Bilimsel Gerekçeler Işığında DAG Teleskobu için Düşünülen Olası Odak Düzlemi Aygıtları ve İşbirlikleri

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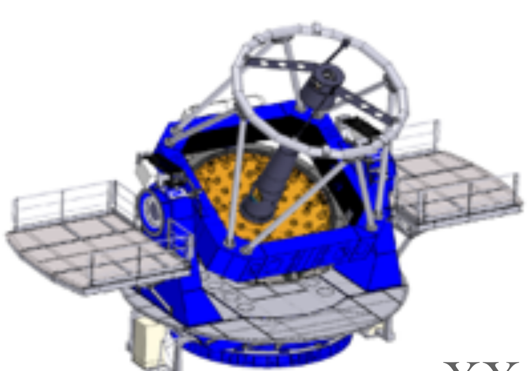
UAK
2016



DAG - Proje Bilimsel Kurulu adına

XX. Ulusal Astronomi Kongresi, 5-9 Eylül 2016, Atatürk Üniversitesi, Erzurum

YOL HARİTASI ÖRNEKLERİ: OPTICON YENİ TEKNOLOJİ GELİŞTİRME PROGRAMI

OPTICON

Optical Infrared Coordination Network for Astronomy

EU - FP6, FP7, FP7-II, FP8

FP7-II; 2013-2016; 10M Euro

Workpackage Number	Description
WP1	Towards Adaptive Optics for the European Extremely Large Telescope
WP2	Fast Detectors and Cameras
WP3	Astrophotonics
WP4	Image reconstruction in optical interferometry
WP5	Development of Active Freeform Mirrors (AFMs)
WP6	Novel Dispersive and Holographic Optical Elements for Astronomy
WP7	Transnational Access
WP8	Management
WP9	Innovation
WP10	European Extremely Large Telescope Science
WP11	Time Domain Astronomy
WP12	Medium Sized Telescope Integration
WP13	Enhancing community skills - Integrating Communities
WP14	The European Interferometry Initiative

Optical Infrared Coordination Network for Astronomy

University of Cambridge	European Southern Observatory	Centre National de la Recherche Scientifique
Istituto Nazionale di Astrofisica	Max Planck Gesellschaft zur Foerderung der Wissenschaften E.V.	Science and Technology Facilities Council
Instituto de Astrofísica de Canarias	Consejo Superior de Investigaciones Cientificas	Office National d'Etudes et de Recherches Aerospatiales

OPTICON

Optical Infrared Coordination Network for Astronomy

Department of Innovation Industry Science and Research	The Nordic Optical Telescope Scientific Association	Stichting Astronomisch Onderzoek in Nederland
National Observatory of Athens	Liverpool John Moores University	Universiteit Leiden on behalf of Nederlandse Onderzoekschool voor de Astronomie
Universidade do Porto	Politecnico di Milano	National University of Galway

OPTICON

Optical Infrared Coordination Network for Astronomy

University of Durham	Astrophysikalisches Institut Potsdam	Uniwersytet Warszawski
Durham University	AIP Leibniz-Institut für Astrophysik Potsdam	University of Warsaw
Heriot-Watt University	University of Bath	ALPAO
Heriot Watt University	University of Bath	

Bilimsel hedefler, kırmızı öte ve optik astronomideki gelecek nesil aygıtları belirliyor.

Belli başlı vizyon çalışmaları;

- ASTRONET Science Vision
- ASTRONET Infrastructure Roadmap
- NASA Advanced Telescope and Observatory Roadmap
- ESA’s Cosmic Vision
- US Adaptive Optics Roadmap

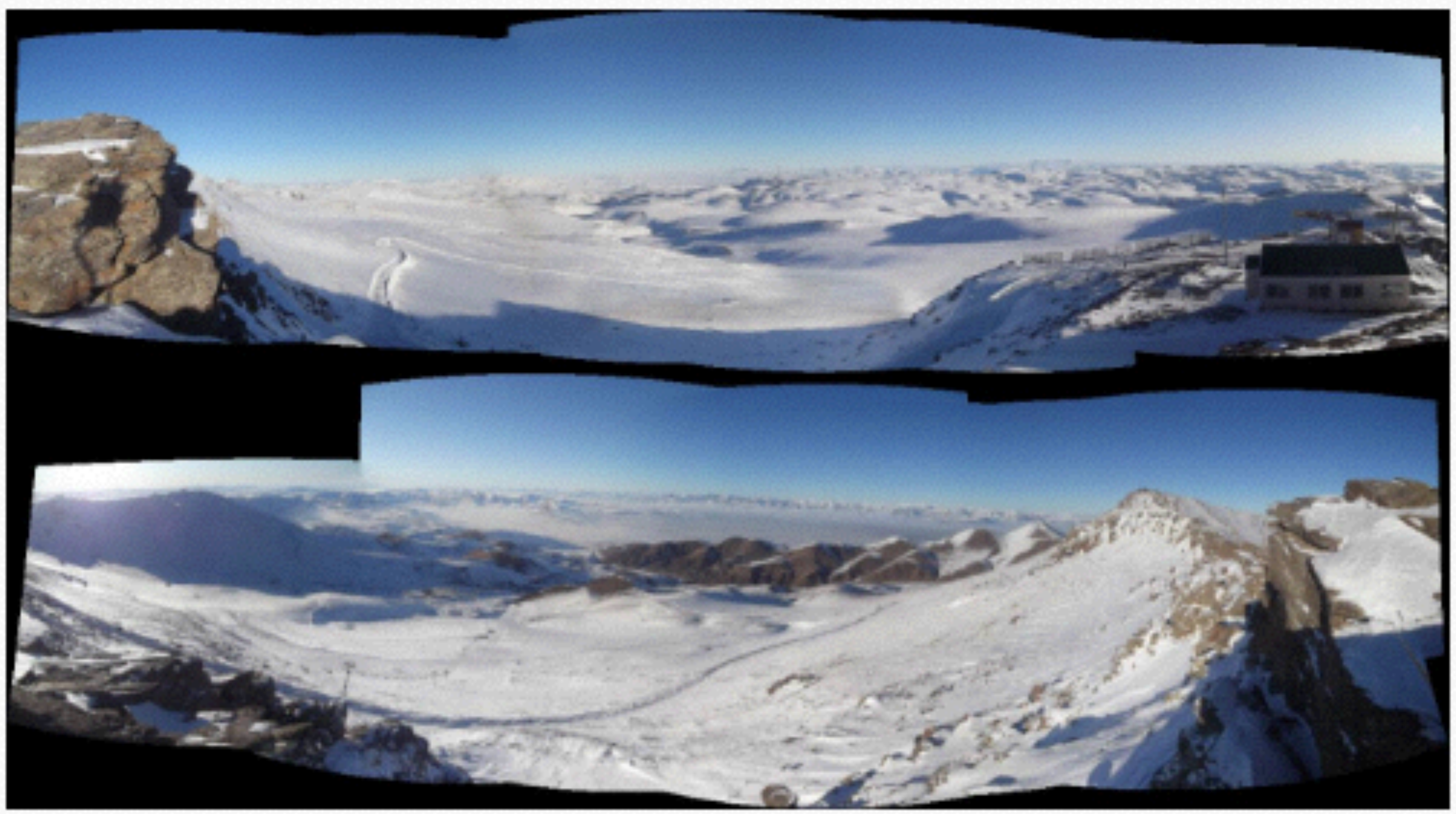
Ötegezegenler
Galaksi Oluşumu
Karadelikler
Yıldız ve Gezegen Oluşumu
İlk Nesneler

Karanlık Madde ve Karanlık Enerji
Astrobiyoloji
Güneş Sistemi
Yıldız Popülasyonları

Doğu Anadolu Gözlemevi - DAG

DAG in SPIE 2016 (Edinburg, UK - 26 June - 1 July, 2016):
Posters and Presentations of DAG in SPIE-AS16

DAG in Physics Today (October 2014):
Visit the web site
DAG in SPIE 2014 (Montreal, Canada - 22-27 June, 2014):
You can download PDF form of the poster here



Karakaya Tepeleri - 3170 m - Erzurum
(Zirveden Güney -üst- ve Kuzey -alt- yönü)
(South -top- and North -bottom- direction at the summit)
39° 47'N - 41° 14'E

DAG Bilimsel Gerekçeler Belgesi
(White Paper, Draft, Mayıs 2012)

#	Topic	Assigned to
	Planets	
1.1	Solar System Bodies	Sacit, Timur
1.2	Exoplanets	Deniz, Aybüke, (Baha/Ralf Neuhaeuser)
	Stars	
2.1	Stars and stellar evolution	Ünal, Ayşe, Sacit, Timur
2.2	Transient objects (SNe, GRBs, SGRs, Novae, Microquasars etc.)	Aysun, Emrah, Eda, Şölen, Ünal, İlham
2.3	ISM and Star Formation	Nazım, Umut
	Galaxies and Cosmology	
3.1	Galaxy Formation and Evolution	Aybüke, Eda, Korhan
3.2	Observational Cosmology	Aliş, Korhan
3.3	Galaxy Clusters	Aliş, Korhan
	Synergies with Current and Future Facilities	
4.1	High Energy missions (Gamma-ray and X-ray, Cherenkov)	Tolga, Emrah, Şölen
4.2	Optical	Aliş, Korhan, Tolga
4.3	Near-IR	Aybüke, Tolga, Sacit
4.4	Mid/Far-IR	Umut
4.5	Sub-mm/Radio	Umut
	Competition in the Northern Sky	
5.1	Current and Future Projects with 4m-class Telescopes	Korhan, Tolga, Aybüke
5.2	Current and Future Survey Projects	Korhan, Tolga, Aybüke

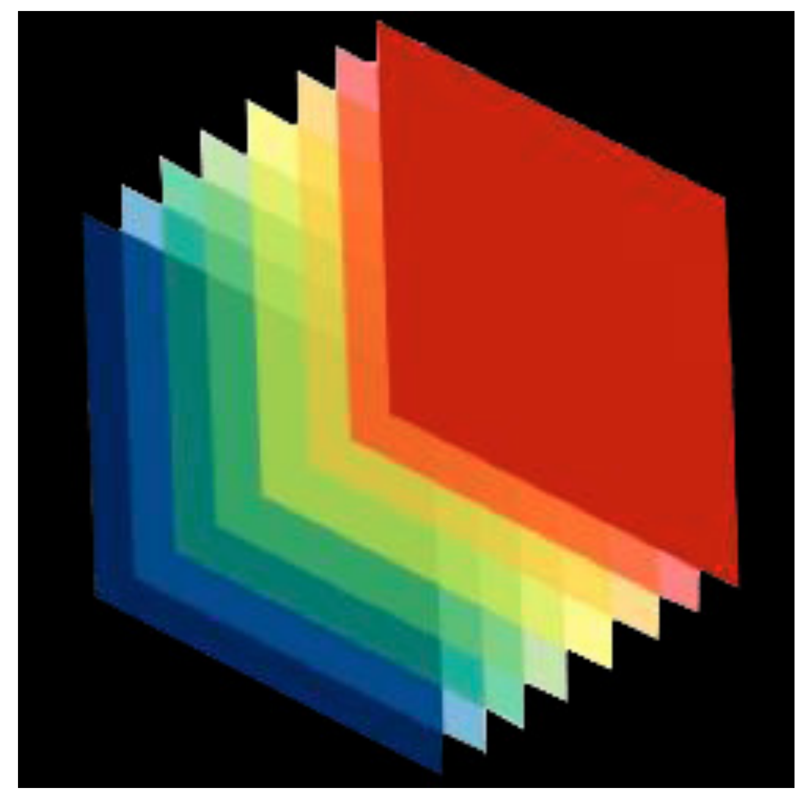
Günümüzde Kullanılan Aygıt Teknolojileri

Optical Technologies	Interferometry	Detectors
Multi-Object Spectroscopy	Beam Transport & Delay Lines	CCDs
Integral Field Spectroscopy	Control Systems, Metrology &	IR detector arrays
Fourier Transform Spectroscopy	Phasing	Energy Sensitive Detectors
Atmospheric Dispersion Correction	Detectors	Single Photon Devices
Reflective and refractive optics	Beam Combination	
Dispersive optics	Spectral Coverage	
Polarization Optics	**Cryogenics**	**Cryogenics**
Optical Coatings & Filters	Cryocoolers	Mechanical Structures
Active Optics	Cryostats	Simulation
Integrated On-Chip Spectrometers	Cryo-Materials	Calibration
Optical Connections	Cold Electronics	Instrument control
Fibres	Cryo Mechanisms	
	Wiring	

Sıçramalı Teknoloji Gelişimi - Tarihsel Örnekler

1609 Galileo'nun cam mercekleri teleskop için kullanması
1663 - 1672 James Gregory ve Isaac Newton'un yansıtıcı teleskoplar için yeni tasarımları
1864 Leon Foucault'nun gümüş kaplamalı yansıtıcı teleskobu keşfi
1908 - 1948 George Ritchey ve George Ellery Hale'nin ilk büyük aynalı teleskopları yapması (2.5 m ve 5m Palomar teleskopları)
1975 - 1990 Fotoğraf plakları yerine elektronik dizge alıcıların kullanılmaya başlanması
1975 Teleskopların bilgisayar kontrollü hale gelmesiyle Alt-Az tasarımların standartlaşması
1990 Uzay teleskoplarının devreye girmesi
1990 - 1997 Çok parçalı aynaların üretilmeye başlanması, aktif optik ve hareketli aynalar
1989 - 2010 Adaptive optik uygulamalarının kullanılmaya başlanması

DAG Odak Düzlemi Aygıtları İçin Potansiyel Bağlantılar ve Aygıt Önerileri



SPIE.

2 Nasmyth odakta optimum olarak 6 ODA barınabilir.

Nasmyth 1 FPIs

N1-a: An optical imager such as CCD with high quantum efficiency will be used for general photometry purposes and monitoring transient objects.

N1-b: An infrared imager will be used to study X-ray binaries and AGNs as well as galaxy evolution.

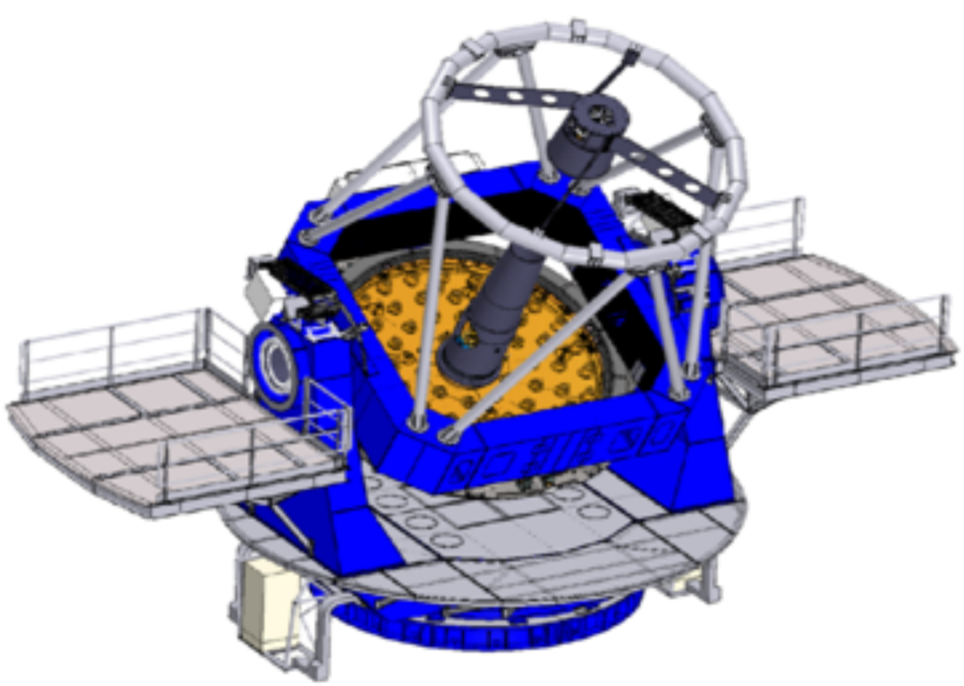
N1-c: New technology detectors operating around 100 mK and allow observations from optical to near-infrared wavelengths.

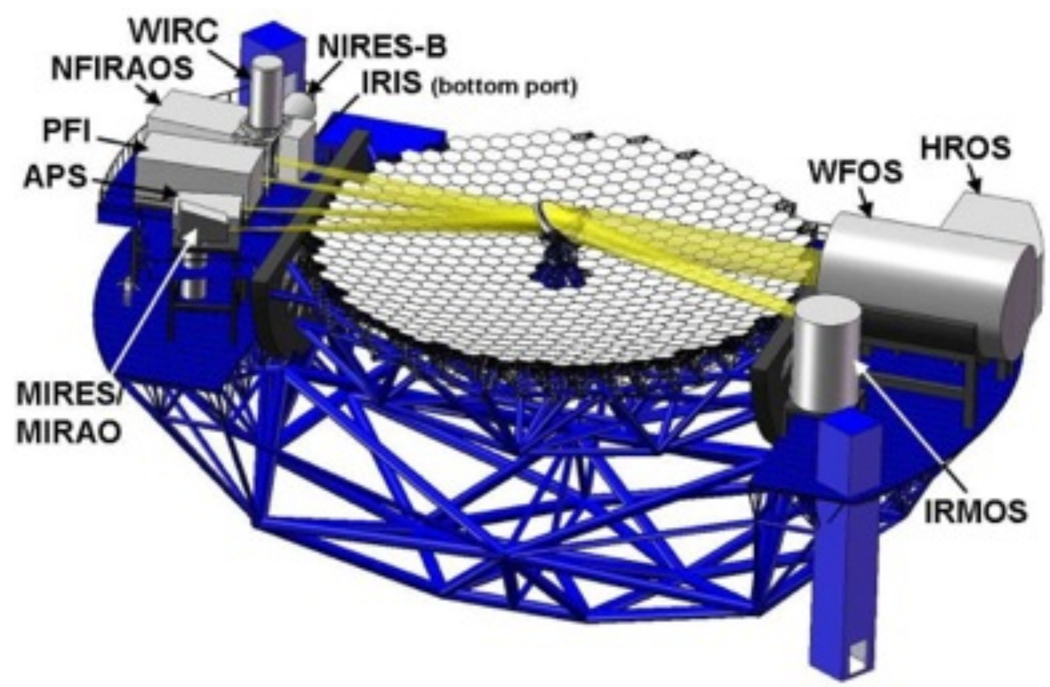
Nasmyth 2 FPIs

N2-a: DAG Project team has decided to obtain a spectrograph which willl operate between 350-1000 nm with resolutions between 100-3000. This instrument is expected to be a workhorse for the Turkish astronomical community.

N2-b: As DAG will be the first and largest telescope to operate in the near-IR in Turkey, spectroscopy will be very crucial. This instrument will enable Turkish astronomers to work in the wavelength range of 0.9 – 2.5 microns.

N2-c: Although it is desired to have a multi-object spectrograph, this instrument slot can be reserved for future collaborations.



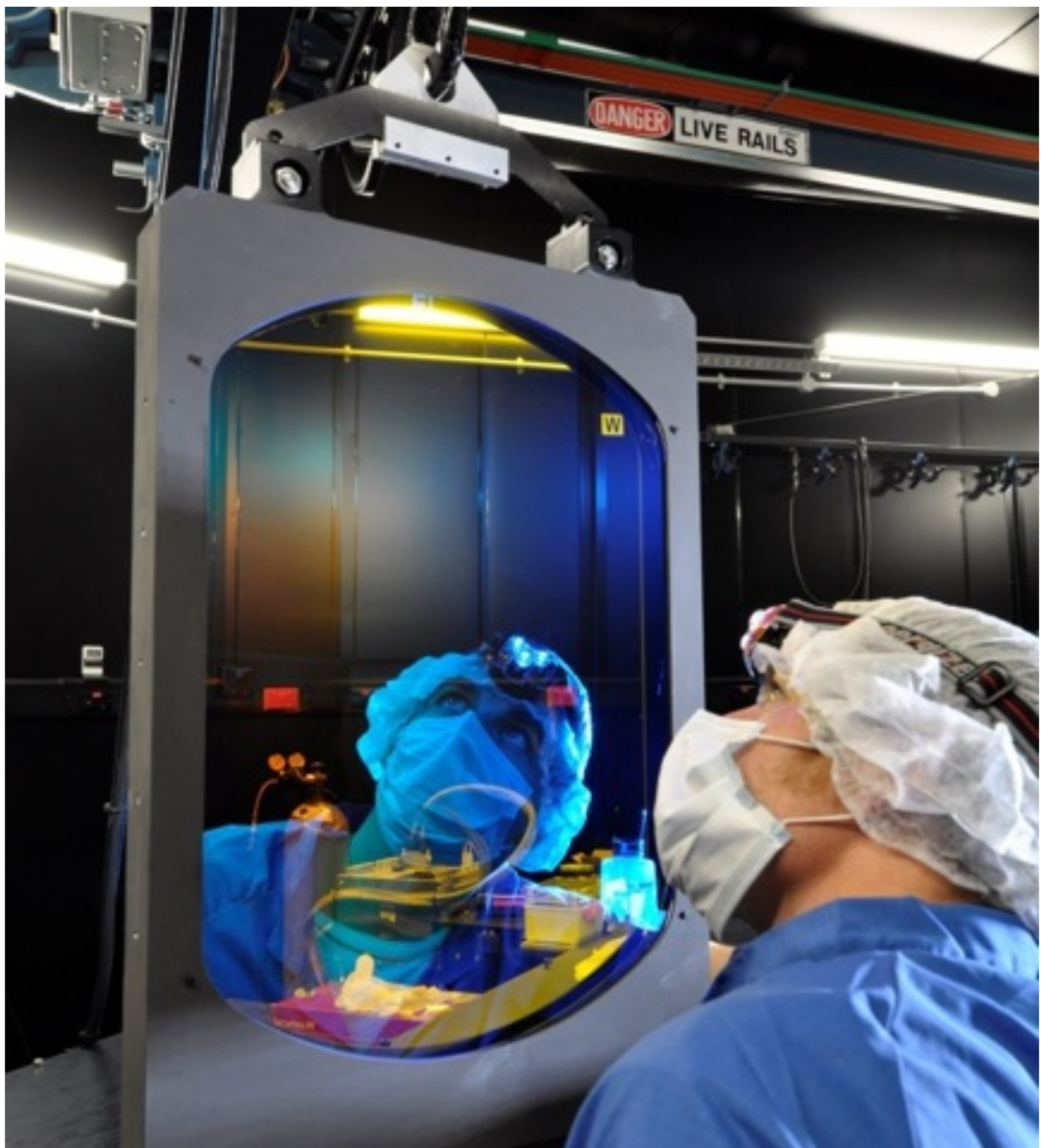


DAG_AAO

Australian Government
Department of Industry,
Innovation and Science

AAO

VIS
Imager Multi-Object Spectrograph



- AAOmega upgrade - new CCDs for the AAOmega instrument at the AAT – 2014
- HERMES - moderate resolution optical spectrograph for the AAT – 2014
- KOALA - 500 element fibre-IFU for the AAT – 2014
- SAMI -multi-IFU hexabundle fibre feed for the AAT – 2013
- CYCLOPS2 - fibre image slicer for UCLES at the AAT – 2012
- GNOSIS - OH suppression fibre feed for IRIS2 at the AAT – 2012
- CURE - Cassegrain calibration and guide unit at the AAT – 2012
- SAMI prototype - multi-IFU hexabundle fibre feed for the AAT – 2011
- CYCLOPS - fibre image slicer for UCLES at the AAT – 2010
- APT camera - wide-field optical camera for the APT – 2008
- AAT-TCS - telescope control system upgrade for the UKST – 2008
- FMOS/Echidna - fibre positioning robot for Subaru – 2007
- SPIRAL - upgrade to SPIRAL-B for use with AAOmega at the AAT – 2006
- AAOmega - optical multi-object spectrograph for the AAT – 2006
- OzPoz - fibre positioning robot for the VLT – 2003
- DAZLE - near infrared narrow-band imager for the VLT – 2003
- IRIS2 - near-infrared slit-mask spectrograph and imager for the AAT – 2002
- 6dF - 150-fibre positioning robot for the UKST – 2001
- WFI - wide field optical imager for the AAT – 2000
- PFU - prime focus unit for the AAT – 2000
- MAPPIT 2 - high resolution interferometer for the AAT – 2000
- Taurus Polarimeter - imaging polarimetry mode for Taurus – 2000
- SOAR-IFU - prototype fibre-IFU for the SOAR telescope – 2000
- SPIRAL-B - fibre-IFU and spectrograph for the AAT – 2000
- UKS-TCS - telescope control system upgrade for the UKST – 2000

- AESOP: spine based fibre positioner for the VISTA telescope
- GHOST: high resolution Echelle spectrograph for Gemini
- Hector: multi-IFU positioner and spectrograph for the AAT
- MANIFEST: Starbugs-based fibre positioner for the Giant Magellan Telescope
- PRAXIS: atmospheric OH suppression spectrograph for the AAT
- TAIPAN: Starbugs-based fibre positioner and spectrograph for the UKST

DAG_FLAMINGOS

UF | UNIVERSITY of FLORIDA

FLoridA Multi-object Imaging Near-ir Grism Observational Spectrometer

Array: Hawaii II 2048×2048 HgCdTe science grade array, divided into four quadrants with 8 amplifiers each (32 amplifiers for the whole array).

Linearity at 1.0V bias:
0.5% non-linear at 25,000 ADU
2.0% non-linear at 35,000 ADU
> 3% non-linear at 40,000 ADU

$S' = 1.00425\,S - 1.01413\times10^{-6}\,S^2 + 4.18096\times10^{-11}\,S^3$ (Anthony Gonzalez, UF)
IRLINCOR coefficients: A = 1.00425 B = -0.03323 C = 0.04489

Plate Scale and Field of View: 0.316 arcsec/pixel
10.8 arcmin FOV
Typical image quality (FWHM) = 2–3 pixels = 0.63 – 0.95 arcsec.

Detector Characteristics

	Imaging	*Spectroscopy*
Bias Voltage (Volts)	1.0	0.75
Full Well (ADU)	~50,000	~38,000
Target Count level (ADU)	25,000 – 35,000	15,000 – 20,000
CDS Read Noise without Differential Amplifier (e)	~40	~40
Gain (e / ADU)	~4.9	~4.1

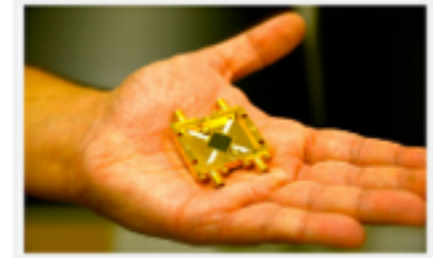
NOTE: The default bias on boot of the MCE4 array controller is 0.776 V, which is not used in any observing configuration; the initialization script initflam.pl automatically sets the bias to 1.0 V for imaging, but queries the user if they wish to change the bias.

Filters: J, H, K, Ks, JH (0.9 μm – 1.8 μm), and HK (1.25 μm – 2.5 μm) bandpass filters.

FLAMINGOS-II
@Gemini

- **Upgrade**
- **UNAM ile ortaklık**
- **Zaman paylaşımı**
- **Bilimsel ortaklık**

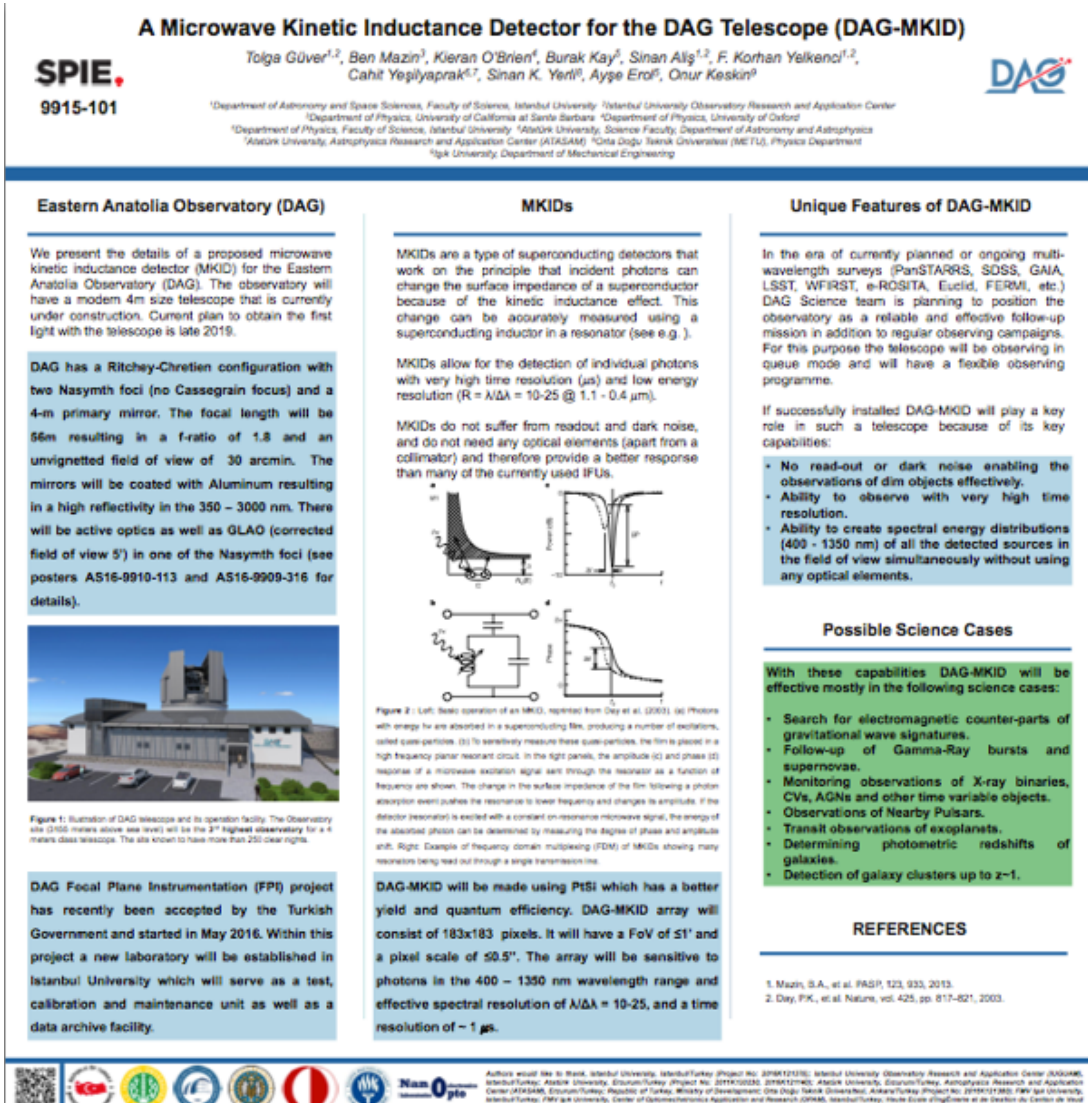
DAG_MKID



ARCONS is a superconducting photon detector consisting of a 2,024-pixel (44 x 46) array sensitive to UV, optical, and near-infrared light.

Mazin Lab

All of the wavelengths
All of the times



A Microwave Kinetic Inductance Detector for the DAG Telescope (DAG-MKID)

SPIE.

9915-101

Tolga Güver[1,2], Ben Mazin[3], Kieran O'Brien[4], Burak Kaya[5], Sinan Aliş[1,2], F. Korhan Yelkenci[1,2], Cahit Yeşilyaprak[6,7], Sinan K. Yerli[8], Ayşe Erol[5], Onur Keskin[9]

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Eastern Anatolia Observatory (DAG)

We present the details of a proposed microwave kinetic inductance detector (MKID) for the Eastern Anatolia Observatory (DAG). The observatory will have a modern 4m size telescope that is currently under construction. Current plan to obtain the first light with the telescope is late 2019.

DAG has a Ritchey-Chretien configuration with two Nasymth foci (no Cassegrain focus) and a 4-m primary mirror. The focal length will be 56m resulting in a f-ratio of 1.8 and an unvignetted field of view of 30 arcmin. The mirrors will be coated with Aluminum resulting in a high reflectivity in the 350 – 3000 nm. There will be active optics as well as GLAO (corrected field of view 5') in one of the Nasymth foci (see posters AS16-9910-113 and AS16-9909-316 for details).

Figure 1: Illustration of DAG telescope and its operation facility. The Observatory site (3165 meters above sea level) will be the 3rd **highest observatory** for a 4 meters class telescope. The site known to have more than 250 clear nights.

DAG Focal Plane Instrumentation (FPI) project has recently been accepted by the Turkish Government and started in May 2016. Within this project a new laboratory will be established in Istanbul University which will serve as a test, calibration and maintenance unit as well as a data archive facility.

MKIDs

MKIDs are a type of superconducting detectors that work on the principle that incident photons can change the surface impedance of a superconductor because of the kinetic inductance effect. This change can be accurately measured using a superconducting inductor in a resonator (see e.g.).

MKIDs allow for the detection of individual photons with very high time resolution (μs) and low energy resolution ($R = \lambda/\Delta\lambda$ = 10-25 @ 1.1 - 0.4 μm).

MKIDs do not suffer from readout and dark noise, and do not need any optical elements (apart from a collimator) and therefore provide a better response than many of the currently used IFUs.

Figure 2 : Left: Basic operation of an MKID, reprinted from Day et al. (2003). (a) Photons with energy hν are absorbed in a superconducting film, producing a number of excitations, called quasi-particles. (b) To sensitively measure these quasi-particles, the film is placed in a high frequency planar resonant circuit. In the right panels, the amplitude (c) and phase (d) response of a microwave excitation signal sent through the resonator as a function of frequency are shown. The change in the surface impedance of the film following a photon absorption event pushes the resonance to lower frequency and changes its amplitude. If the detector (resonator) is excited with a constant on-resonance microwave signal, the energy of the absorbed photon can be determined by measuring the degree of phase and amplitude shift. Right: Example of frequency domain multiplexing (FDM) of MKIDs showing many resonators being read out through a single transmission line.

DAG-MKID will be made using PtSi which has a better yield and quantum efficiency. DAG-MKID array will consist of 183x183 pixels. It will have a FoV of ≤1' and a pixel scale of ≤0.5". The array will be sensitive to photons in the 400 – 1350 nm wavelength range and effective spectral resolution of $\lambda/\Delta\lambda$ = 10-25, and a time resolution of ~ 1 μs.

Unique Features of DAG-MKID

In the era of currently planned or ongoing multi-wavelength surveys (PanSTARRS, SDSS, GAIA, LSST, WFIRST, e-ROSITA, Euclid, FERMI, etc.) DAG Science team is planning to position the observatory as a reliable and effective follow-up mission in addition to regular observing campaigns. For this purpose the telescope will be observing in queue mode and will have a flexible observing programme.

If successfully installed DAG-MKID will play a key role in such a telescope because of its key capabilities:

- **No read-out or dark noise enabling the observations of dim objects effectively.**
- **Ability to observe with very high time resolution.**
- **Ability to create spectral energy distributions (400 - 1350 nm) of all the detected sources in the field of view simultaneously without using any optical elements.**

Possible Science Cases

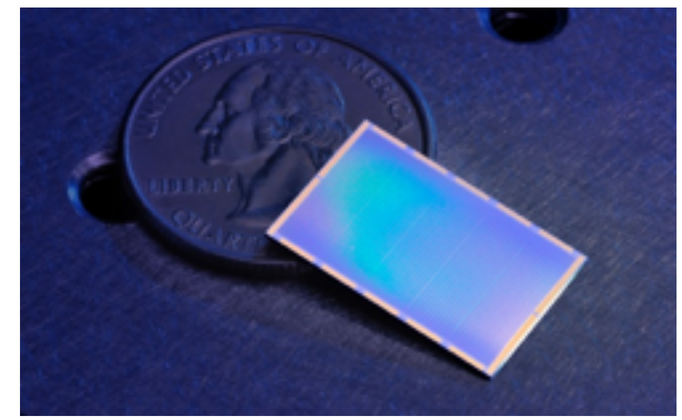
With these capabilities DAG-MKID will be effective mostly in the following science cases:

- **Search for electromagnetic counter-parts of gravitational wave signatures.**
- **Follow-up of Gamma-Ray bursts and supernovae.**
- **Monitoring observations of X-ray binaries, CVs, AGNs and other time variable objects.**
- **Observations of Nearby Pulsars.**
- **Transit observations of exoplanets.**
- **Determining photometric redshifts of galaxies.**
- **Detection of galaxy clusters up to z~1.**

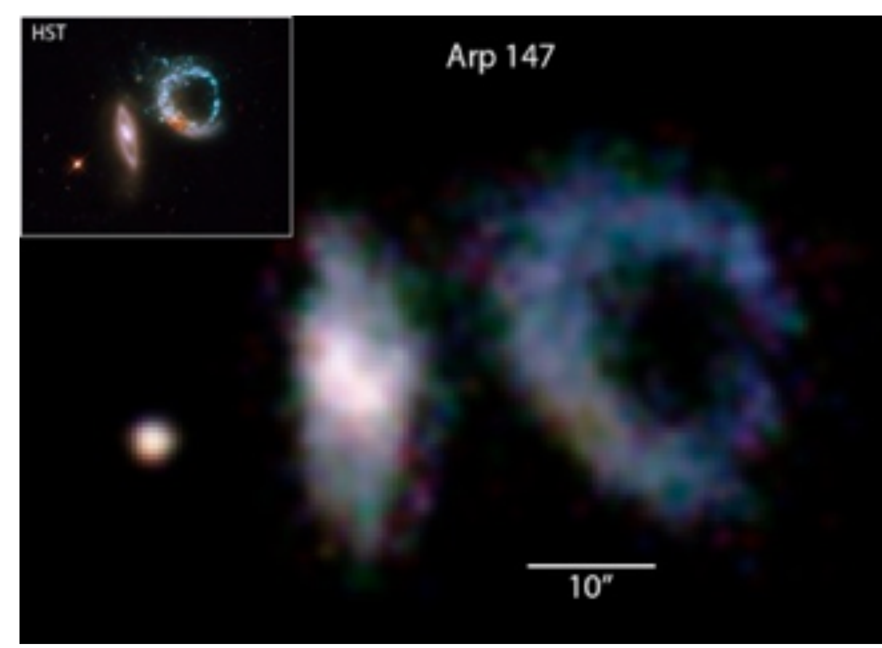
REFERENCES

1. Mazin, B.A., et al. PASP, 123, 933, 2013.
2. Day, P.K., et al. Nature, vol. 425, pp. 817–821, 2003.

Yeni Teknoloji
Süper İletken Materyal
Katıhal Fiziği ile yakın temas

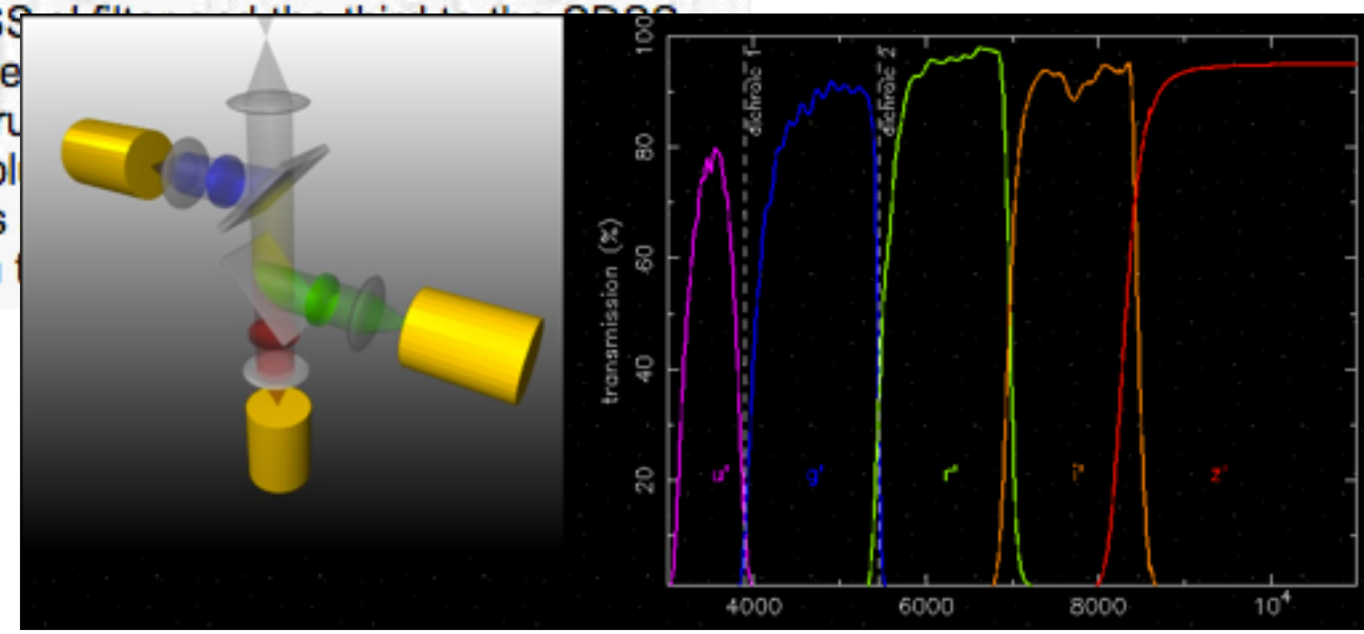


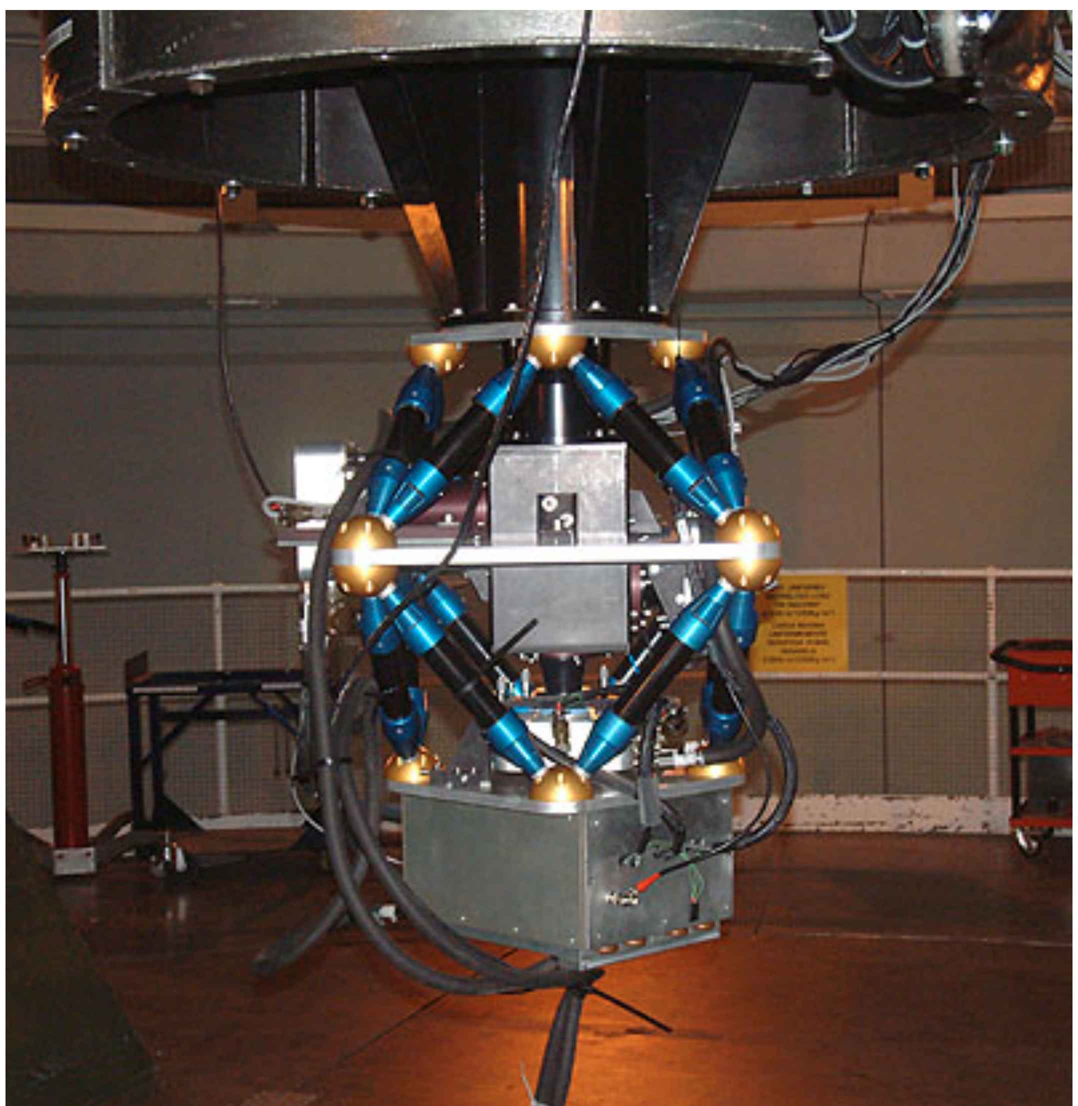
4000 - 13500 A



DAG_ULTRACAM/HIPERCAM

Description: ULTRACAM is a high-speed, three-colour CCD camera designed to provide imaging
photometry at high temporal resolutions. The instrument is highly portable and will be used at a
number of large telescopes around the world. On the WHT, ULTRACAM mounts at the Cassegrain
focus and provides a 5 arcminute field on its three 1024×1024 CCDs (i.e. 0.3 arcsec/pixel). Incident
light is first collimated and then split into three different beams using a pair of dichroic beamsplitters.
One beam is dedicated to the SDSS u' filter, another to the SDSS
r'/i'/z' filters, although it is possible to use different filters if require
and coatings on the optics and chips, we have achieved an instru
50% in the green and red arms of ULTRACAM and 30% in the bl
ULTRACAM mounts at Cassegrain, and hence telescope losses
of approximately 2,000 per second for a V=18 magnitude star in





Ultracam (3-channel)
300k Pound (PPARC)

Hipercam (5-channel)
3.5M Euro (ERC)

The University Of Sheffield.

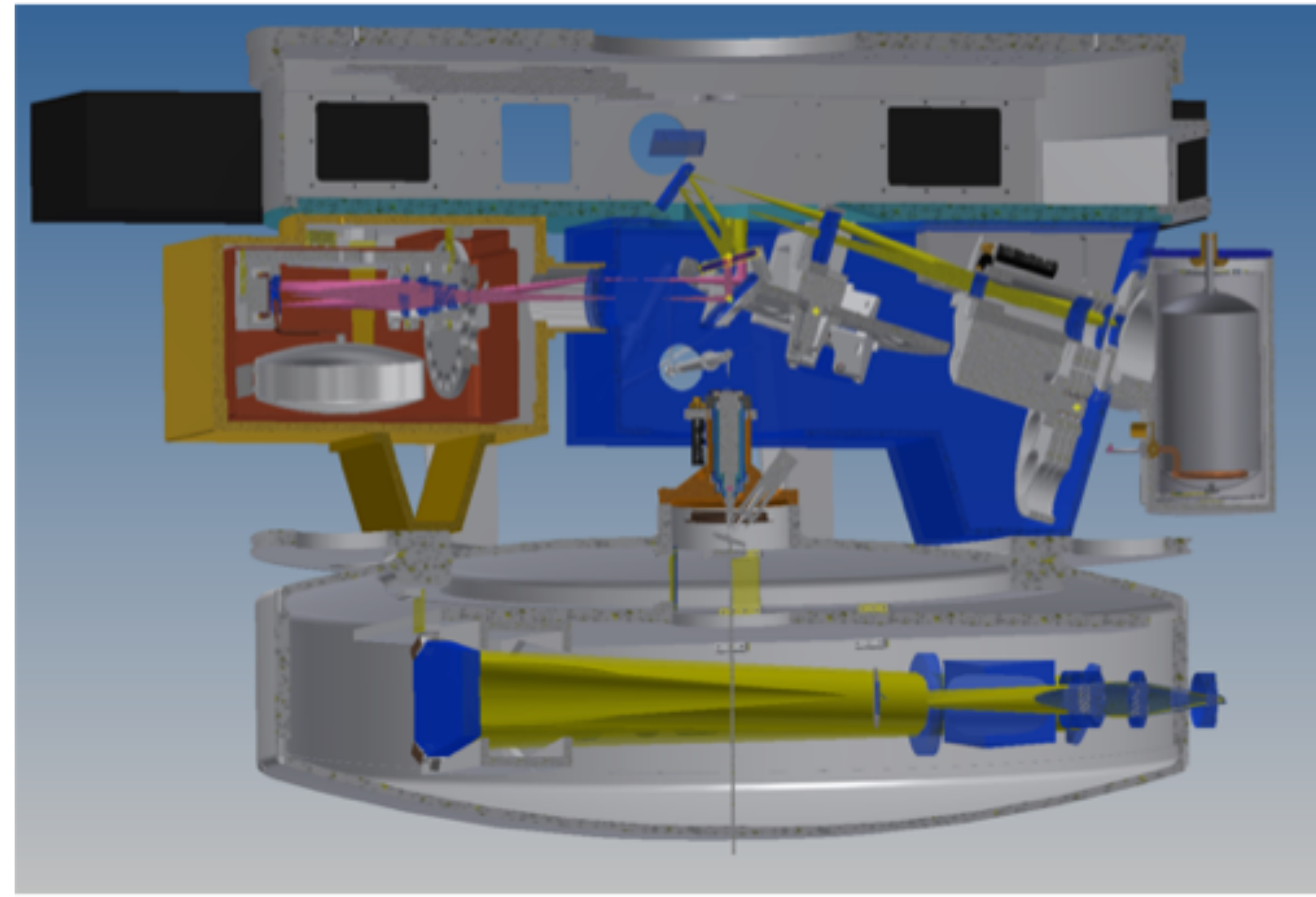
THE UNIVERSITY OF WARWICK

Science & Technology Facilities Council

DAG_ESO

SOXS@NTT
Son of X-Shooter

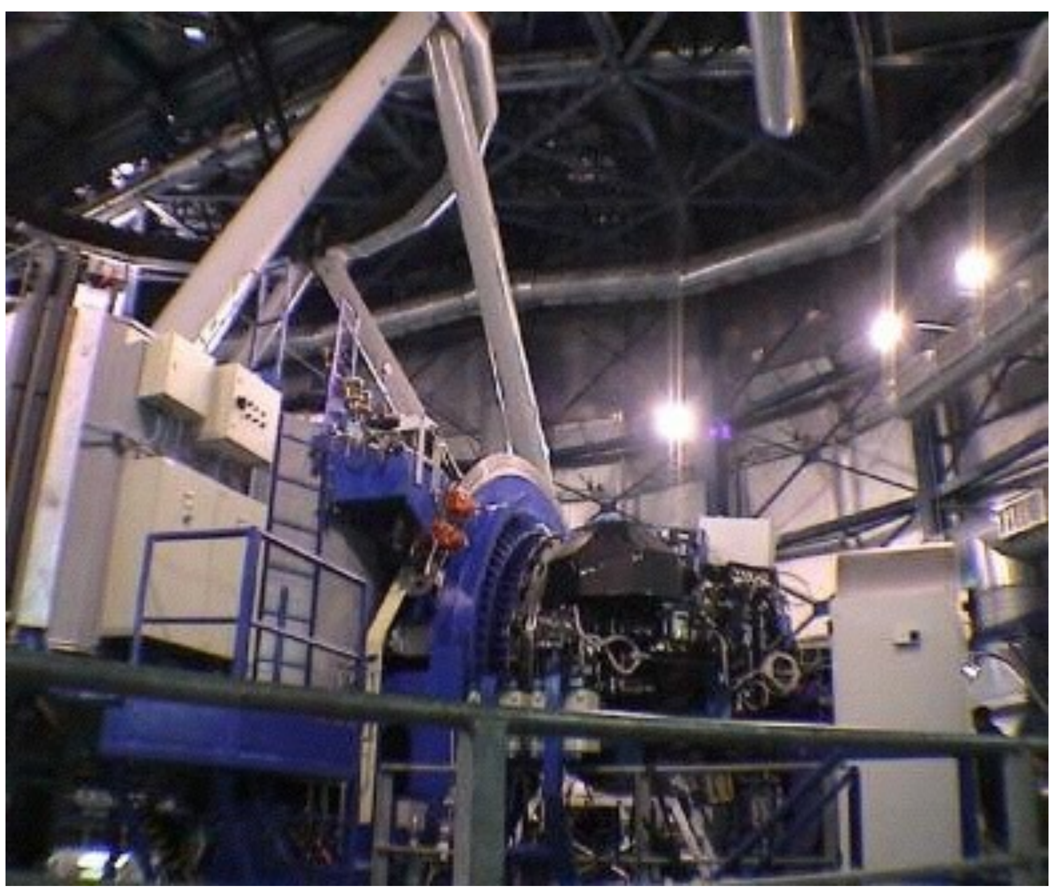
VIS+NIR
Imager Spectrograph



DAG_ESO

- SOXS@NTT ve SOXS@DAG
  Karşılıklı zaman paylaşımı, kuzey-güney sinerjisi

- Decommissioned Instruments
  VIMOS@2018



Description
VIMOS is a multi-mode wide-field optical instrument mounted at the Nasmyth focus B of UT3. VIMOS allows imaging in *UBVRIz* and multi-object low (R ~ 200) to high (R ~ 2500) resolution spectroscopy. The wavelength range covered in the two spectroscopic modes goes from 3600 to 10000 A.

VIMOS Observing Modes
IMG: Imaging is possible in *UBVRIz* filters in a 4 x 7' x 8' field of view.
MOS: Multi-object spectroscopy is carried out using masks (one per quadrant) prepared in Paranal using a laser cutting Mask Manufacturing Unit. Depending on the grism used, the spectral resolution varies from 200 to 2500, and the observable range is from 360 to 1000 nm. The maximum number of slits per mask (quadrant) varies from ~40 at *R*=2500 to ~150-200 at *R*=200, for a field of view of 4 x 7' x 8'.
IFU: VIMOS is also equipped with an integral field unit made of 6400 fibers. The scale on the sky can be changed from 0.67" per fiber to 0.33" per fiber and the integral field unit can cover up 13"x 13" up to 54"x54" on sky depending on spectral resolution and spatial magnification. Spectral resolution and coverage are similar to MOS.

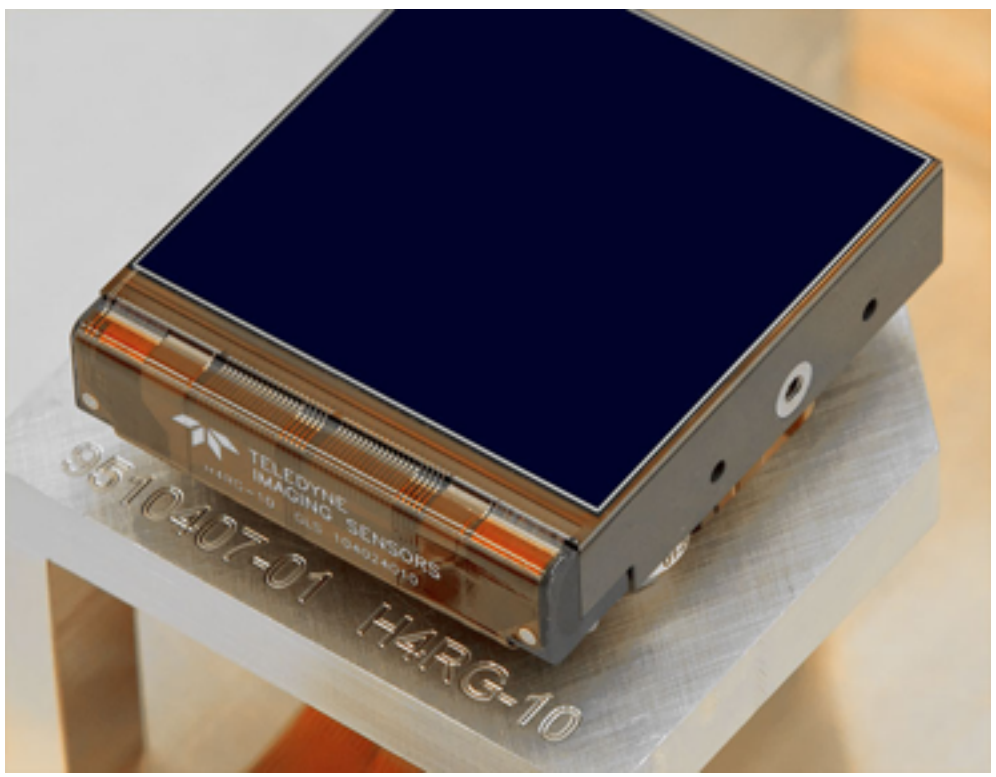
DAG_ZTF

R-band 60s pozlarla gökyüzü taraması

DAG İLK IŞIK AYGITLARI İÇİN ÖNERİLER

NIR Görüntüleyici

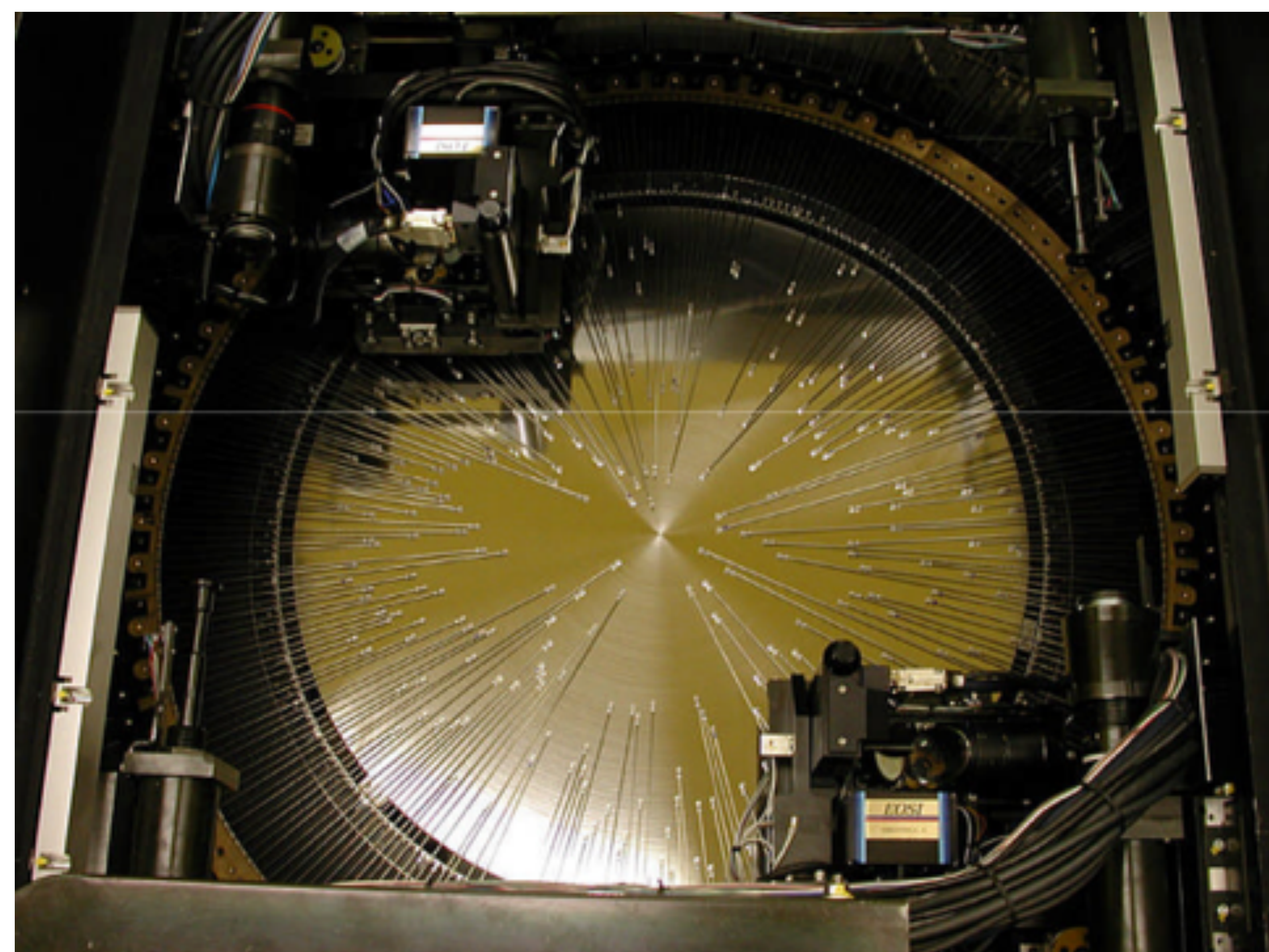
Hawaii 4RG



- Yeni Nesil
- Geniş Alan
- Benzersizlik

VIS Görüntüleyici-Tayfçeker

- 4000 - 10000 A çalışma aralığı
- R ~ 200 - 5000
- Robotik MOS

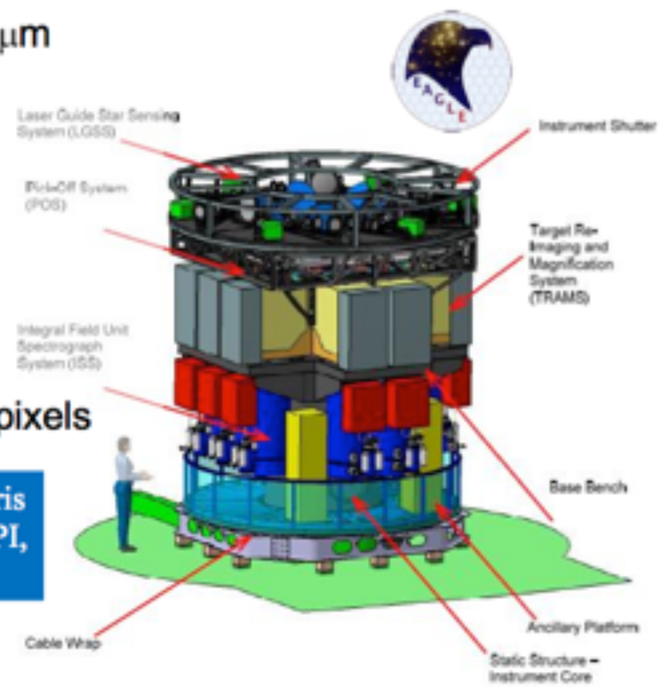


DAG Teleskobu İçin Yüksek Performanslı Aygıt Önerileri

ELT-MOS/EAGLE: a wide-field multi-IFU AO assisted NIR spectrograph

- Near-infrared: 0.8-2.45μm
- Patrol field 38arcmin²
- 20-IFU fields
  - 1.65"x1.65"
- R~4000,10000
- Multi-Object AO
  - 6LGS, 6NGS
  - >30%EE in 75mas pixels

PI: Jean-Gabriel Cuby, Simon Morris
LAM, Uni. Durham, UK ATC, GEPI, ONERA, LESIA



Örnekler yalnızca işlevleri için

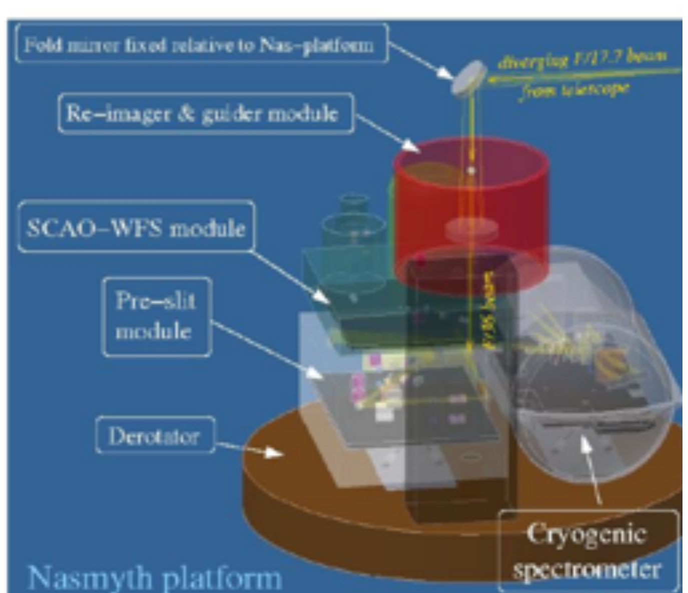
- **VIS HR Tayfçeker**
- **NIR HR Tayfçeker**
- **NIR/VIS IFU Tayfçeker**

ODA+ ??

ELT-HIRES/SIMPLE: High resolution NIR spectrograph

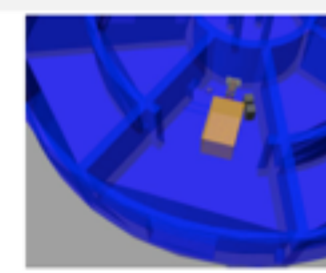
- Wavelength 0.84-2.5μm
- Complete spectrum
- R~130,000
- Slit: 27x450mas
- Adaptive optics
  - SCAO on-board
  - MCAO/MAORY
  - LTAO/ATLAS

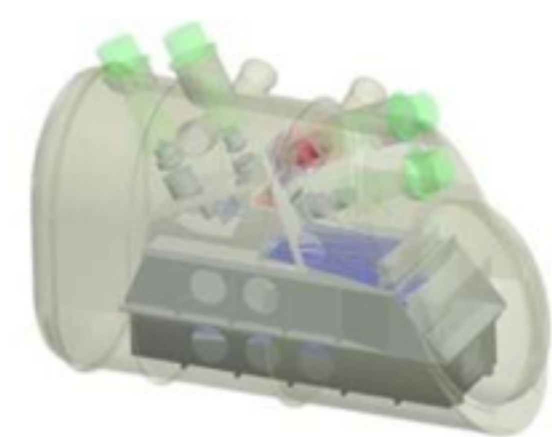
PI: Livia Origlia
INAF,UAO, TLS, PUC



ELT-HIRES/CODEX
high stability, high resolution visible spectrograph

- Wavelength range 0.37-0.71μm
- R~130,000
- Field of view (0.82")
- ~2cms⁻¹ Doppler precision over 30yrs
- no adaptive optics
- located in the coudé room





PI: Luca Pasquini, ESO
Geneve Observatory, IAC, INAF-Trieste and Brera, IoA

DAG-ODA / Phase A - Yol Haritası

1) Araştırma-geliştirme
(PS Team) Ağustos 2016

2) ODA özelliklerinin belirlenmesi
(PS Team) Eylül 2016

3) Taleplerin revizyonu
(PS Team + PIs + PM) Ekim 2016

4) Tekliflerin değerlendirilmesi
(PS Team + PIs + PM) Kasım 2016

5) Siparişlerin verilmesi / anlaşmaların yapılması
(PI) Ocak-Şubat 2017

Bilimsel Gerekçeler Işığında DAG Teleskobu için Düşünülen Olası Odak Düzlemi Aygıtları ve İşbirlikleri

Sinan Aliş
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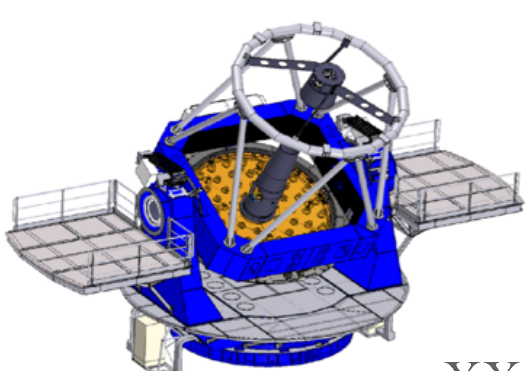
Mehtap Özbey Arabacı, Sinan Kaan Yerli, Cahit Yeşilyaprak, Tolga Güver, Onur Keskin, Laurent Jolissaint, Tenay Saguner



DAG - Proje Bilimsel Kurulu adına

XX. Ulusal Astronomi Kongresi, 5-9 Eylül 2016, Atatürk Üniversitesi, Erzurum