Why the UV Range is Important

- Richness of experimental data for study of plasma with temperatures from 3,000-300,000K.
  - Unmatched by any other domain
- Electronic transitions of most abundant molecules, observed in this range
  - E.g. H_2, OH, or CO: also the most sensitive to the presence of large molecules such as the PAHs.
- Most sensitive spectral tracers of diffuse baryonic matter
  - HI Lyα in the nearby Universe and HeII Lyα at $2<z<9$

Major Science Issues Requiring UV Data

I. Re-ionization of the Universe
II. The early evolution of the Sun & its interaction with the young planetary disk
III. Atmospheres of extrasolar planets

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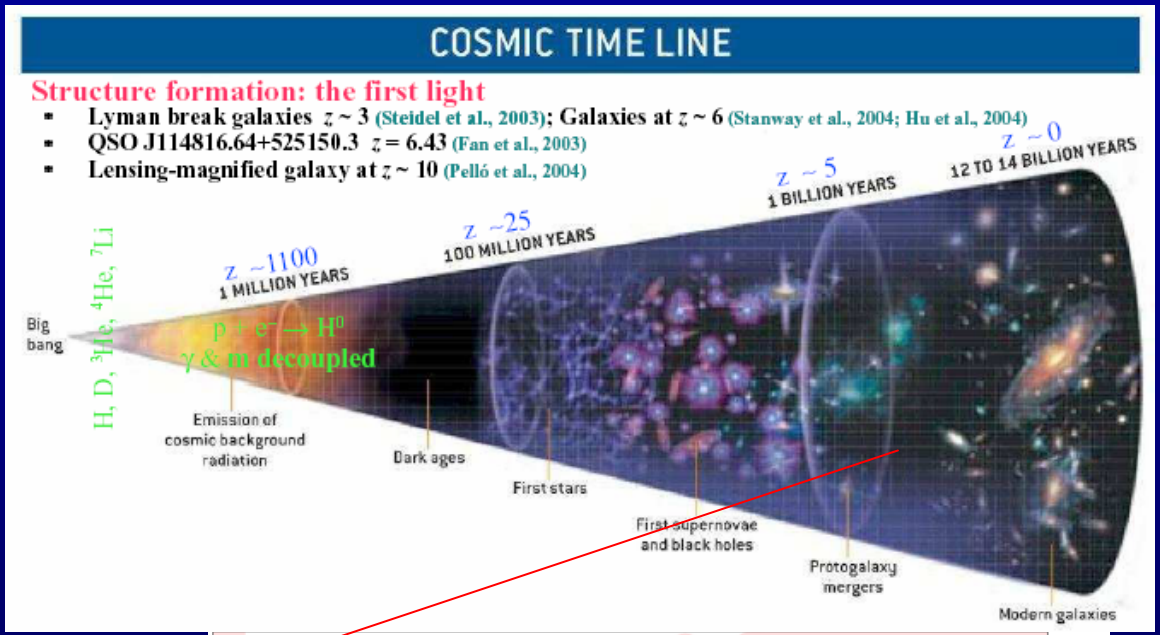
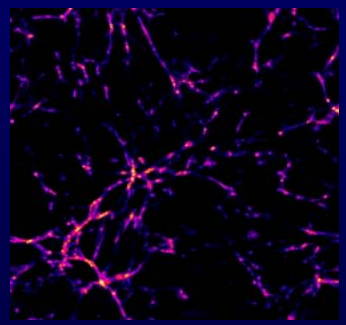
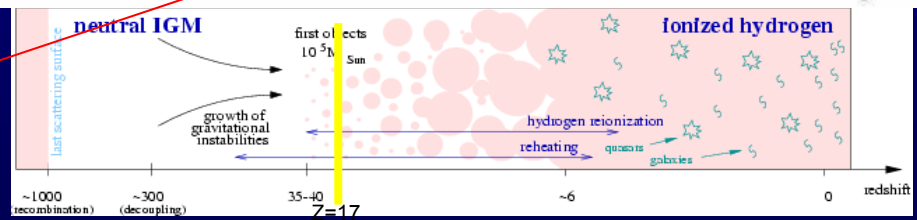
I. Re-ionization of the Universe

- Determine baryonic number density of diffuse IGM & discrete clouds
- Probe cosmic reionization history







WMAP

(Spergel et al 2003)

Surveys: SLOAN (10^5 QSOs z~2-4), GALEX(10^4 QSOs z~2)

He II reionization phase ends at z=2.9 (Reimers, 1997)

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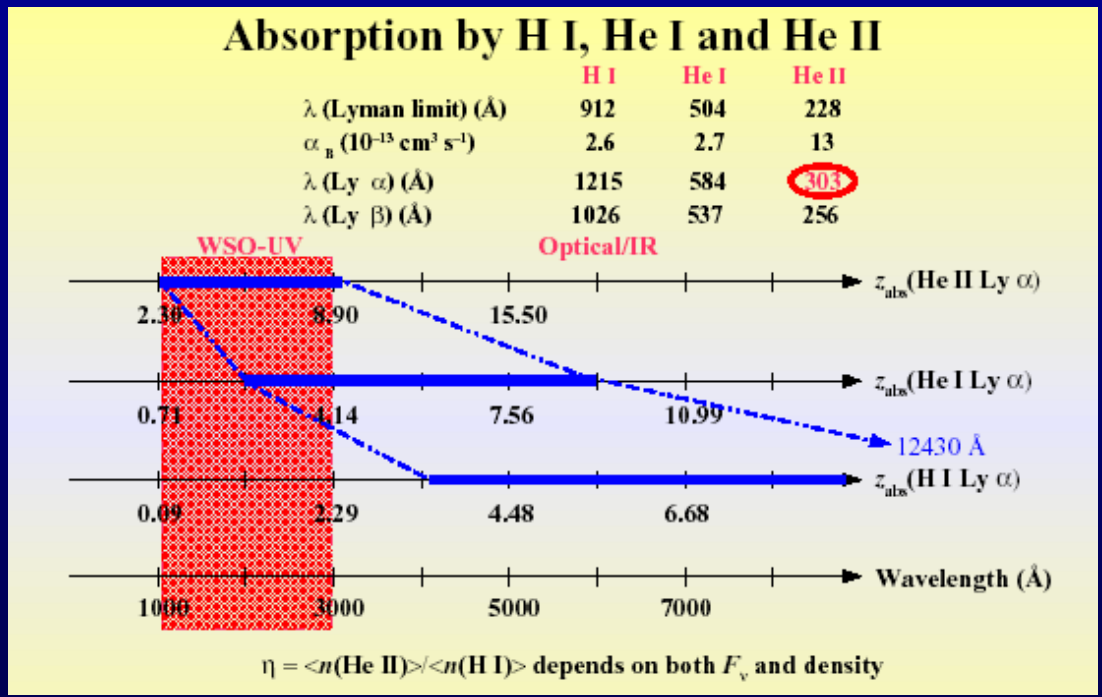
Key scientific objective:

Determine ionization & abundances of highly ionized component @ 2nd HeII reionization



- Observe simultaneously, HI & HeII in range 2.1<z<2.9
- Abundances of O, Ne, S for z<2.1
  - Intrinsic wavelength of (OIII-OV, NeIII-NeVII, SIII-SVI) in EUV (300-900A).

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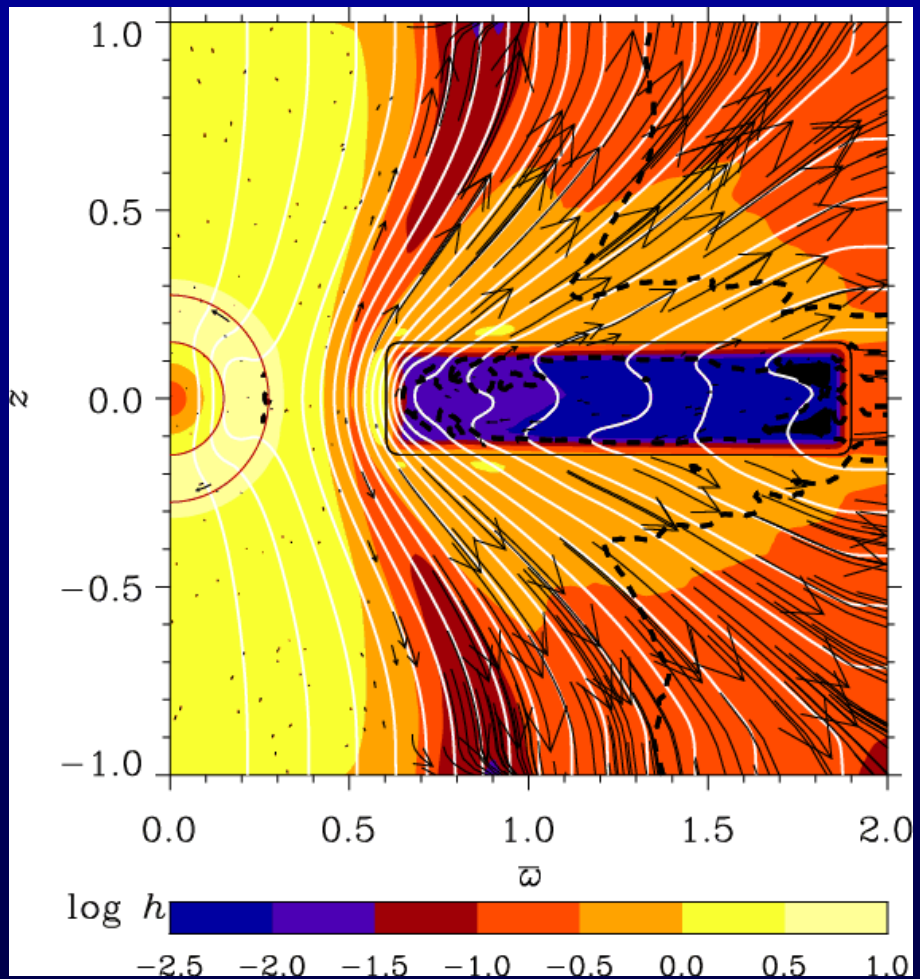
II. The Young Solar System



- "Planetary Systems are angular momentum reservoirs produced as a left-over of the formation of stars"
- Young stars are surrounded by very hot plasma emitting UV that interacts with the disk
- Observe ~100 T Tauri stars
  - determine temperature, density & velocity of system

Key scientific objective:

Understand source of UV at the early stages of the Solar evolution and its role in planetary disk chemistry

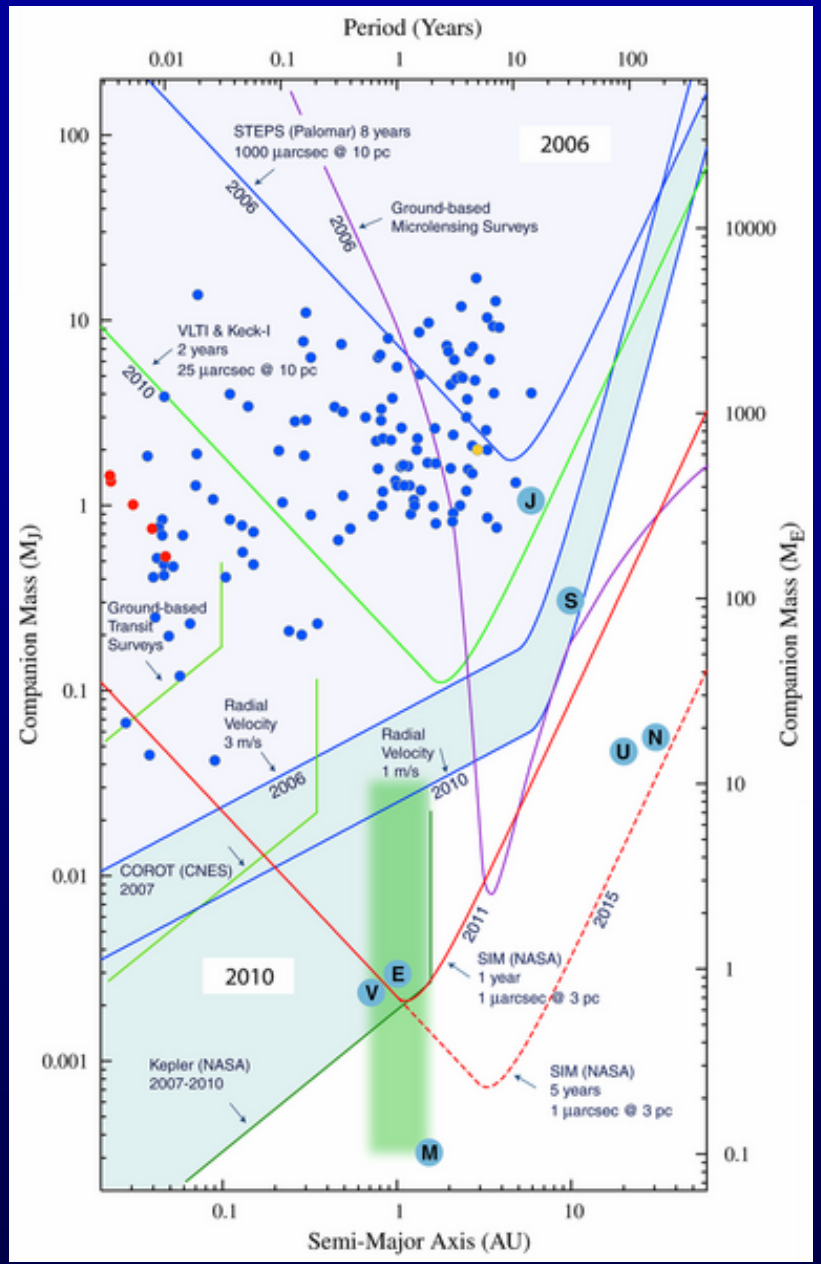
- UV effects on planetary formation
  - UV radiation important photochemical agent… accelerates formation of large organic molecules
  - Evolution of embryonic planetary atmospheres
  - Vertical structure of disk
  - Planet-disk decoupling time
- Young planetary systems
  - detection of volatiles released by dust, planetesimals & comets through the stellar wind/disk interaction.
  - CO from comets

III. Atmospheres of exoplanets

- Composition of atmospheres
  - Atmospheres out of equilibrium… O3 (life induced?)
  - Relative abundances H, H2, O, C, CO, OH, etc.
  - Hartley bands of O3 are the main absorbers at 200-350 nm.
- Dynamics of atmospheres
  - Escaping atmospheres from water rich planets detected in Lyα.

Key Scientific Objective:
Follow-up of transiting planets discovered by surveys

- Nature of intermediate mass planets *(5-20 Earth mass)*
  - Absorption by molecules, haze and atoms
- Atmospheric content of low density planets and satellites of giant planets
  - Ocean planets; Titan-like satellites
  - Low density ➔ large absorptions in UV
- Evolution of water-rich planets
  - Evaporation of Venus-like planet in the early stage;
    Evaporation of Earth-like planet in the last Gyr
  - Absorption of H_2O dissociation products: HI in Lyman-alpha, O at 130nm
- Evaporation of gaseous planets
  - Observation in Lyman-alpha, but also C, O, FeII, MgII, etc.



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Other Science Topics

- Planets and the origin of life:
  - Planetary atmospheres, auroral variability, comets
- ISM and Formation and Evolution of Stars:
  - Hot stars atmospheres (and abundance determination) from white dwarfs to hypergiants
  - Cool stars atmospheres and magnetic dissipation phenomena
  - Interacting binaries and accretion physics
  - Circumstellar material and shells in warm environments, jets, shocks and HH objects
  - Chemical abundances in supernovae remnants and in the early phases of supernovae explosions
  - The warm and hot components of the ISM

Other Science Topics

- AGN and Compact Objects:
  - Accretion physics and disk instabilities
  - Reverberation mapping and gas distribution around AGNs
- Universe, Galaxies and Galaxy Evolution:
  - Star formation rates
  - Galactic haloes
  - High velocity clouds, magnetic buoyancy in galactic disks and disk-halo interaction
- Fundamental Physics and Cosmology:
  - Variation of fundamental constants with the gravitational field and redshift