EPIC (Exploring PhysIcal Conditions in quasar outflows)

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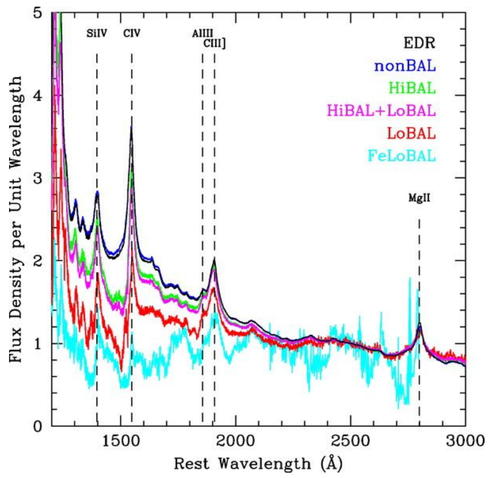
Introduction

- Quasar outflows are detected as broad blueshifted absorption lines (BALs) in the rest-UV spectra.
- BAL quasar outflow is the strongest candidate for quasar feedback mechanism.
- In order to understand the energetics of the BAL quasar outflows, it is important to constrain the physical conditions of the outflowing gas.
- HiBALs show line transitions only from the highly ionized species (e.g. C IV, Si IV) and LoBALs also show absorption lines from the low-ionization ions (e.g. MgII, Al III).

In this project we explored the various physical conditions of the outflowing gas with CLOUDY.



Reichard et al 2003

CLOUDY Models

SOLAR ABUNDANCE
NO GRAINS
POWER LAW DENSITY

SOLAR ABUNDANCE
NO GRAINS
HARD SED (NGC 5548)

SED AGN
HDEN 3

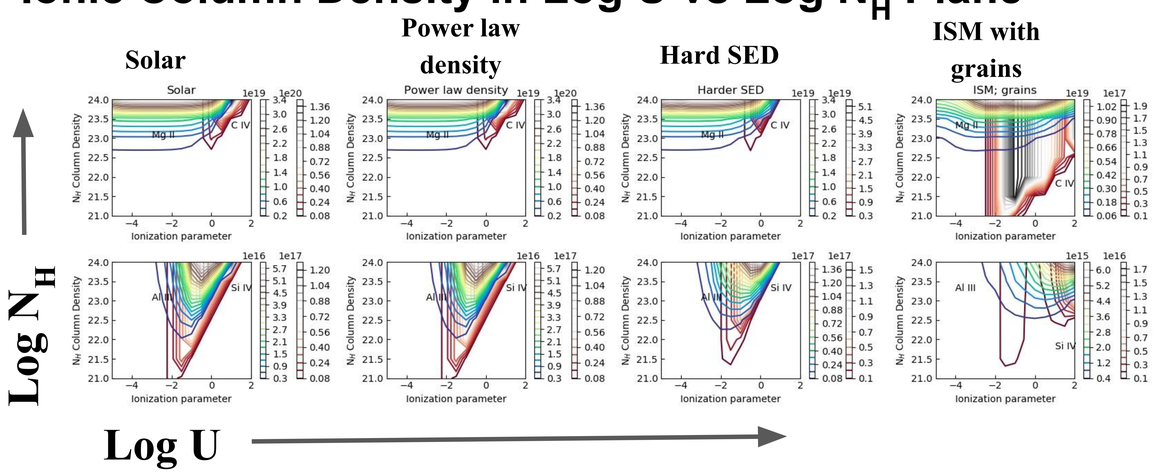
VARY Log (U): [-5 -- 2]
VARY Log (N(H)): [18 -- 24]

SOLAR ABUNDANCE
NO GRAINS

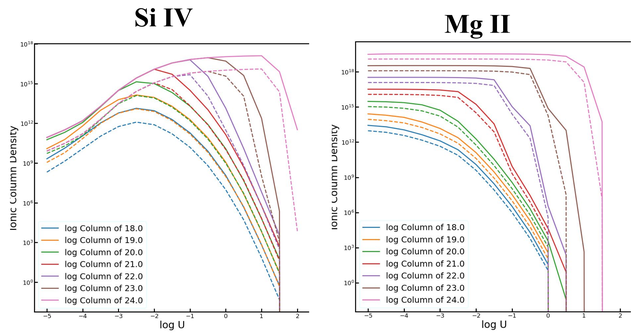
ISM ABUNDANCE
NO GRAINS

ISM ABUNDANCE
WITH GRAINS

Ionic Column Density in Log U vs Log N_H Plane

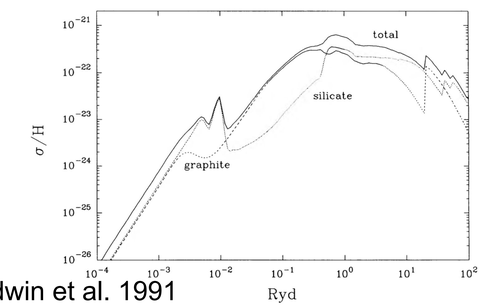


Effect of Abundances



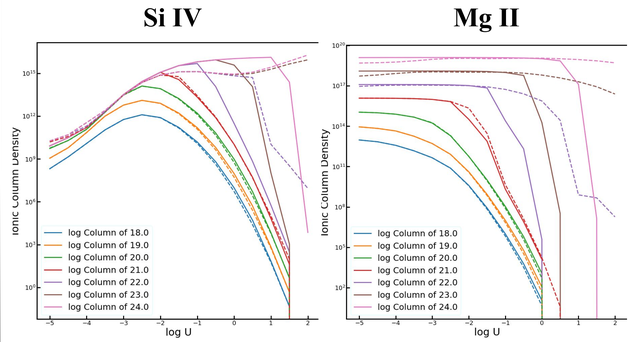
Solar abundances: Solid, ISM abundances: Dash
Ionic column densities of Si IV, C IV, Mg II & Al II

scale with abundances



Baldwin et al. 1991

Effect of Dust

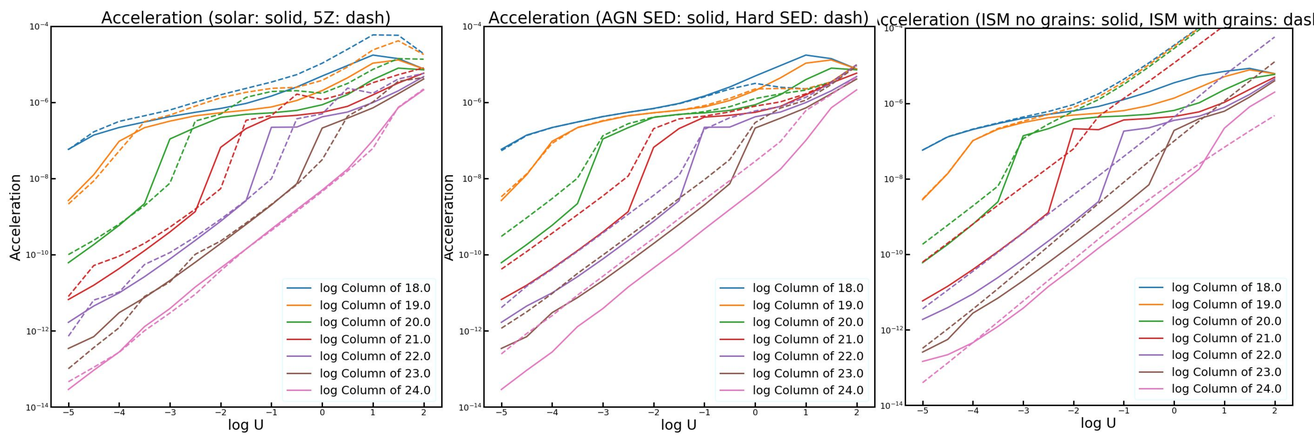


No grains: Solid, With grainss: Dash

- For log (N_H) < 21.5. grains have no effect on the ionic column density
- For log (N_H) > 21.5, grains have no effect for Low ionization parameters (log U < -2.0)
- For log (N_H) > 21.5 & log U > -2.0 grains suppress Si IV & C IV

Dust opacity to high energy photons becomes important at log N_H ~ 22. For l og N_H > 22, dust absorbs a large fraction of incident radiation.

Acceleration of the absorbing cloud



- 5 times solar metallicity: Overall more acceleration on the cloud.
- Hard SED: Slightly lower log U at overionization.
- ISM grains: Grains are more effective in harnessing the photon momentum.

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