



The ILMT, QSO's and gravitational lenses



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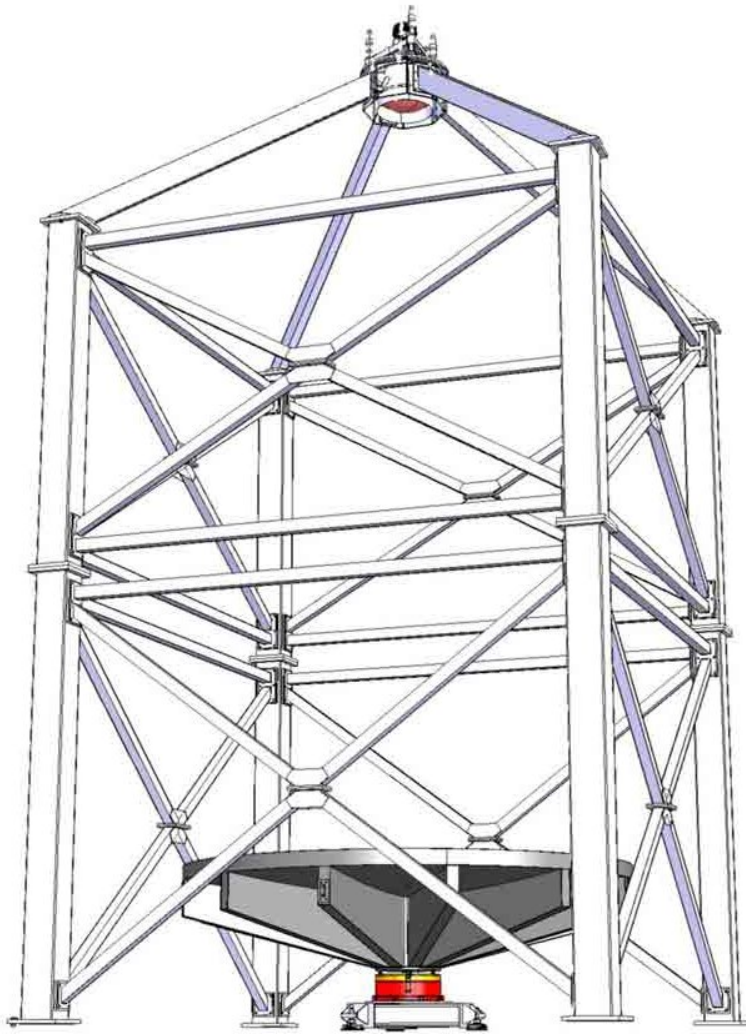
ARC Meeting, 2012



Presentation Layout

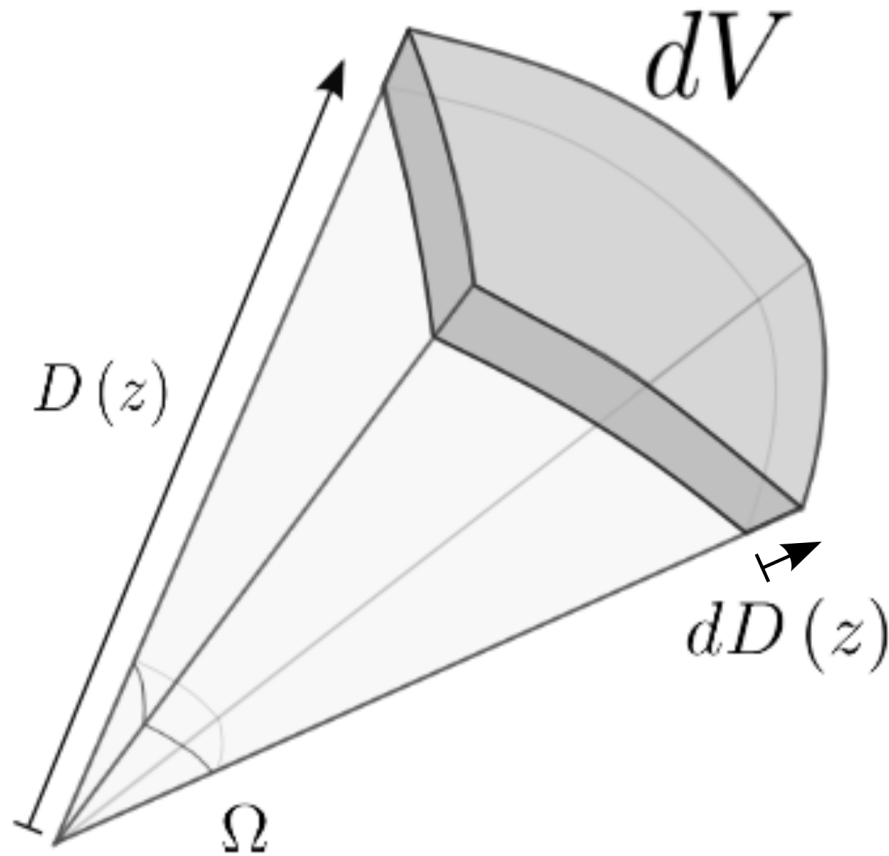
- The ILMT project
- QSO population to be detected by the ILMT
- Fraction of gravitationally lensed QSO's
- Conclusions

The ILMT



- 4m Zenithal telescope
- FOV : strip of $\sim 30'$
(~ 156 sq. deg.)
- Imaging \sim same strip every night
 - Photometric follow up
- Difference imaging :
 - Detection variable object (QSO's)
 - Detection of Gravitational lensed QSO's

QSO's to be detected



- FOV for QSO detection?
 - High galactic latitude fields ($|l| > 30^\circ$)
 - ~ 88 sq. deg.

- Volume defined by the FOV?
 - Static Euclidean universe :

$$dV = \Omega D^2 dD$$

- Expanding Universe?
(as a function of z)

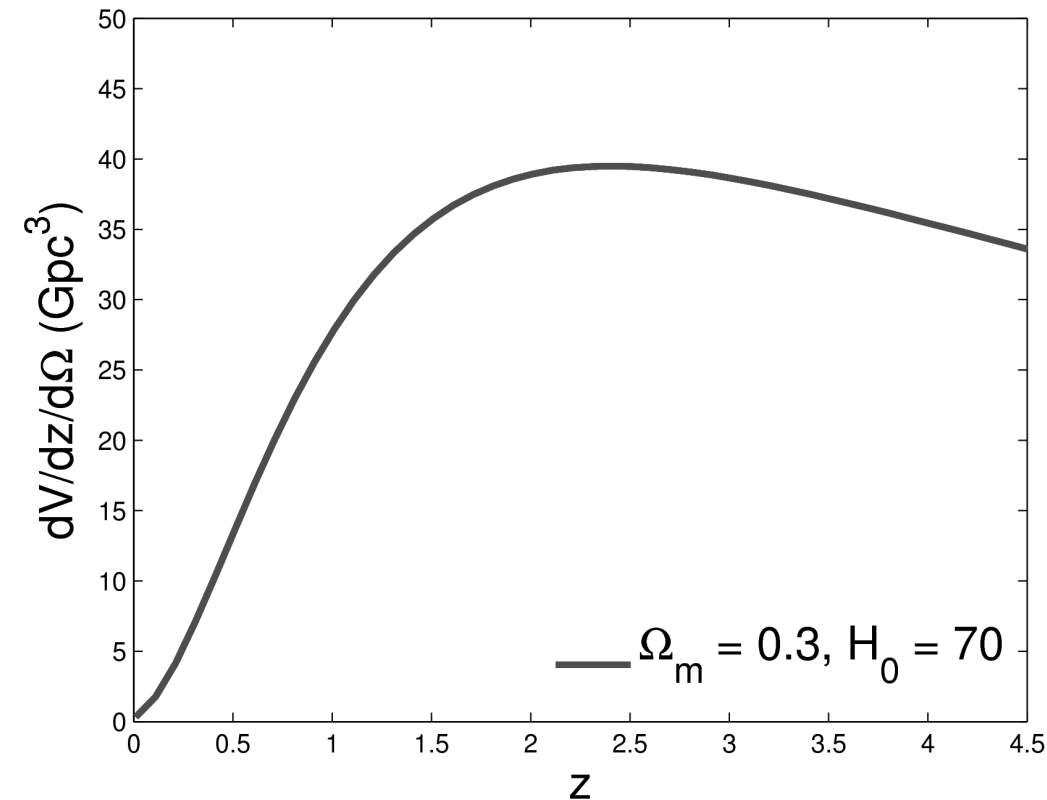
QSO' to be detected

- In a flat expanding universe:

$$dV = \Omega D_C^2 \frac{dD_C}{dz} dz$$

- QSO population in the accessible volume?
 - Divide volume in redshift bins
 - Calculated the associated volume
 - QSO density as a function of z ?

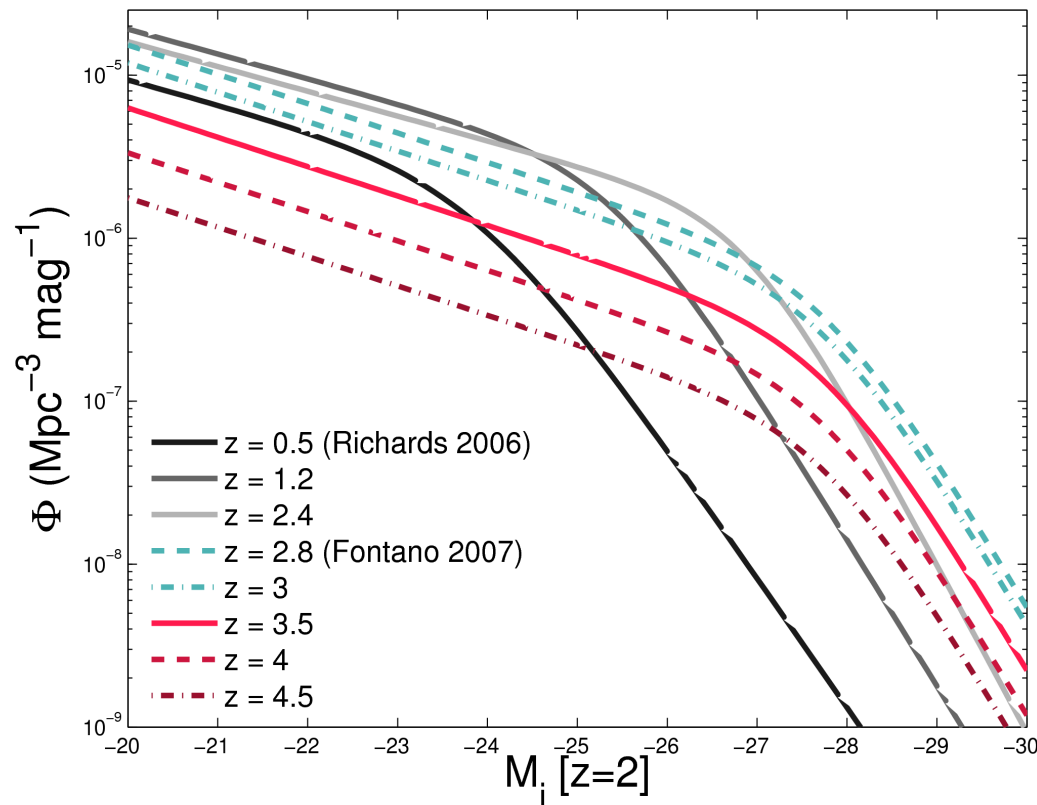
→ QSO Luminosity Function



QSO's Luminosity function

- QSO LF in SDSS I band:

$$\Phi = \frac{\Phi_{\star}}{10^{0.4(\alpha+1)(M_i - M_{\star})} + 10^{0.4(\beta+1)(M_i - M_{\star})}}$$



- Redshift evolution :

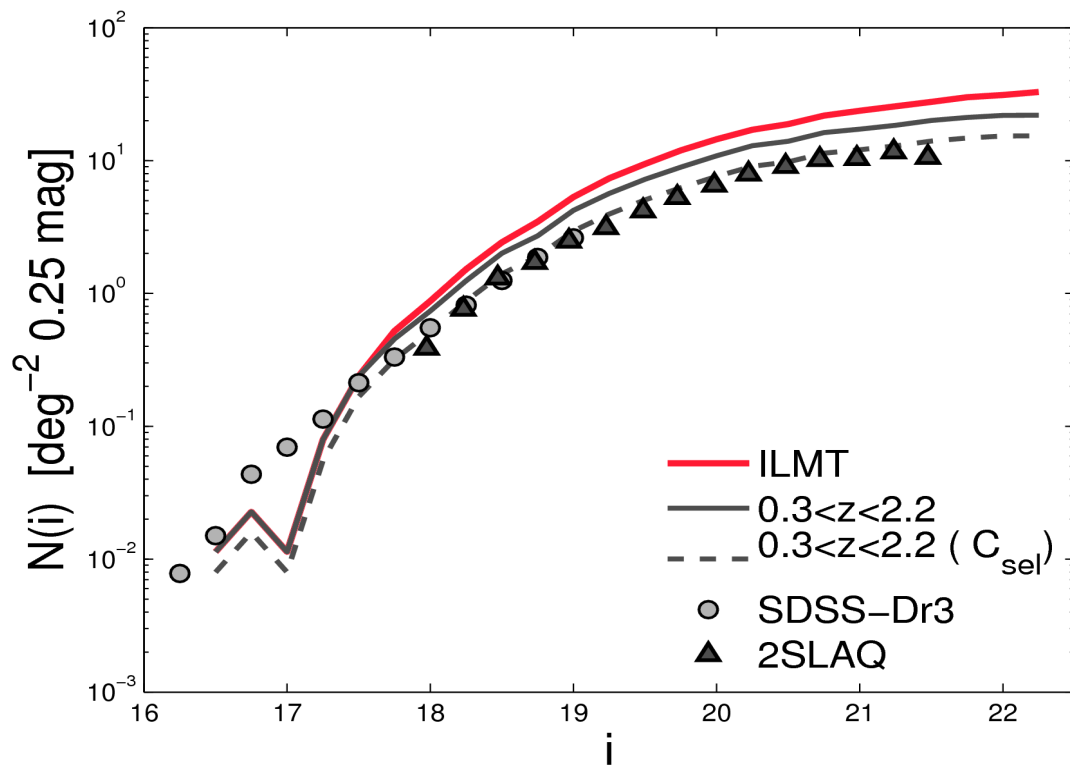
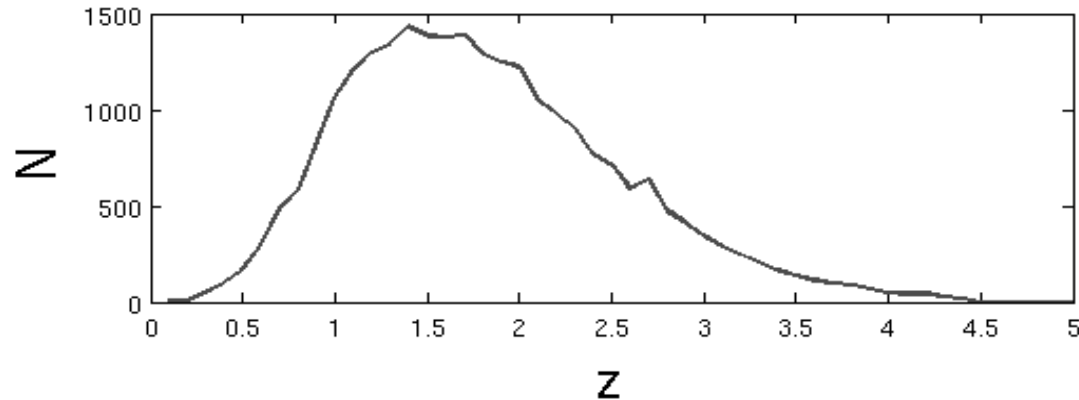
- $z < 2.6$: Richards 2006
- $z > 3.5$: Fontano 2007
- $2.6 < z < 3.5$: extrapolation of Fontano 2007

- Apparent magnitude :

$$m_i = M_i + DM + K$$

- Brighter than 22.5? → we keep it!

Catalog characteristics

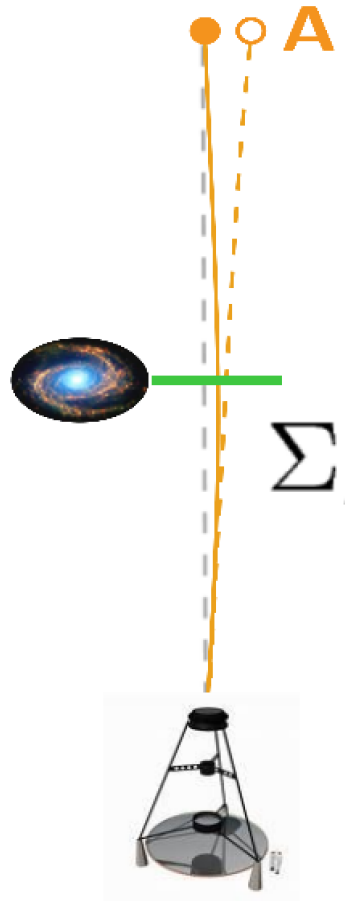
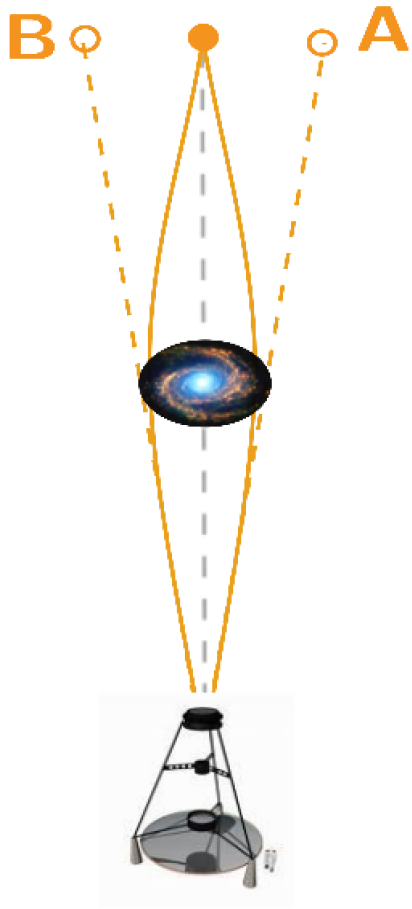


- Redshift distribution:
peaking at $z \sim 1.6$
- Validity check : Comparison of the differential number count function
→ mock catalog overestimates the QSO population by $\sim 30\%$
- Reliability?
(→ 48000 QSO's)

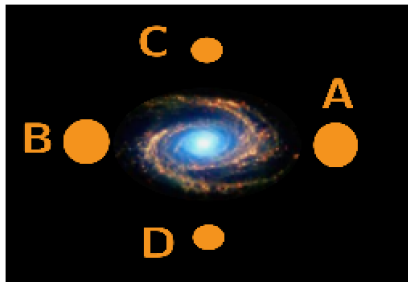
Fraction of lensed QSO's?

- QSO catalog → OK
- Number of Gravitational lenses in the detected Population?
- Method :
 - Calculate the probability for each QSO to be a lensed
 - Mean probability through the QSO catalog
→ Expected fraction of lenses!
- Probability associated to a single source?

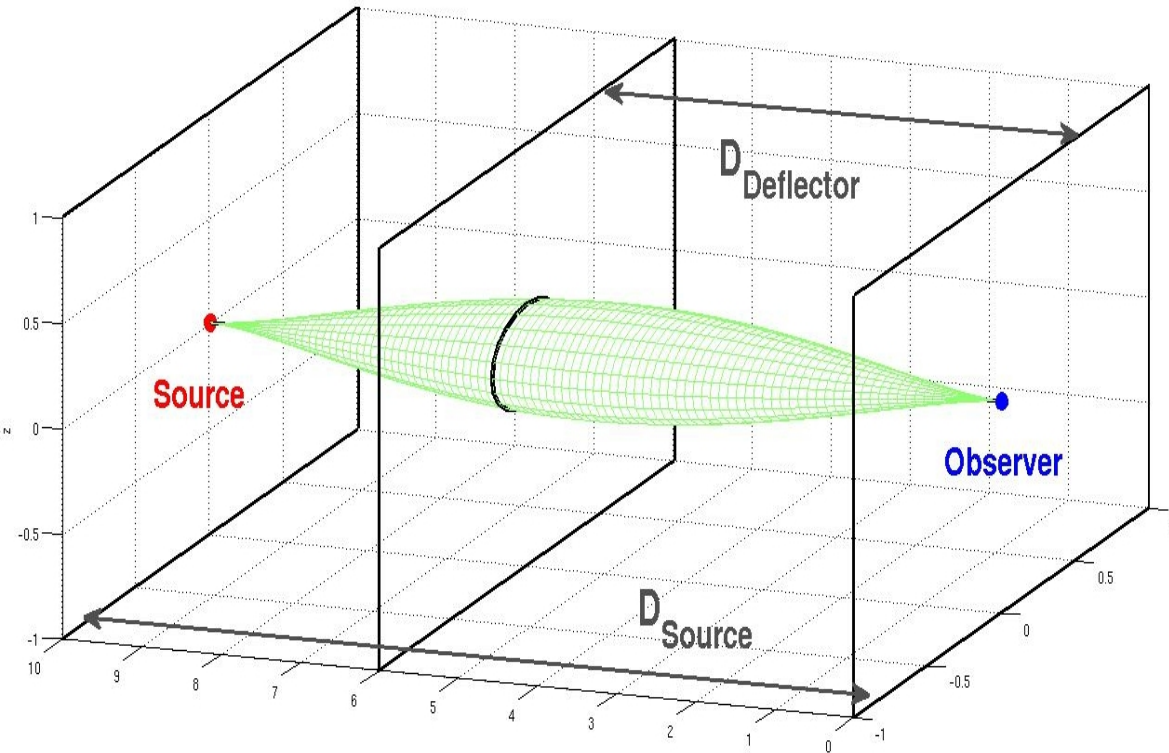
Lensing cross section



- Lens system :Source, deflector, observer
- Misalignment \rightarrow Different image configurations
- Ellipticity \rightarrow 2, 3 or 4 images
- Lensing cross section : measures the efficiency of a deflector
- Changing the deflector mass distribution \rightarrow Cross section changes

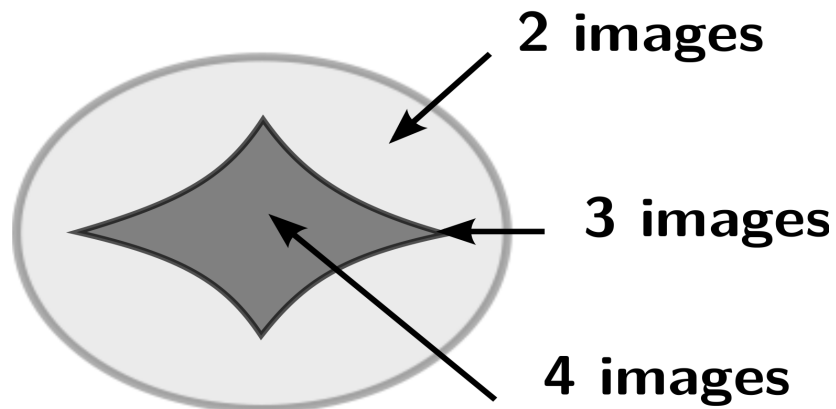


Lensing volume



- Lensing Volume: envelope of the lensing cross sections
- Cross section associated to the different configurations
- Different volumes for different cross sections considered

SIE Cross section:



- Integrate density of deflectors on the volume

Lensing probability

- Deflector density : Velocity Dispersion Function
- *Effective lensing cross section* accounts for :
 - Ellipticity distribution of deflector population
 - Deflector population Mass distribution
 - Finite angular resolution of the telescope
- Permits to determine
 - Fraction of lens event
 - Fraction of lenses with a given number of images

Conclusions

- QSO's to be detected by the ILMT : done?
- Fraction of lensing events :
 - Software developed
 - Results in the coming weeks

