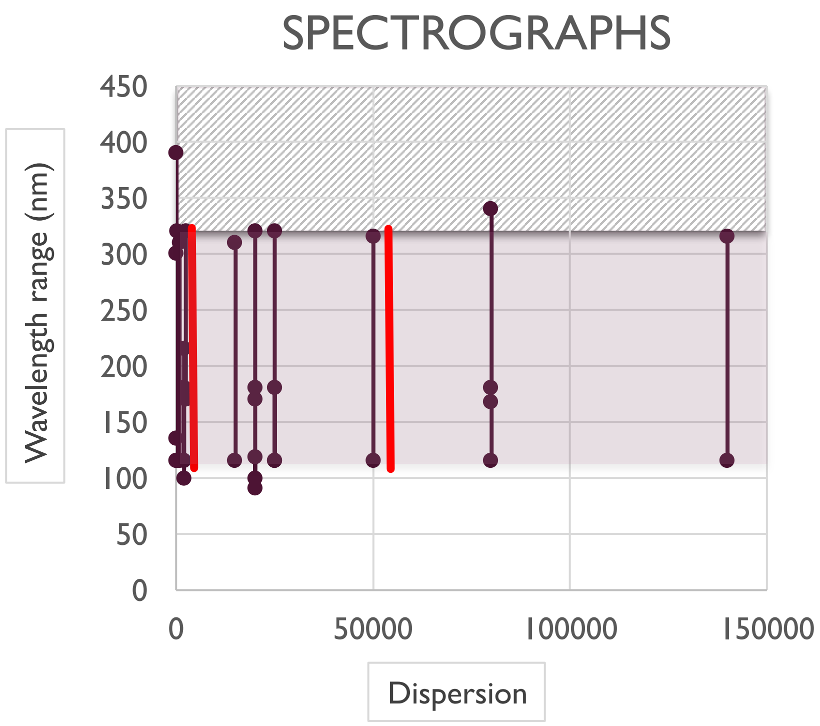
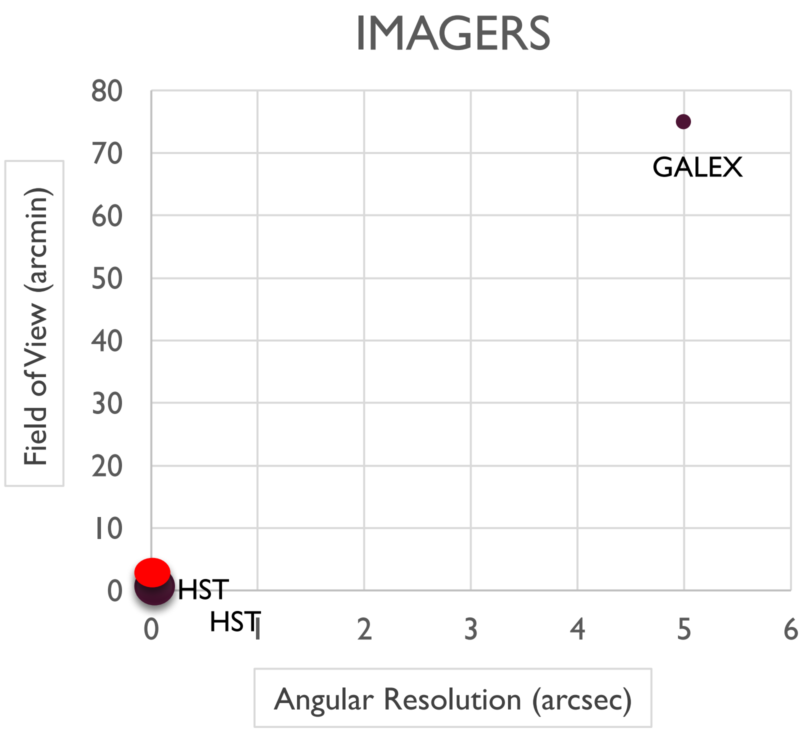
SCIENTIFIC POLICIES FOR WSO-UV
CORE PROGRAM CALLS, POLICY & PROCEDURES
GUARANTEED TIME KEY PROGRAMS (KPGT)

WSO-UV TEAM

WSO-UV CORE PROGRAM

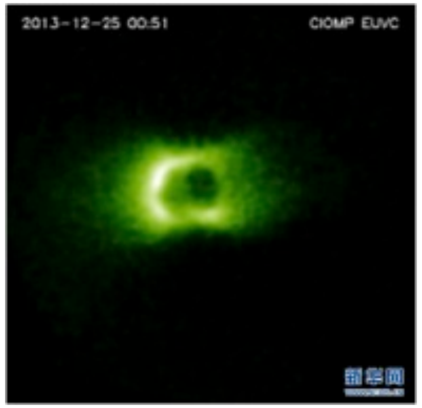
WSO-UV INSTRUMENTS IN CONTEXT





WSO-UV ORBIT AND THE EARTH EXOSPHERE

OBSERVATION



THEORY

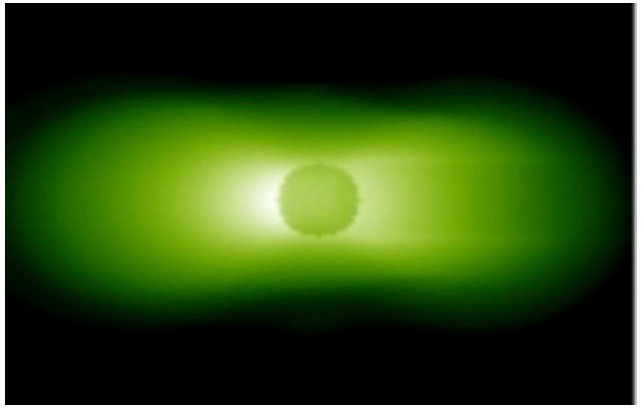
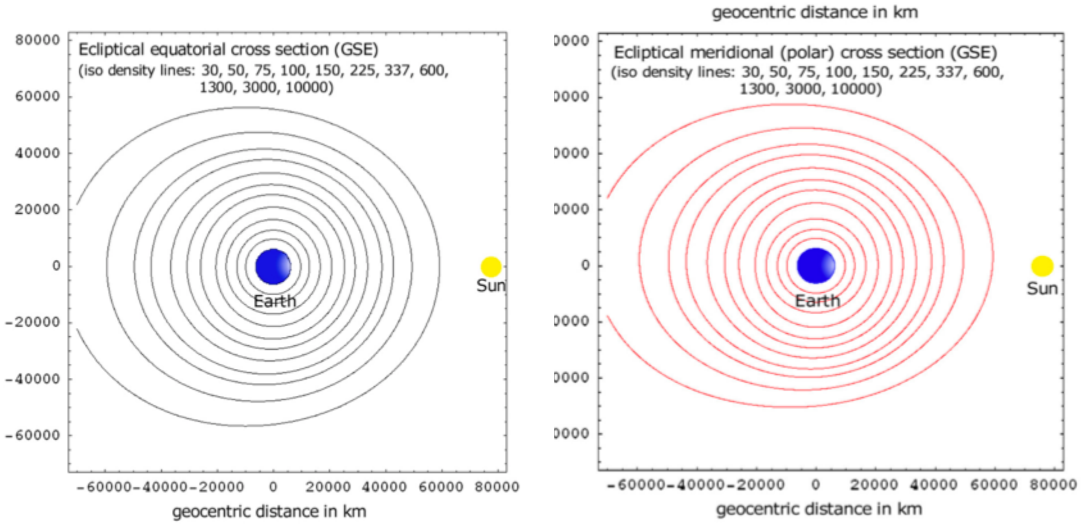


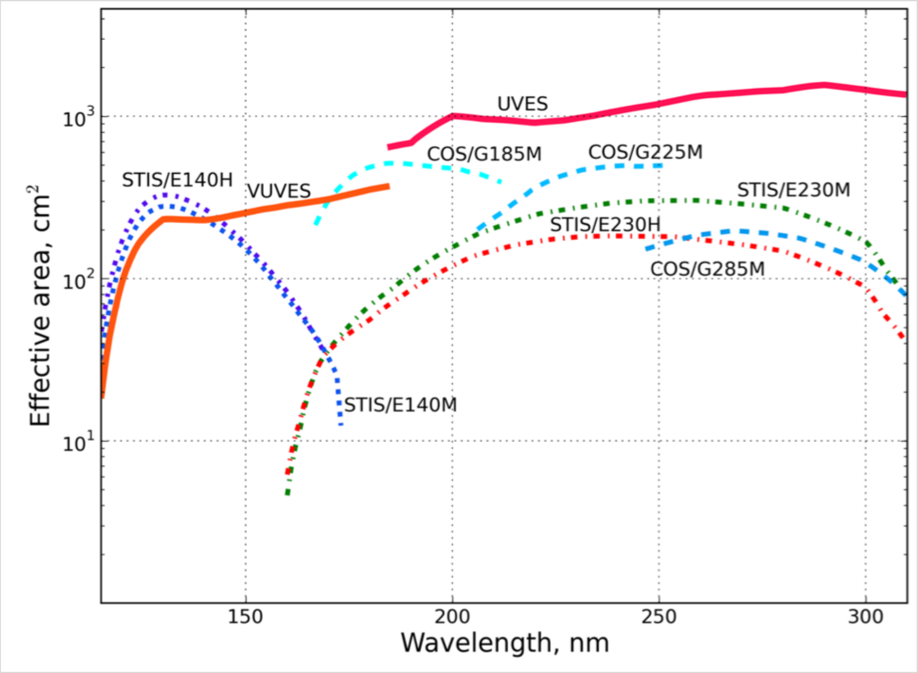
IMAGE OF THE EARTH MAGNETOSPHERE AT 30.4 NM (HE II) OBTAINED WITH THE EUV CAMERA ON CHANG'E 3
[SOURCE: CHINESE ACADEMY OF SCIENCES].



H I DISTRIBUTION IN THE EARTH EXOSPHERE OBTAINED BY THE TWINS MISSION (NASA)
Zoennchen et al. 2011

WSO-UV UNIQUE CAPABILITIES

THE HIGHEST EFFECTIVE AREA IN THE NUV BAND FLOWN TO DATE

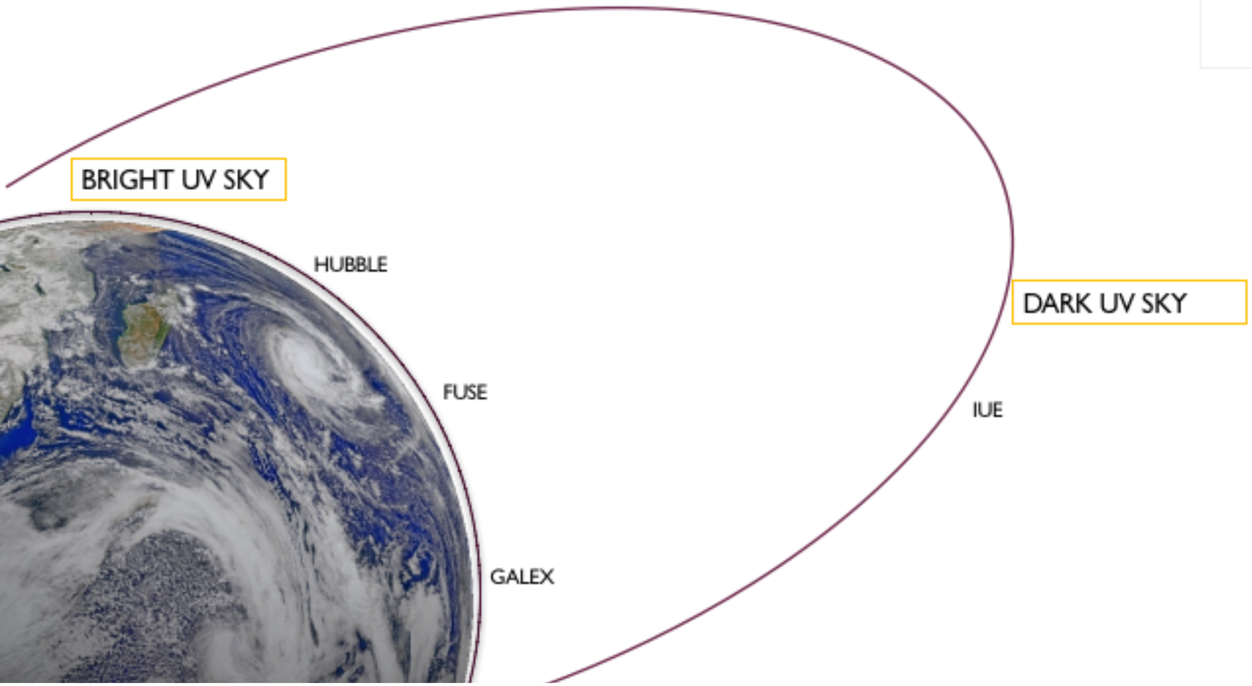


WSO-UV UNIQUE CAPABILITIES

HIGH EARTH ORBIT

- ✦EFFICIENT OBSERVING CYCLE
- ✦EFFICIENT MONITORING
- ✦SMALL POLLUTION FROM THE EARTH EXOSPHERE

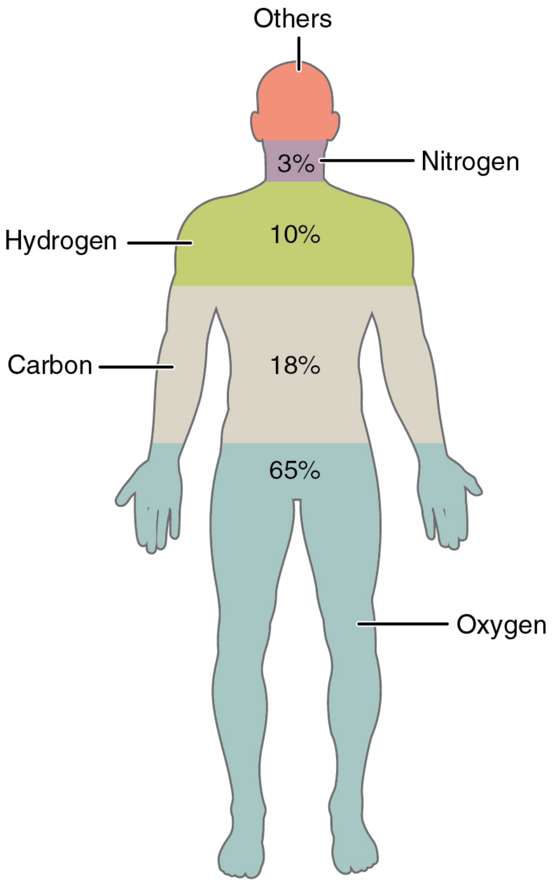
CLEAN SKIES!



WSO-UV: SCIENTIFIC OBJECTIVES OF THE MISSION

- TO INVESTIGATE THE CHEMICAL EVOLUTION OF THE UNIVERSE
  - STELLAR EVOLUTION, ABUNDANCES, STAR FORMATION TO z=2, MIXING AT GALACTIC AND INTERGALACTIC SCALES, FORMATION AND EVOLUTION OF THE MILKY WAY
- PHYSICS OF ASTRONOMICAL ENGINES
  - JETS, OUTFLOWS AND WINDS FROM STARS, INTERACTING BINARIES, COMPACT OBJECTS, PRE-MAIN SEQUENCE STARS, ACTIVE GALACTIC NUCLEI
- INVESTIGATION OF THE ORIGIN OF LIFE
  - ISM, STAR FORMATION, YOUNG PLANETARY DISKS, PLANET FORMATION
  - ASTROCHEMISTRY IN HEAVILY IRRADIATED ENVIRONMENTS, COMETS, PLANETS AND EXOPLANETS, ASTROBIOLOGY

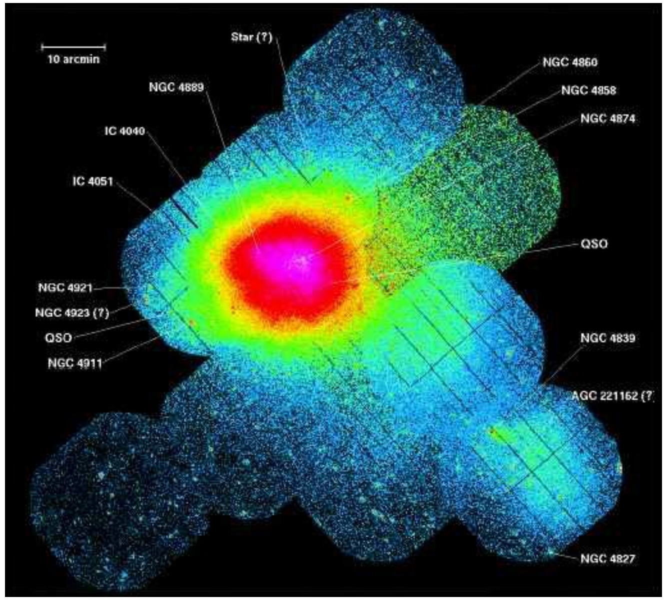
METALS IN THE UNIVERSE



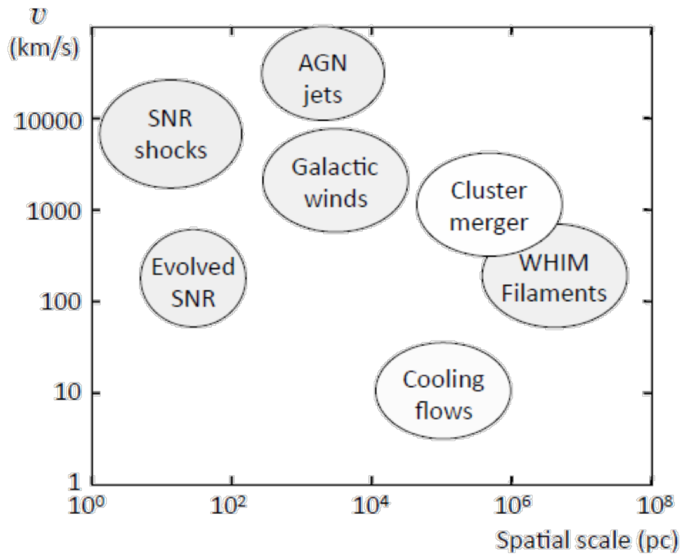
Element	Symbol	Percentage in Body
Oxygen	O	65.0
Carbon	C	18.5
Hydrogen	H	9.5
Nitrogen	N	3.2
Calcium	Ca	1.5
Phosphorus	P	1.0
Potassium	K	0.4
Sulfur	S	0.3
Sodium	Na	0.2
Chlorine	Cl	0.2
Magnesium	Mg	0.1
Trace elements include boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).		less than 1.0

METALS IN THE INTERGALACTIC SPACE

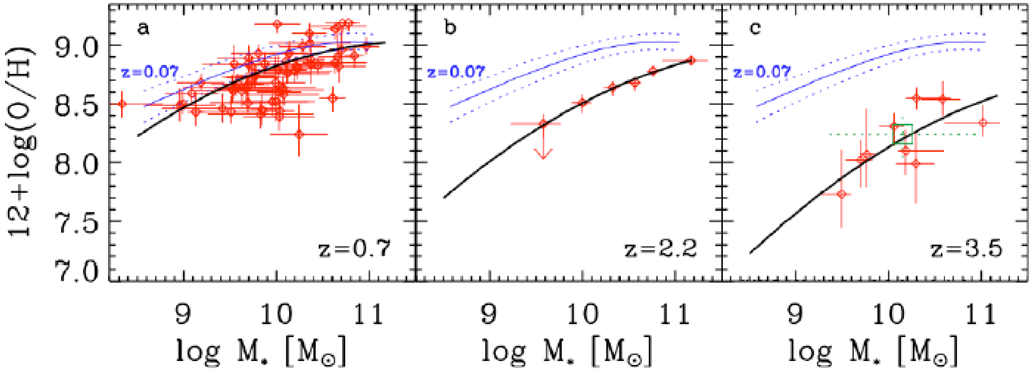
Hot gas in the Coma Cluster (XMM-Newton)



Gas motion on various scales (Ohashi et a. 2012)

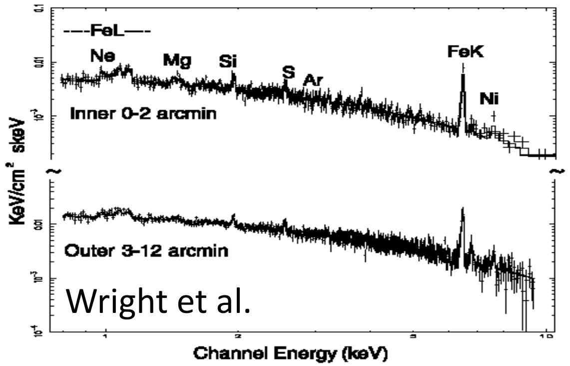


Metal enrichment with mass and redshift



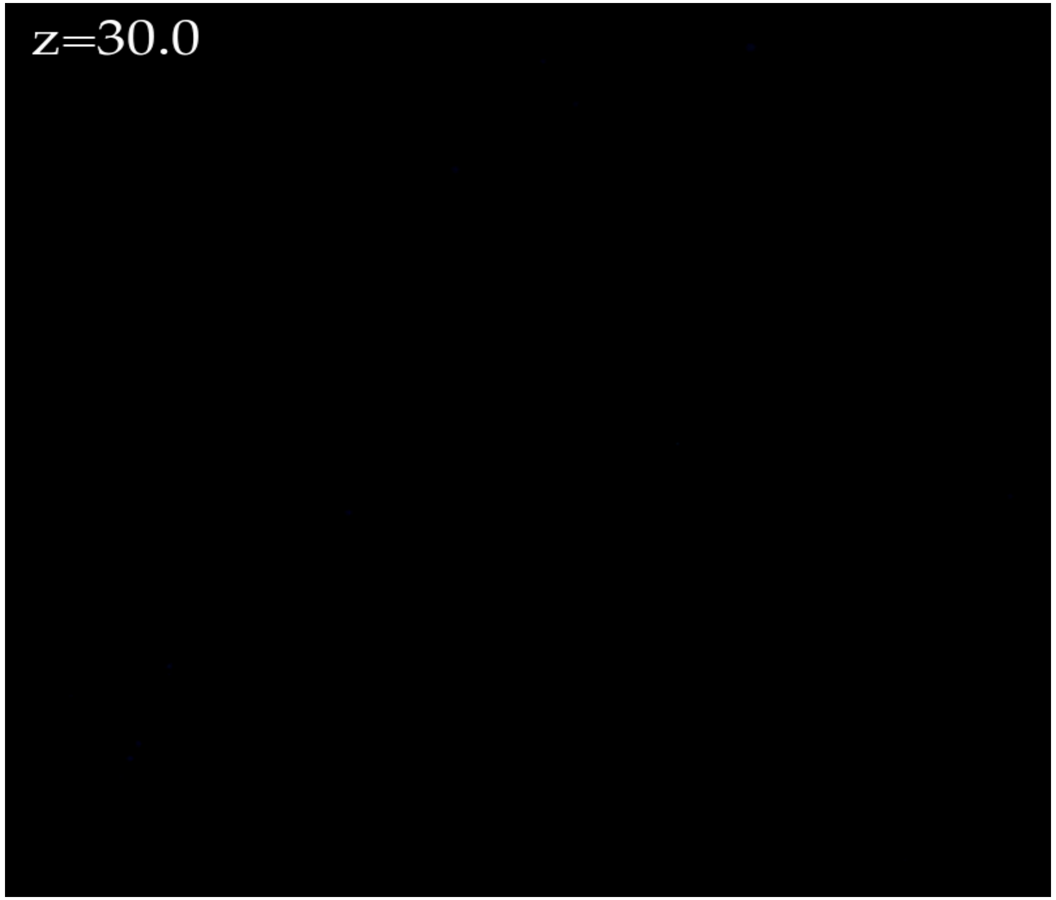
Low-mass galaxies at high-z? Does the relation still hold?

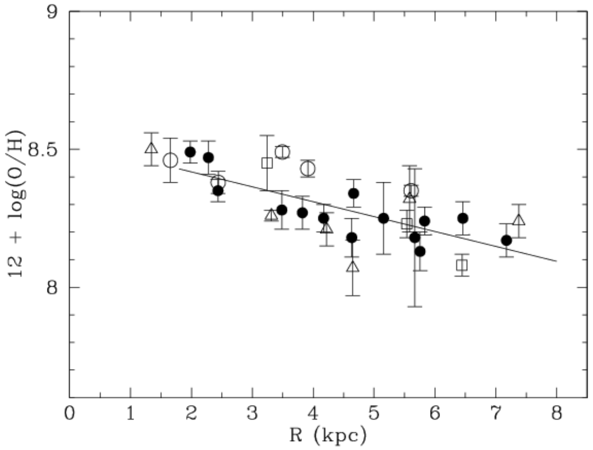
- What is the origin of the hot gas in clusters?
- How much of it is material processed in galaxies?



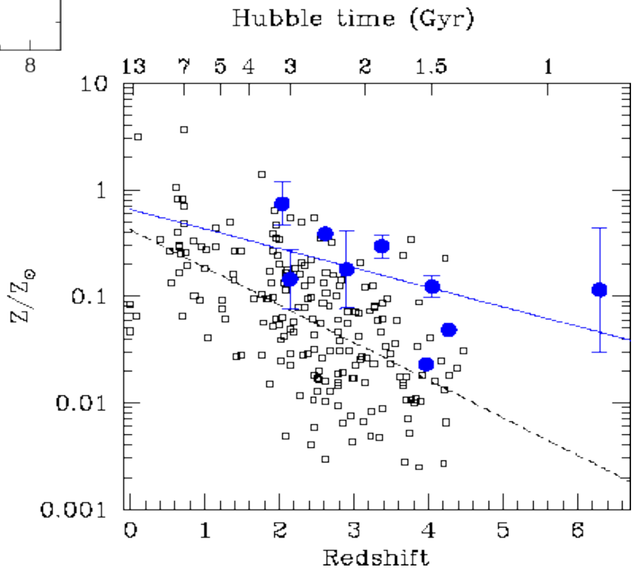
ASCA spectrum of Abell 496: reduced metallicity in the cluster outskirts

METALS IN THE GALAXY





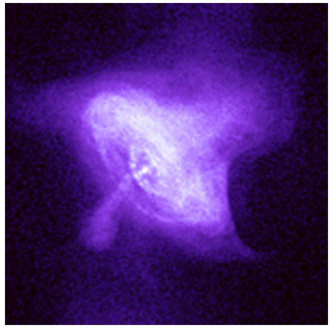
M33: Magrini et al. 2007

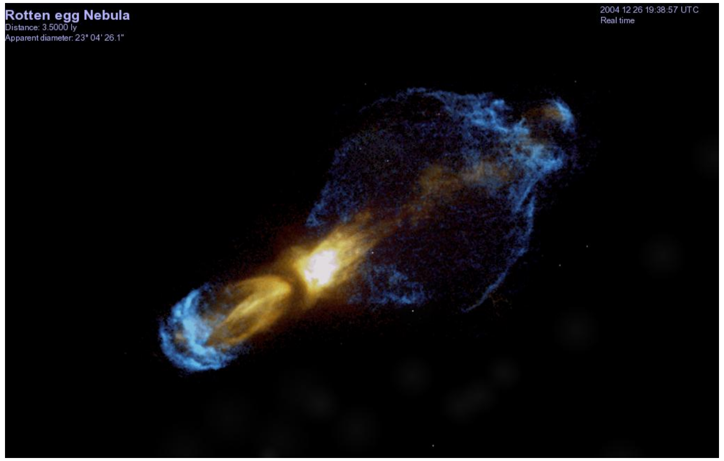


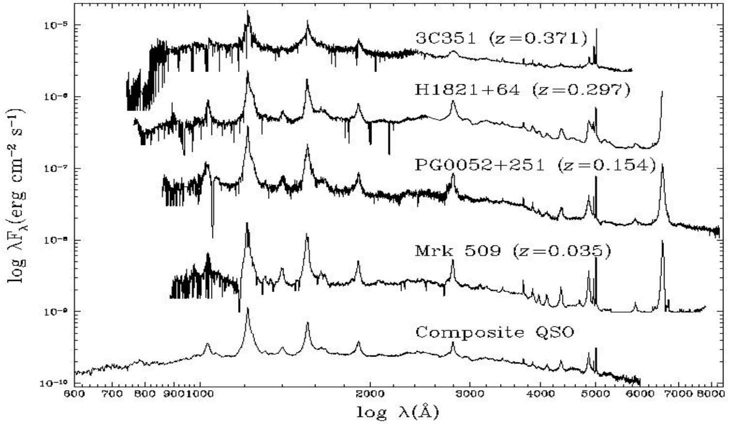
Milky Way formation.
Simulations by Harding.
Accreting dwarf galaxies

PHYSICS OF ASTRONOMICAL ENGINES

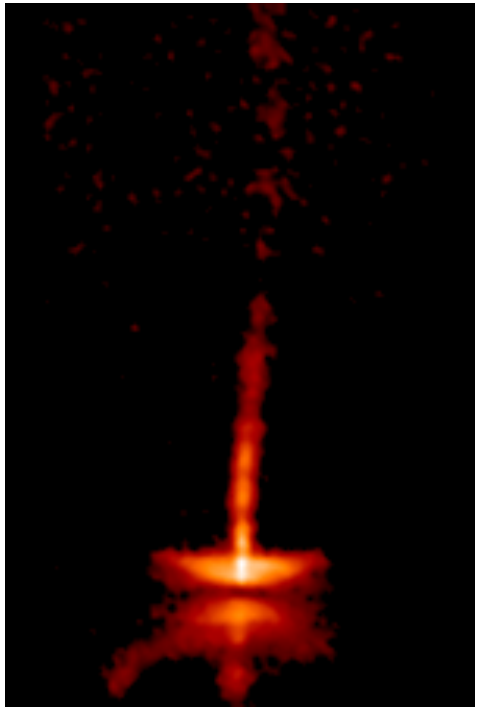
TYPE/OBJECT	Mass of Gravity Source (M_{sun})	Mass Fuel M_{sun}/yr	Velocity	Mechanic Power (MW)
PROTOSTARS	1	$1x10^{-8}$	300 Km/s	$6x10^{20}$
SUPERMASSIVE BLACK HOLE	10^{8}	1	0.98c	$5.6x10^{32}$





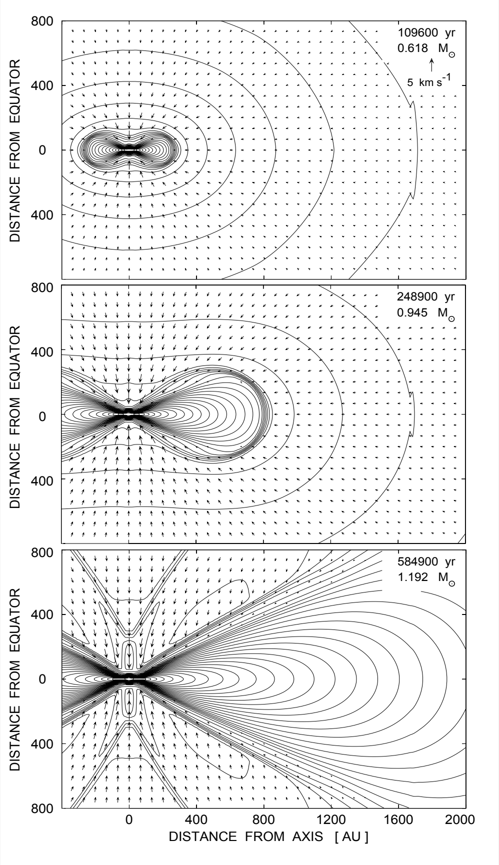


AGNs spectra --- Kriss 2000

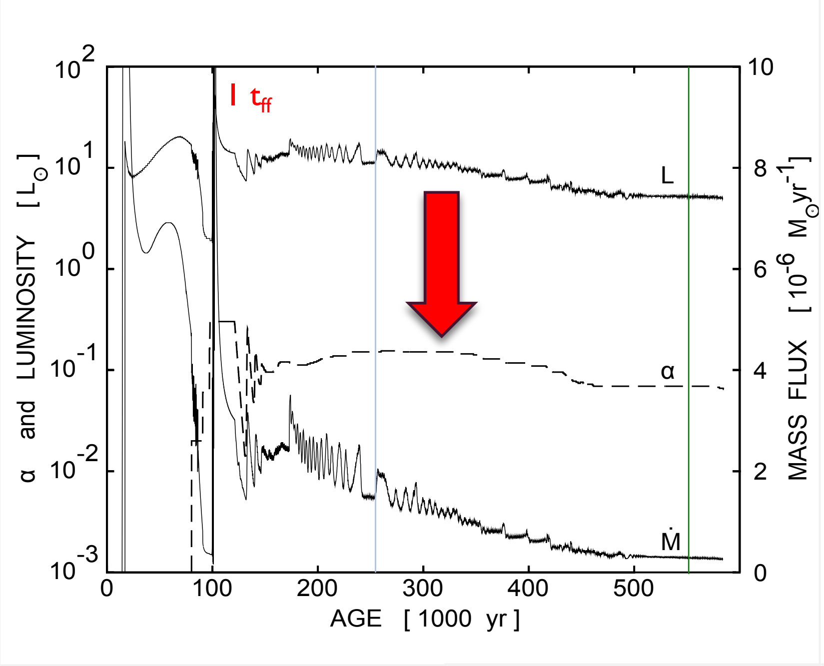


PHYSICS OF ASTRONOMICAL ENGINES

Disks form because free-fall drives rotating cores to its minimum energy configuration where most of the mass is concentrated in the centre and most of the angular momentum is stored in a distant reservoir of negligible mass, as in the Solar System.



Simple HD simulations of collapse from an initial sphere with $\rho(r) \propto r^{-2}$ distribution (mass = 2 $M_\odot$)



Yorke & Bodenheimer, 1999

PHYSICS OF ASTRONOMICAL ENGINES

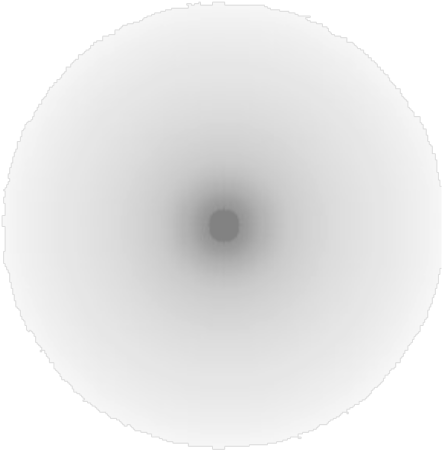
THE α-DISK (or the Holy Grail of accretion physics)

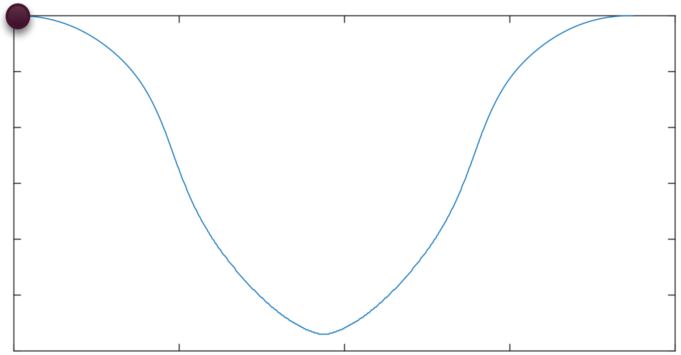
- Friction between adjacent rings scales as $-\alpha\Sigma c_S^2$
  (Shakurai & Sunyaev 1973)
- MRI, HM turbulence causes the friction that scales as $-\alpha_B \rho V_A^2$ with $\alpha_B \approx 0.5$-0.6
  (Balbus & Hawley, 1991; $\alpha_B \approx 0.5$-0.6 => $\alpha \approx 0.01$ Hawley 1995)
- Gravitational waves – spectrum of shock waves gravoturbulence (Balbus & Papaloizou 1999)
  IMPORTANT: relates with disk fragmentation
  $\alpha_g < 0.06$ momentum transport viable without fragmentation (Rice et al 2005)

OUTFLOWS ALSO CARRY ANGULAR MOMENTUM AND ASSIST ACCRETION

INVESTIGATION OF THE ORIGIN OF LIFE/EXOPLANET TRANSITS

an image worths a thousand words
(parameters for M5 V star)





INVESTIGATION OF THE ORIGIN OF LIFE

Using as input the functions $n(r)$, $T(r)$ and $V_e(r)$ from Erkaev et al. 2012, we have computed the optical depth of the exospheric absorption of Lyα photons as a function of R, the cylindrical distance to the center of the Earth-like planet and the velocity of the exospheric gas v, as,

$$\tau(R,v) = \sigma \int_{-z_l}^{+z_l} n(r) f(r,v) dz \tag{5}$$

with $f(v,z)$ the normalized velocity profile of the gas at a distance r obtained by the convolution of the thermal broadening (assuming T(r) as in Erkaev et al. 2012) and the natural broadening profile ($\phi(v)$). Hence,

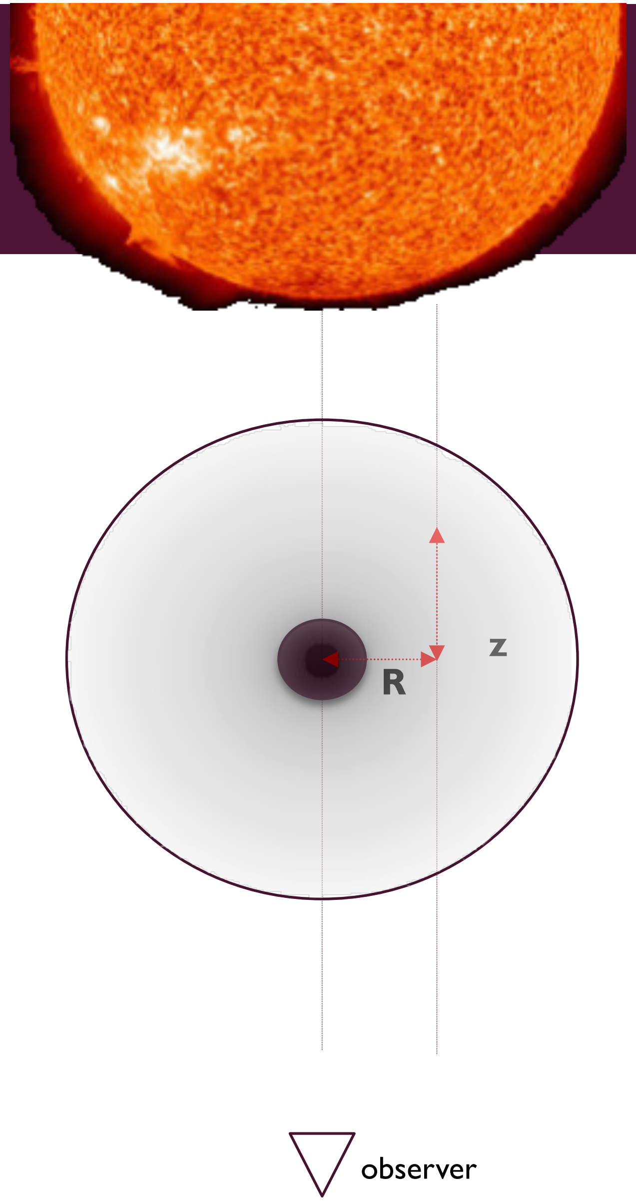
$$f(r,v) = \frac{\exp(-U(r,v))}{2k\pi T(r)/m_H} * \phi(v) \tag{6}$$

and,

$$U(r,v) = \frac{(v - V_e(r))^2}{2kT(r)/m_H} \tag{7}$$

Note that m_H is the mass of a hydrogen atom, k is the Boltzmann constant and

$$r = \sqrt{(R^2 + z^2)} \tag{8}$$

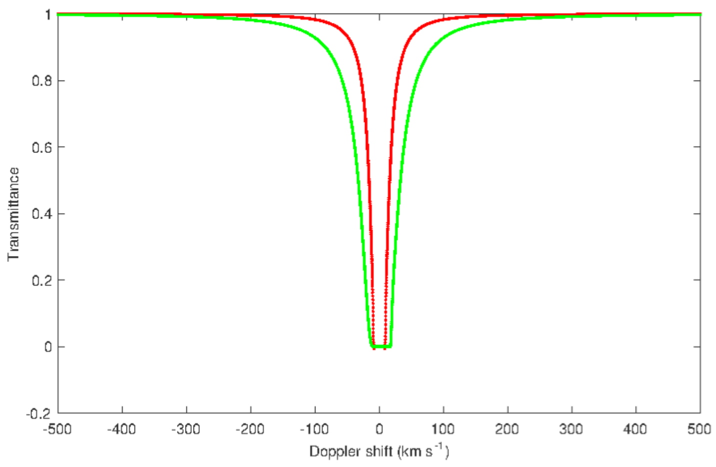


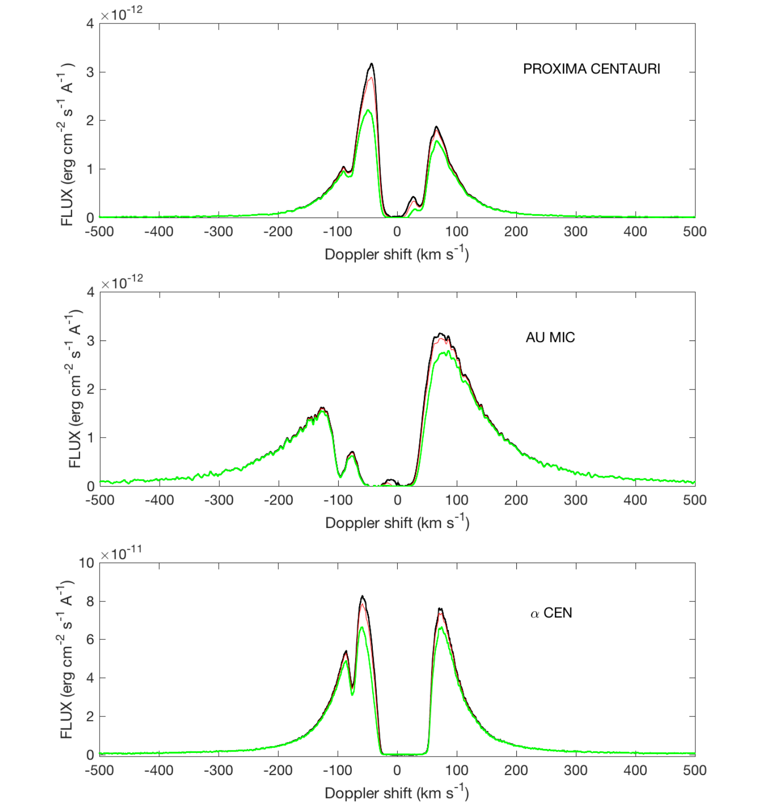
INVESTIGATION OF THE ORIGIN OF LIFE

Lyα absorption profiles produced by the exosphere.

Models by Erkaev et al 2012 give detailed predictions for V(r), n(r), T(r) for the exospheres of Earth-like planets submitted to various XUV fluxes: from solar-like (red) to 100 times this value.

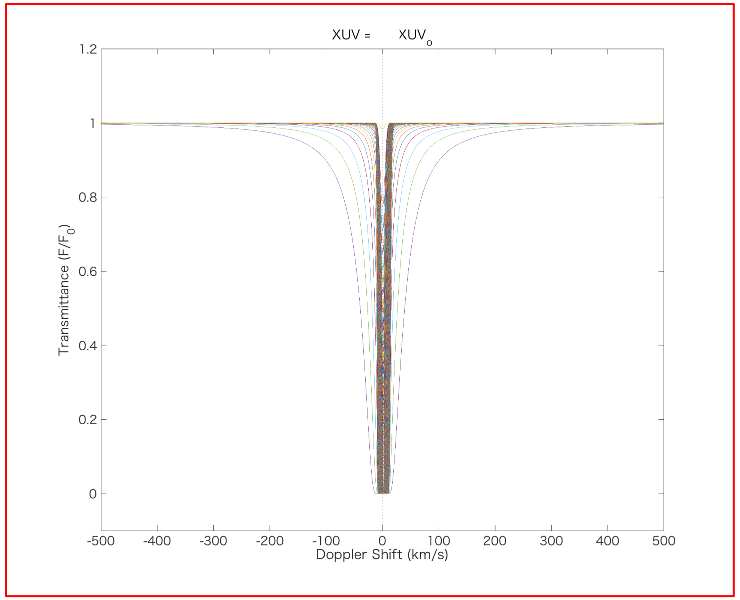
Green curves correspond to 50 XUV_{sun} (smaller than typical values in M stars)

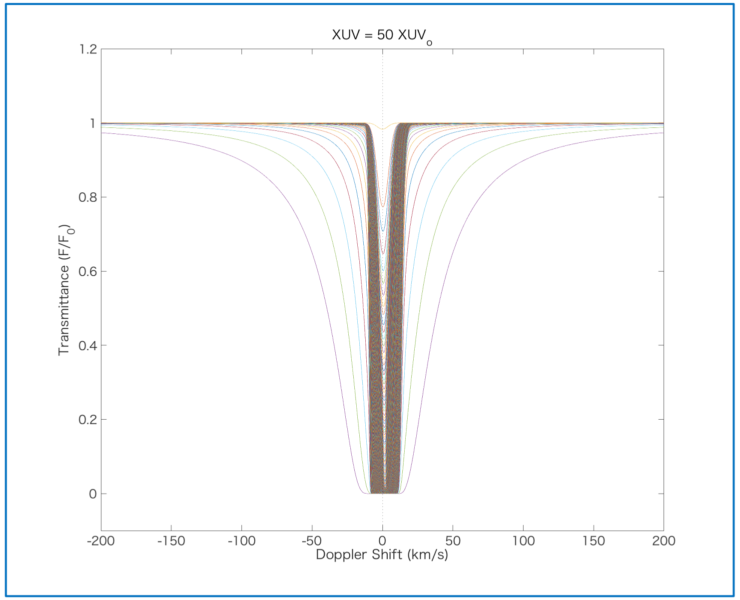




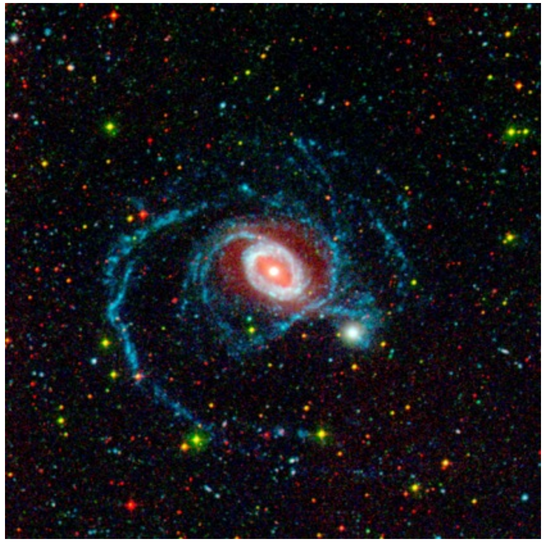
INVESTIGATION OF THE ORIGIN OF LIFE

THE EXOSPHERIC ABSORPTION BY DEPTH

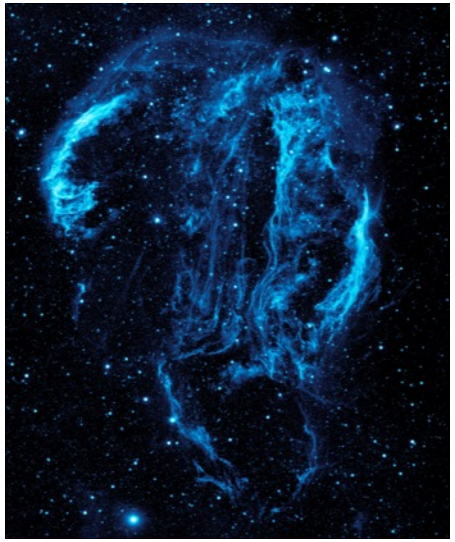




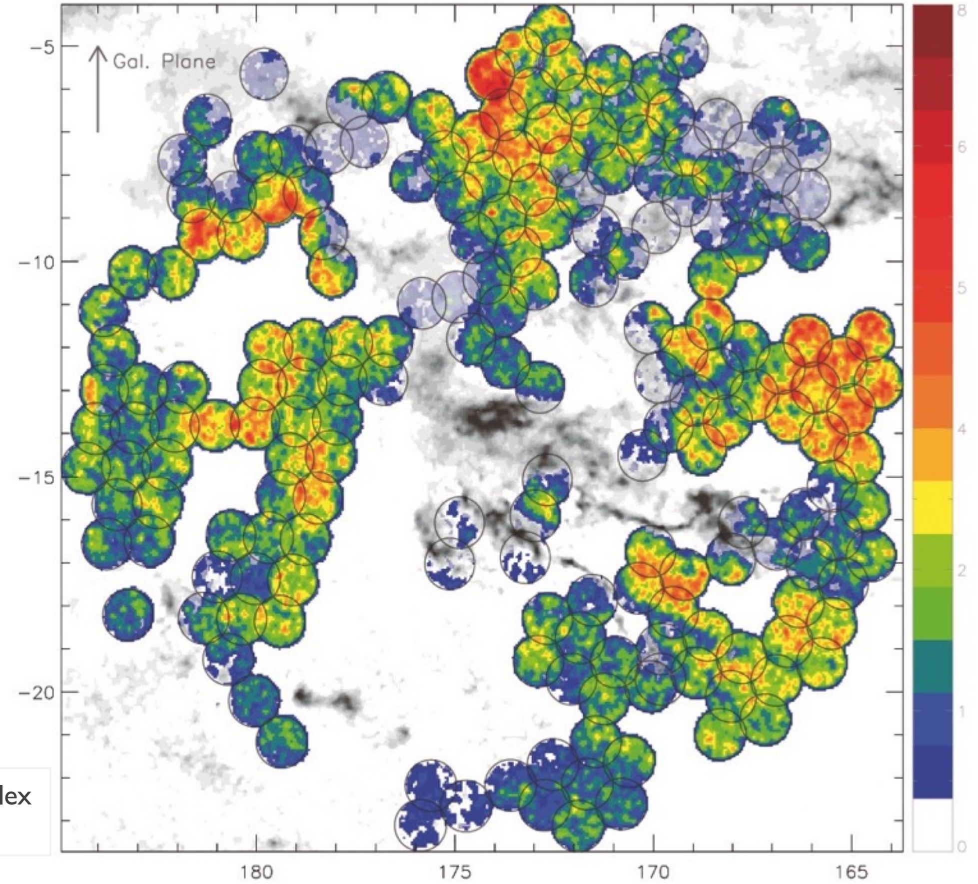
MASSIVE STARS & FAINT NEBULAE IN THE I.S.M.



NGC1512/1510
Credit: NASA/JPL-Caltech/DSS/GALEX



CYGNUS LOOP
Credit: NASA/JPL-Caltech



NUV Star Counts in the Taurus-Auriga Molecular Complex
Credit: Gómez de Castro et al. 2016

WSO-UV SCIENTIFIC PROGRAMS

SCIENTIFIC PROGRAMS

Core Program (CP): Fundamental science to be carried by the project team

Funding Bodies Program (FBP): Guaranteed Time to the countries funding the project

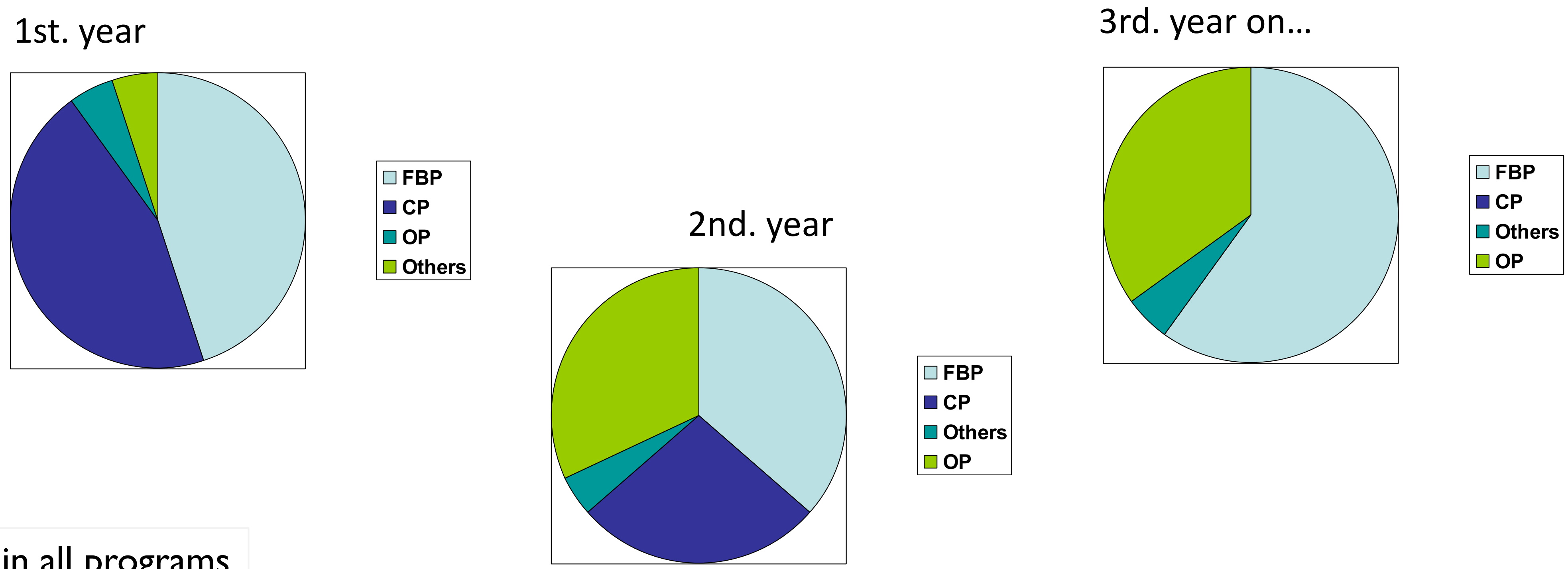
Open Program (OP): Open program to the world wide scientific community

DIRECTOR DISCRETIONARY TIME

CALIBRATION PROGRAM

GUARANTEED TIME FOR THE INSTRUMENTS TEAMS

SCIENTIFIC PROGRAMS



ToO in all programs

CORE PROGRAM CALL:

REGULATIONS & PROCEDURES

KEY PROGRAMS CHARACTERISTICS

Research projects submitted to the "Core Programme" should lead to a **significant advance in our understanding of an important area of astronomy within the master lines defined in the "Core Programme**". They must use the unique capabilities of the WSO-UV to address scientific questions with a comprehensive approach that is not possible with smaller time allocations. Selection of a Research Proposal for implementation within the core programme does not rule out the acceptance of smaller projects to do similar science, however duplications must be justified. All the proposals accepted within the "Core Programme" are **large programmes, requiring 100 (or more) hours of observation**.

ELEGIBILITY I: CONDITIONS TO BE FULFILLED BY THE PROPOSAL

- Proposals must result in a major advancement in the research areas designated as priority by the mission
- Excellent proposals that cannot be ascribed to any of these fields are also welcome though, they may be awarded lower priority.
- The proposed programme must produce a lasting value contribution to the WSO-UV Science Archive.
- The programme must require more than 100 hours of observing time.
- The scientific results should not depend on the availability of further data or coordinated observations with other facilities.
- The programme is expected to generate High Level Science Data Products (HLSD products) to be shared with the astronomical community at large.

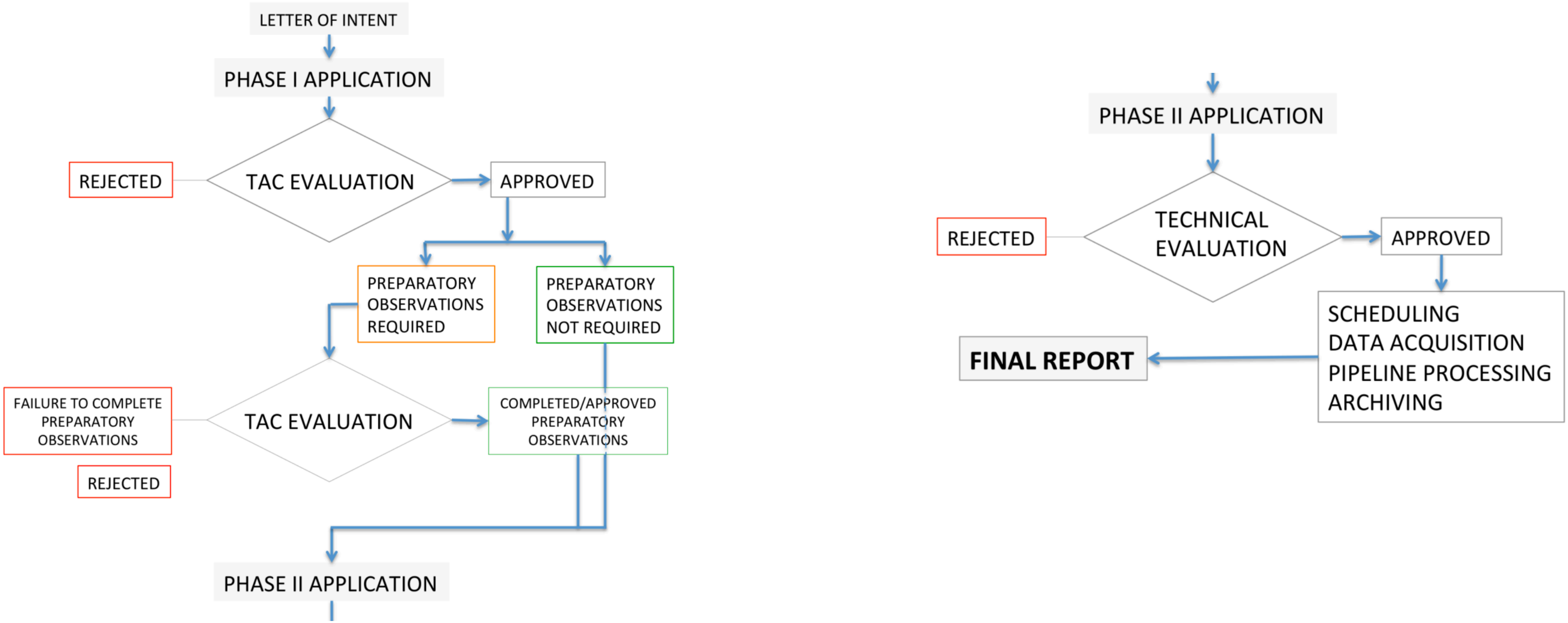
ELEGIBILITY II: CONDITIONS TO BE FULFILLED BY THE TEAM

- Multinational teams involving researchers from the WSO-UV consortia countries (Russia, Spain, Mexico) are given the highest priority.
- The Principal Investigator must be enrolled in a Scientific Institution (University, Research Institute) of the countries involved in the WSO-UV consortium.
- The teams must describe the HLSDP that will result from the research project. Also management plan must be submitted at the time of the Phase I application including a detailed description of the availability of the resources (manpower, expertise, hardware, and software) needed to complete the scientific program and the generation of the final HLSD products.

FURTHER REQUIREMENTS

- Successful proposals and teams are expected to collaborate closely with the WSO-UV science operations team in the definition of the optimization of the data processing software for the purpose of their data analysis.
- Core programme observations will be made public 1 year after the observing programme is concluded, together with the HLSDPs. A research programme is concluded at the time the last observation of the programme is successfully stored in the Mission Archive.

PROPOSAL LIFE CYCLE



THE WSO-UV CORE PROGRAMME TEAM. RESPONSABILITIES.
(4/5 SCIENTISTS)

- Reviewing the CP Management Plan in all its dimensions. To assess in detail the resources available in the CP Teams (manpower, expertise, hardware, and software), and whether they are adequate to the demands of their proposal. The WCPT also evaluates the proposed data (HLSD) products to be delivered to WSO-UV and whether they are suitable to fulfil the goal of serving a broad community.
- Taking part in the science verification of WSO-UV and collaborating to finalise PHASE2 tools
- Participation to the definition of the WSO-UV standard calibration plan, as well as the configuration of the Quality Control (QC) parameters in the pipeline.
- Support the PI's to optimize the scheduling of the observations (Phase 2). To ensure that the survey strategy (dither size and pattern, tiling, field selection, sky conditions, moon phase, etc.) is compatible with the attributes of WSO-UV, and with the goals of the respective CP.
- Basic monitoring the progress of the CP. To oversee the data transfer from the Observatory to the teams, to monitor PHASE 2 progress, delivery of data products from the CP Teams to the WSO-UV archive, in terms of keeping to the agreed upon delivery schedule, product types, and quantity.
- Validating Survey Data Products. The WCPT will act as a referee and will base its assessment of the data quality of the survey products, on the quality control parameters, and the detailed reports provided by the CP teams.
- Issuing and updating guidelines and WSO-UV standards for ingestion and digestion of data products by the WSO-UV archive.

REGULATIONS FOR PANELS SELECTION

- International panels will be issued to evaluate the proposals during Phase I. Two independent panels will evaluate every proposal.
- At the time of Phase I application: it must be made explicit whether preparatory observations with other astronomical facilities are required.
- If required, preparatory observations must be finished before Phase II. Scientific panels will review the status of the preparatory programs
- The time allocation committee (TAC) will be integrated by experienced astronomers: 40% from the countries funding WSO-UV, 60% from the rest of the countries. The TAC will be chaired by the WSO-UV Principal Investigator (PI). Members of the WSO-UV Science team will be assigned as technical advisors to support the TAC in the technical evaluation of the proposals. There will be four basic panels:
    - Solar System and Planetary Science (including exoplanets)
    - Stellar astrophysics and the Galaxy
    - Extragalactic astrophysics
    - Cosmology
- These panels may be split into sub-panels depending on the number of proposals. They will be redundant to guarantee that only excellent proposals are selected for WSO-UV core programme.

PLANNING

May 2018	Call for letters of intent for the WSO-UV core program
July 2018	Deadline for the submission of letters of intent for WSO-UV core program
September 2018	Letters of intent are made public.
September 2018	Release of the call for Phase I proposals
November 2018	Deadline for submission of Phase I proposals
January 2019	TAC releases the list of approved Phase I proposals
January 2020	Call for re-submission of core program proposals requiring preparatory observations
March 2020	Deadline for re-submission of core program proposals
June 2020	TAC approves the final list of proposals
June 2020	Call for Phase II is released
January 2021	Phase II closes
June 2021	Target list complete /released/ scheduling ready
December 2021	Launch

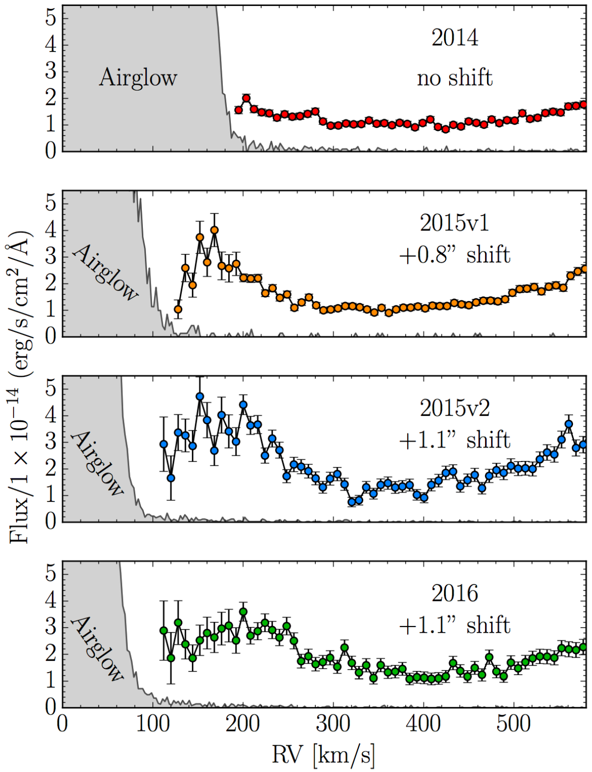
WSO-UV GUARANTEED TIME (GT)

ADVANCE ON GT PROPOSALS. TOPICS

- EXOPLANETS TRANSITS
- EARTH EXOSPHERE AND RADIATION BELTS (PENDING OF TECHNICAL STUDIES)
- MONITORING OF PRE-MAIN SEQUENCE STARS TO STUDY DISK-STAR-OUTFLOW COUPLING
- YOUNG PLANETARY DISKS AND COMETS
- JETS COLLIMATION AND INTERACTION WITH THE CLOUDS
- OH MAPPING OF CLOUDS
- ISM – UV BUMP AND PAH'S DISTRIBUTION
- MONITORING OF CHEMICALLY PECULIAR STARS TO DERIVE THE DISTRIBUTION OF METALS ON THE SURFACE

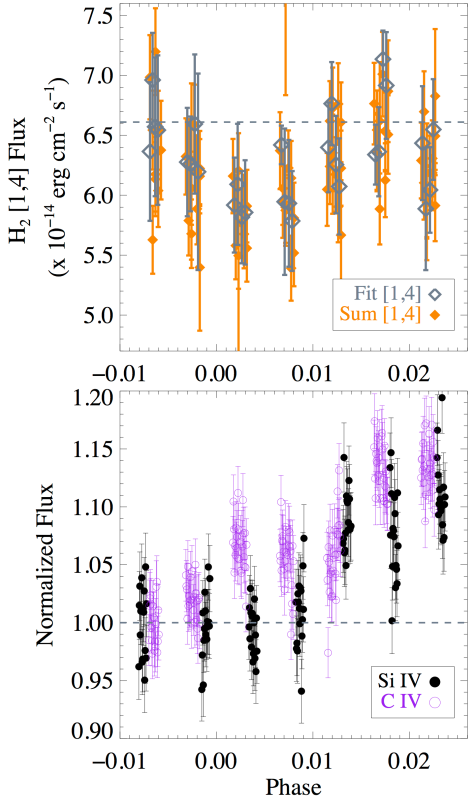
SCIENCE I: "LOW" EFFICIENCY HIGH DISPERSION SPECTROSCOPY
(WITHOUT POLARIZERS)

- Detection of structures in young planetary disks



V = 3.86
A6V
F= 1e-14 erg/s/cm^2/A
COS – 2 orbits/per frame

β Pic
Wilson et al. 2017

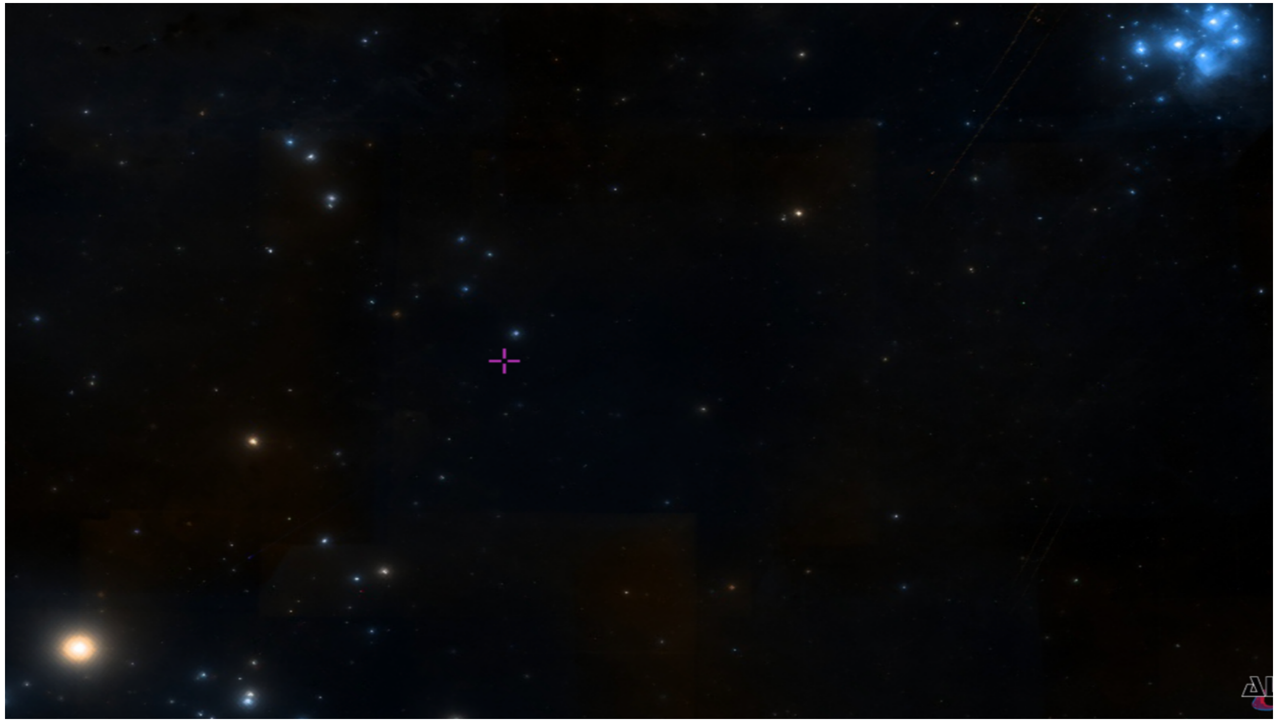


V = 9.00
F5V
F= 1e-14 erg/s/cm^2/A
COS – 1000 s/5 lines

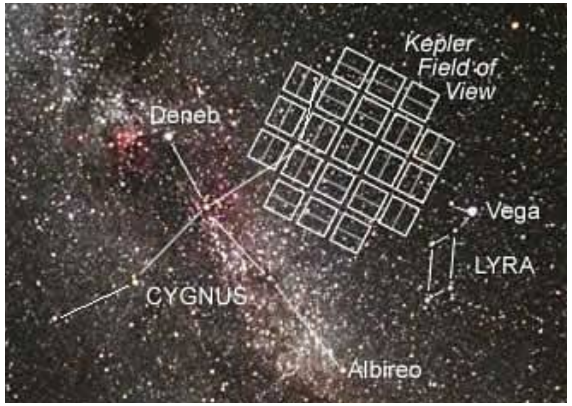
AK Sco
Gomez de Castro et al. 2015

CORE PROGRAM PROPOSALS:
MONITORING A STELLAR FIELD (KEPLER-LIKE) FOR TRANSITS DETECTION

The Hyades (d=47 pc, McArthur et al. 2011), the Pleiades (d=136 pc,) and the Taurus star forming complex (d=140pc) span an area of 18^{o} in the sky.



Contents:
cool stars from the pre-main sequence to the white dwarf stage

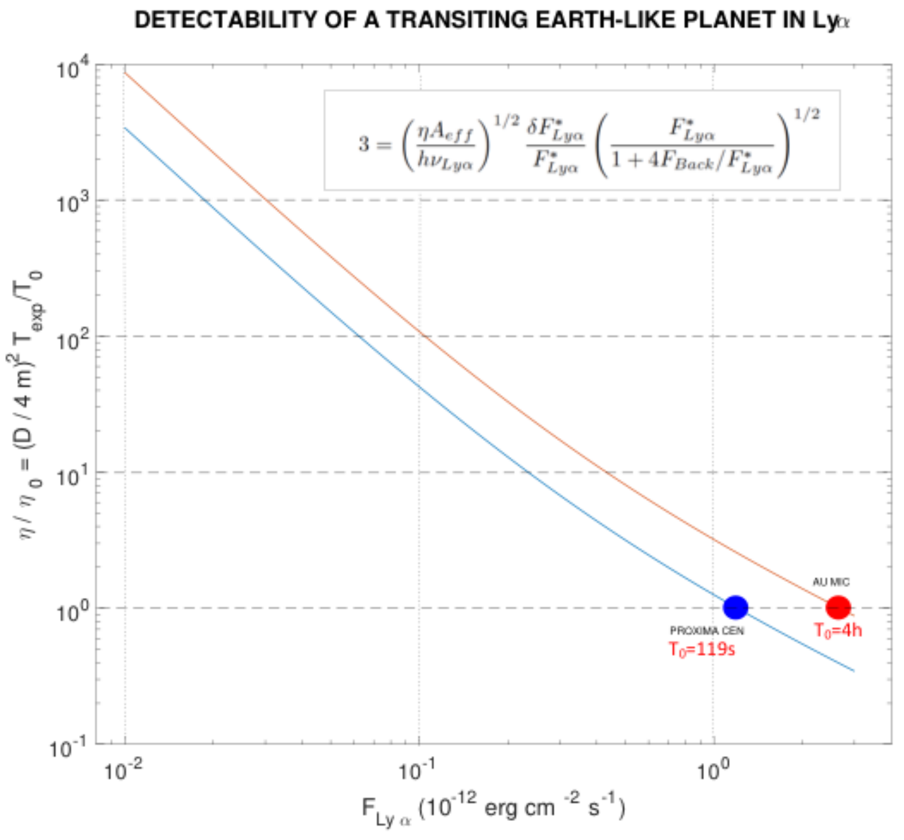


Another possibility: the Keppler field and the North America/Pelican Nebula Complex

CORE PROGRAM PROPOSALS:
MONITORING A STELLAR FIELD (KEPLER-LIKE) FOR TRANSITS DETECTION

PREPARATORY ACTIVITIES:

- TO SELECT THE FIELD: TO IDENTIFY AREAS WITH LOW EXTINCTION TO TRACK EXOPLANETS IN LYA
- TO OPTIMIZE THE SURVEYING METHODOLOGY FOR TRANSITS



CORE PROGRAM PROPOSALS:

COLABORATION PROCEDURES (?)

GENERAL DISCUSSION