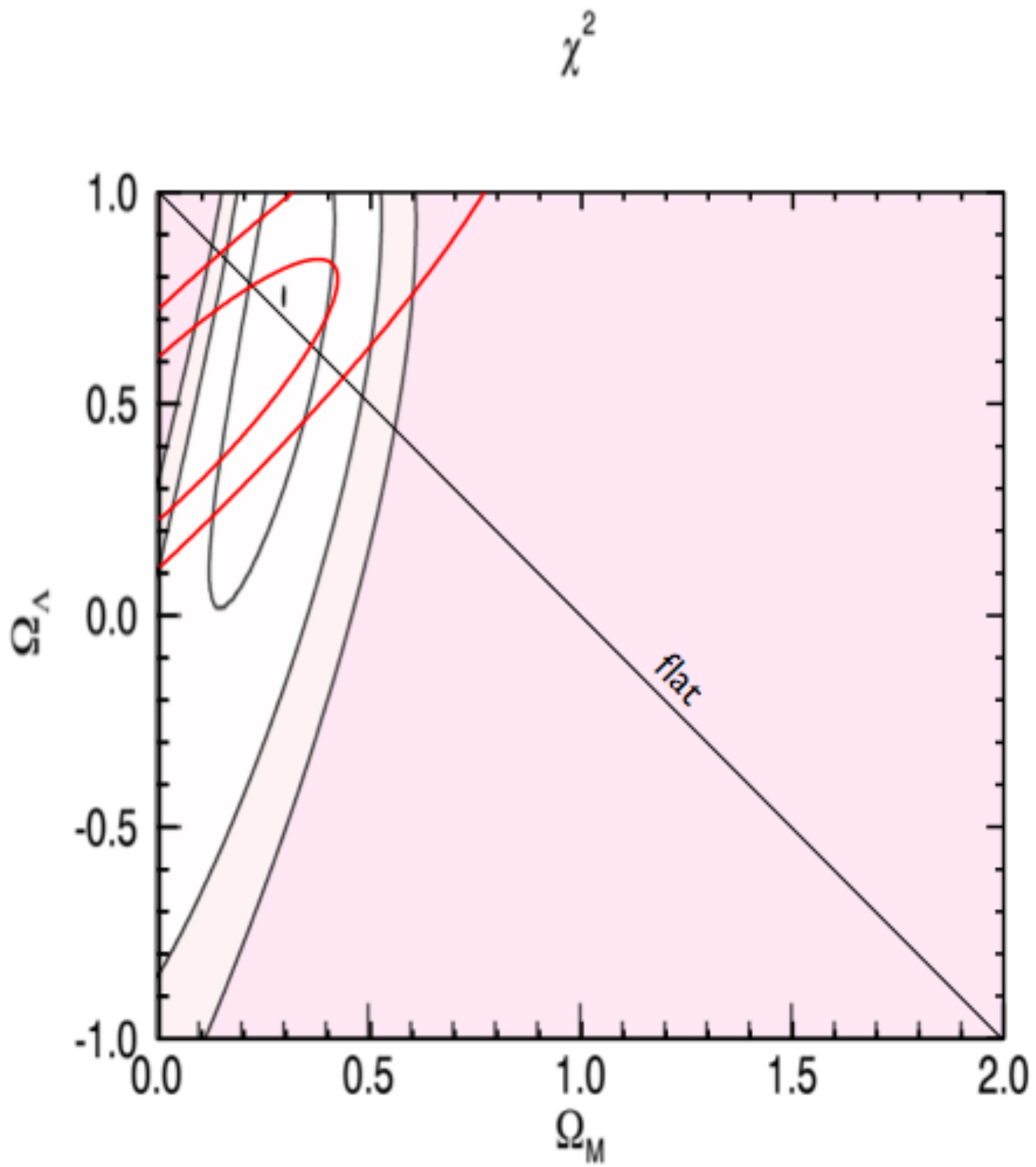
Eddington standard candles

- First part: critical review of several methods to estimate the cosmic matter and dark energy density that have been proposed in the past few years.

* Second part: Observational and statistical study of the dependence of luminosity estimates on observational and physical parameters of xA quasars



* Third part: Simulation of statistical and systematic effects which influence the estimates of the cosmic matter and dark energy density



The goal is to reduce the scatter in the Hubble diagram from xA quasar data.

Who we are (“the extreme team”)

Part of a wide collaborative effort (Italy, Spain, Mexico)

Paola Marziani	INAF-OAPd, Italy
Mauro D’Onofrio	Dip. Fisica & Astronomia Università di Padova, Italy
C. Alenka Negrete	Instituto de Astronomia, UNAM, Mexico
Deborah Dultzin	Instituto de Astronomia, UNAM, Mexico
Ascensión del Olmo	IAA, Granada, Spain
Mary Loli Martínez-Aldama	IAA, Granada, Spain
Giovanna M. Stirpe	INAF, OASS, Bologna, Italy