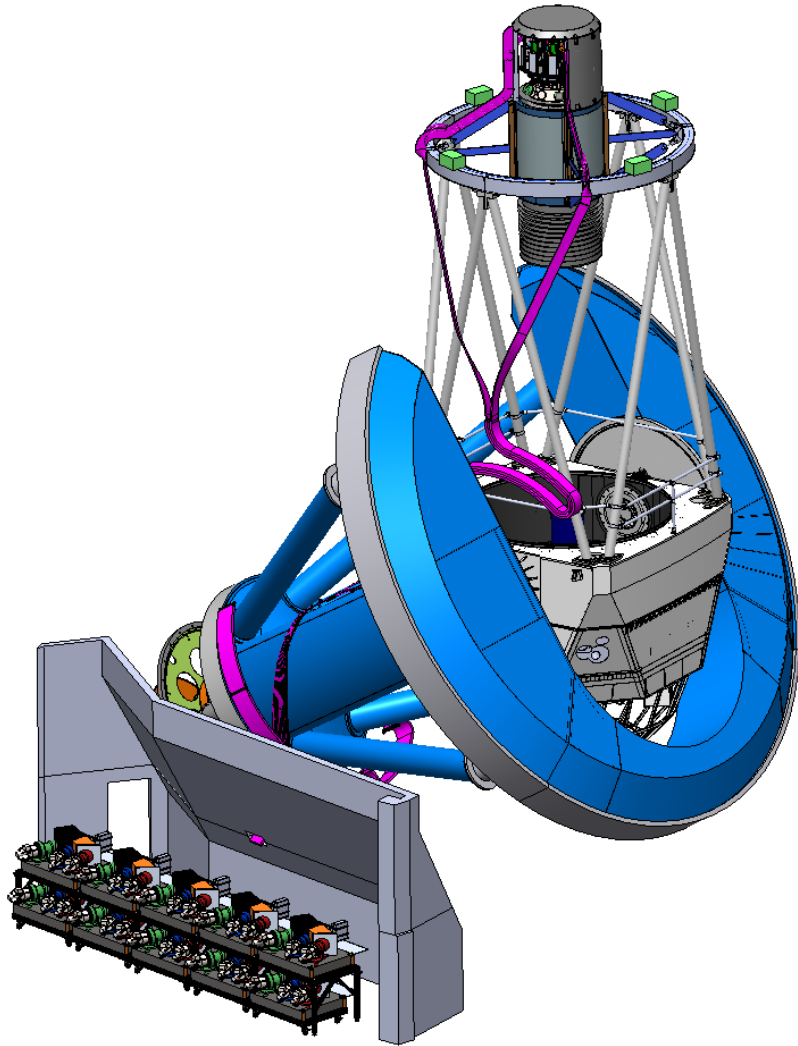# Dark Energy Spectroscopic Instruments, DESI: Quasar Identification

Ignasi Pérez-Ràfols
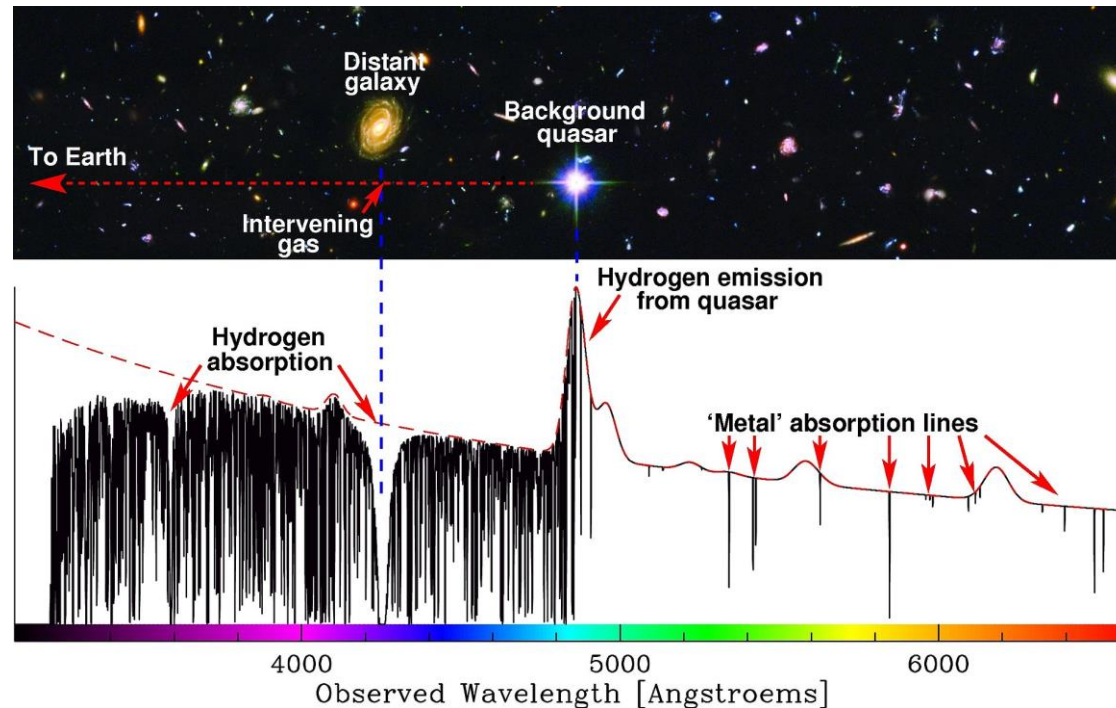
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Introduction

- Quasars are extremely luminous Active Galactic Nuclei (AGNs) that trace the underlying dark matter distribution
- Quasars allow us to probe the Intergalactic Medium (IGM) by analysing the absorption lines in their spectra. One of most known probes of the IGM is the Lyman alpha forest
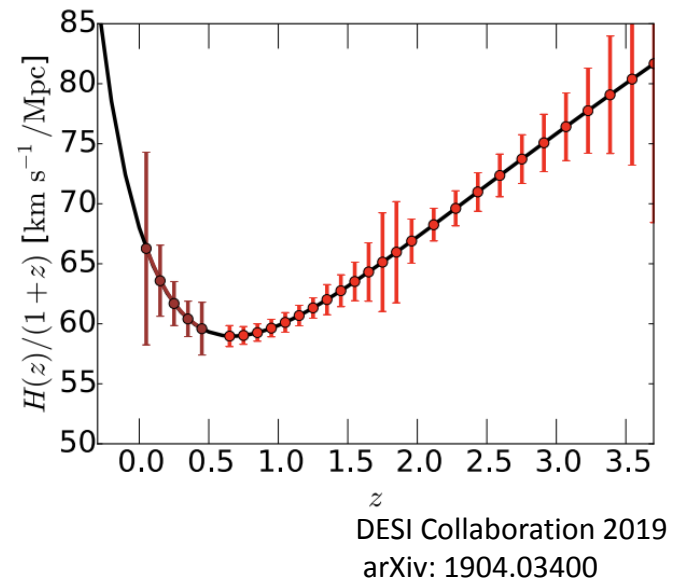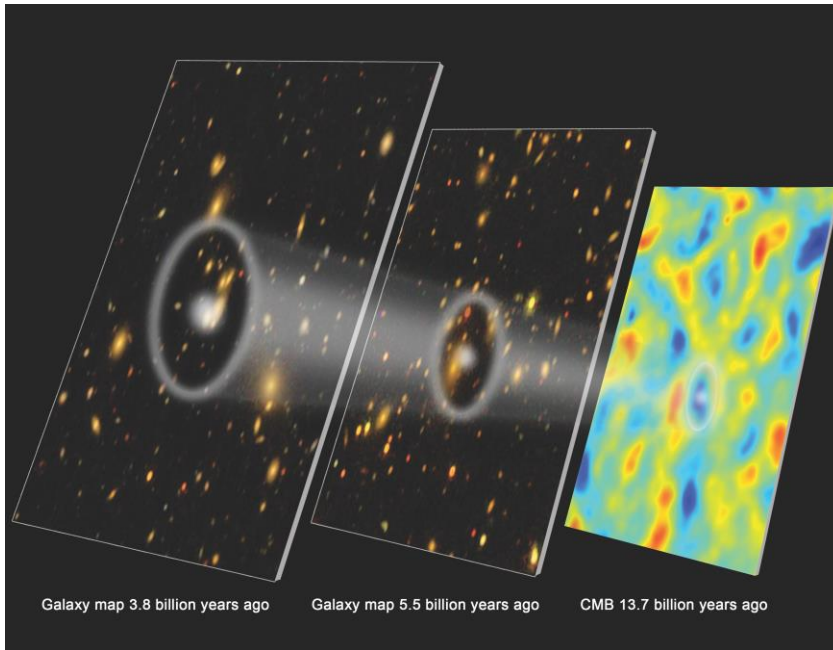
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Introduction

- Quasars can be used to measure the expansion of the Universe using the BAO techniques (both galaxy BAO and Lyman alpha BAO)
- This allow us to constaint Dark Energy

Galaxy map 3.8 billion years ago   Galaxy map 5.5 billion years ago   CMB 13.7 billion years ago

DESI Collaboration 2019
arXiv: 1904.03400

- But we first need to find them…

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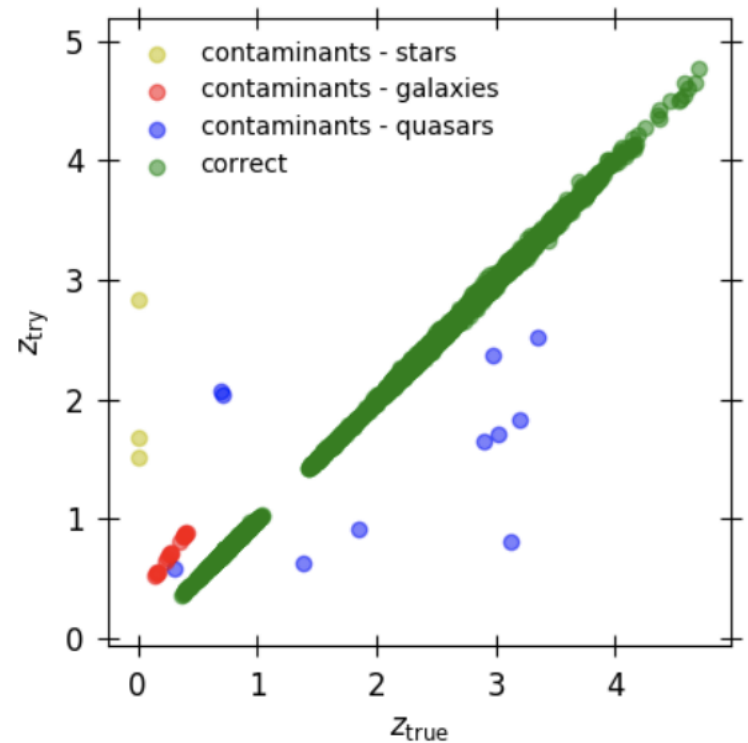
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Quasar identification history

- Quasar candidates are preselected according to their colours in photometric surveys and then their spectra is taken

- In the Sloan Digital Sky Survey (SDSS) Data Release 12 (DR12), the Baryon Oscillation Spectroscopic Survey (BOSS) team visually inspected the spectra of 546,856 objects to find 297,301 quasars

- SDSS DR14 extended BOSS (eBOSS) already performed only a partial visual inspection, and DESI is much faster!!

- Visual inspection is no longer feasible

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This lab

- We will explore machine-learning based quasar identification code. In particular we will focus on SQUEzE

- We will study line confusion plots to identify the origin of contaminants and optimize the classifier

- We will explore the combination of different algorithms in the classification (in particular SQUEzE with the SDSS pipeline

- Unfortunately DESI data is yet to be publicly release → we will use SDSS data instead

Pérez-Ràfols et al. 2020
arXiv: 1903.00023

Installation

- Download SQUEzE package:
    - git clone https://github.com/iprafols/SQUEzE.git
- Install the package
    - cd SQUEzE
    - pip install .
- Download the school materials
    - wget https://drive.google.com/file/d/1gWex8i07p_xWPX7J8dSHY3EaBGKKYITR/view?usp=sharing or just download by clicking
- Untar the materials
    - tar -xzvf infierischoolmaterial.tar.gz
- Download the quasar spectra and catalogue
    - cd infierischoolmaterial
    - ./download_spectra.sh
    - wget https://data.sdss.org/sas/dr12/boss/qso/DR12Q/Superset_DR12Q.fits
    - python filter_superset.py

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Hope to see you all there!

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