

Madrid es Cielo: Estrellas,

enanas marrones y planetas



David Barrado y Navascués.

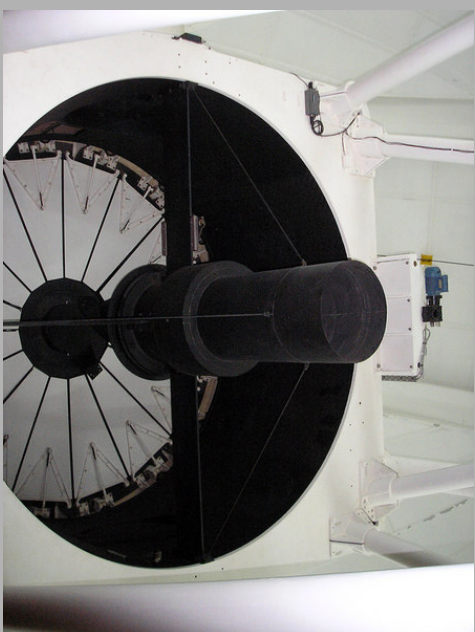
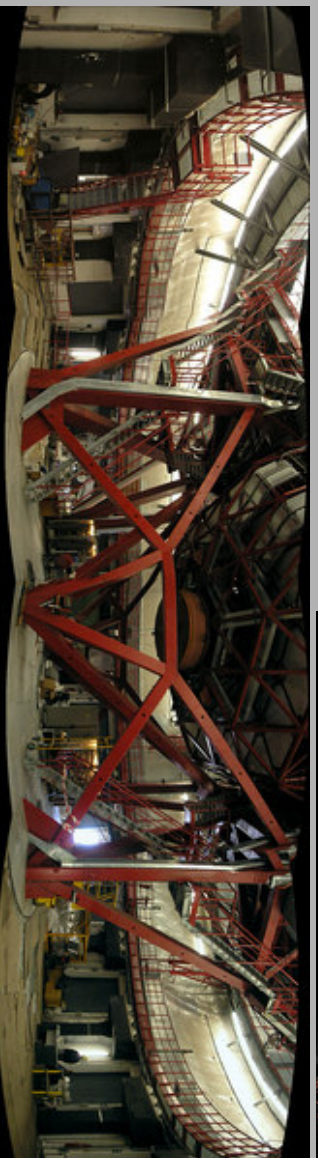
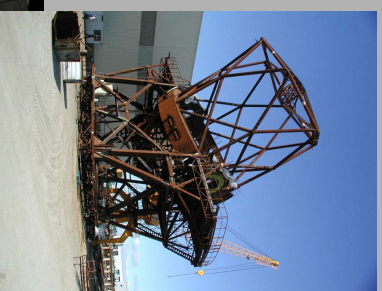
Laboratorio de Astrofísica Espacial y Física Fundamental
(LAEFF-INTA), VILSPA, Madrid

- Formación estelar
- Enanas marrones
- Sistemas protoplanetarios
- Planetas

Huyendo de la contaminación luminosa



Un nuevo gigante: el telescopio español de 10 m



European Space Astronomy Center, Villafraanca del Castillo



Rayos X con XMM-Newton



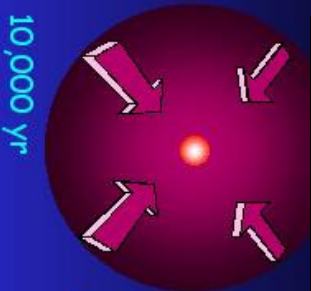
FORMACION ESTELAR Y PLANETARIA

Unas nociones básica:

- ¿Dónde nacen las estrellas?
- ¿Cómo nacen?
- La visión estandar
- Algo sobre la evolución estelar

De las nubes a los planetas

Colapso de nubes de gas y polvo



10,000 yr



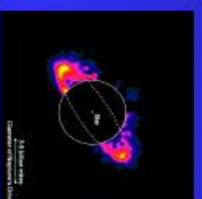
Colapso de nubes de gas y polvo



100,000 yr



Formación de Cometas y asteroides

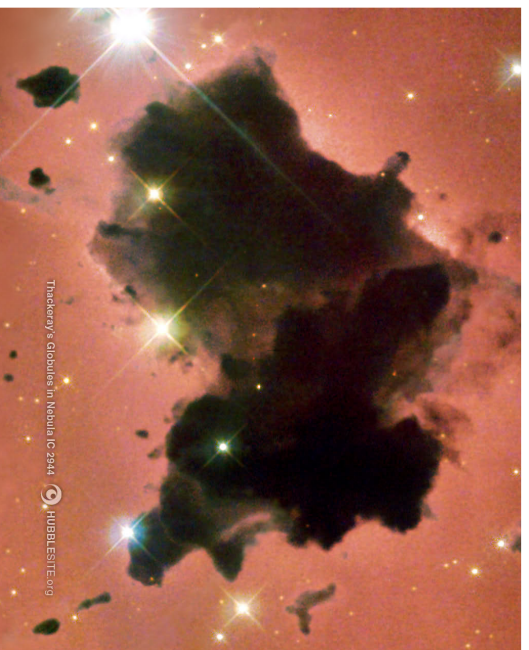


10 Myr



Sistema planetario

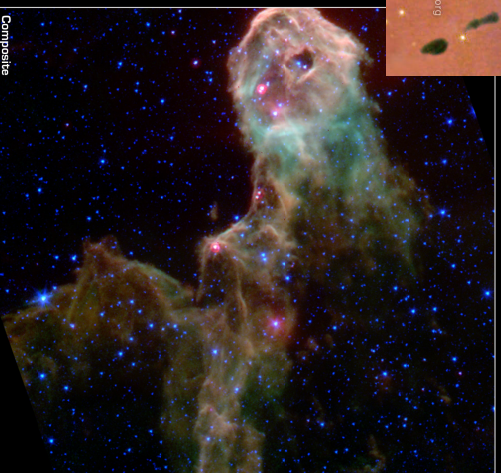
100 Myr



Thackeray's Globules in Nebula IC 2944

HUBBLESTEO.org

¿Dónde se forman las estrellas?
Las nubes de polvo y gas



Composite



MIPS

IRAC

Dark Globule in IC 1396

NASA / JPL-Caltech / W. Reach (SSC/Caltech)

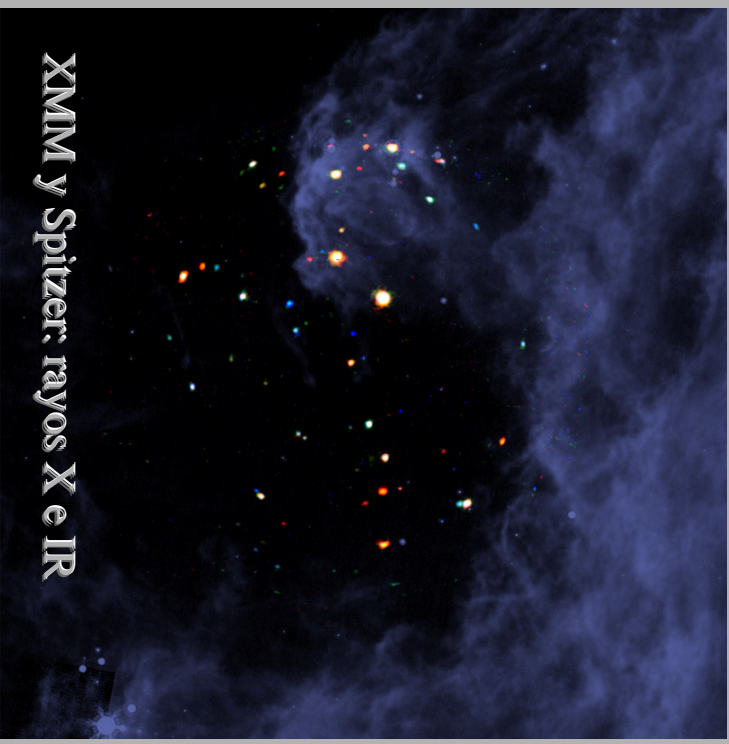
Spitzer Space Telescope • MIPS • IRAC

ssc0003-06b

¿Dónde y cómo mirar?

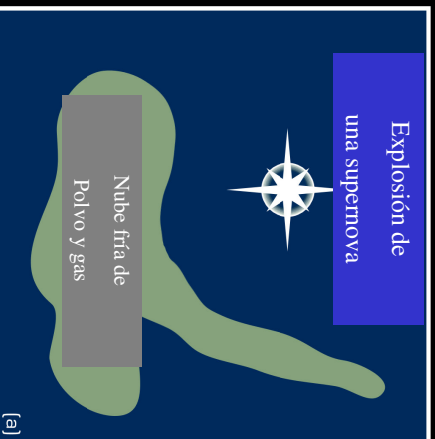


Spitzer: infrarrojo

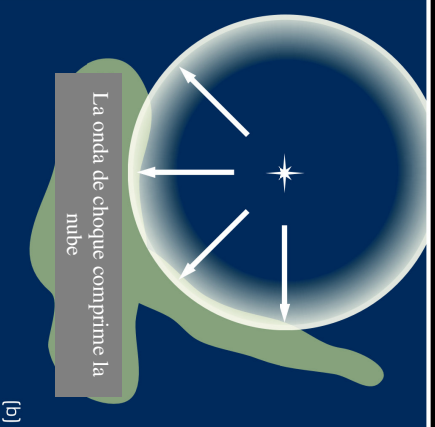


XMM y Spitzer: rayos X e IR

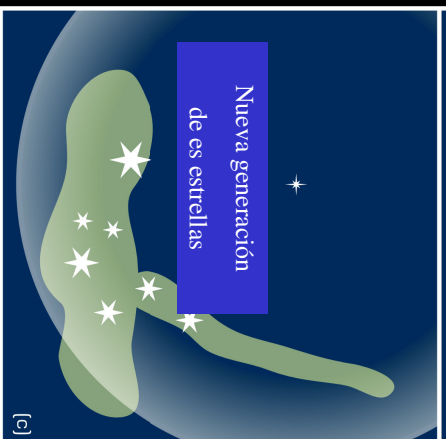
Formación
estelar:
¿cómo?



[a]



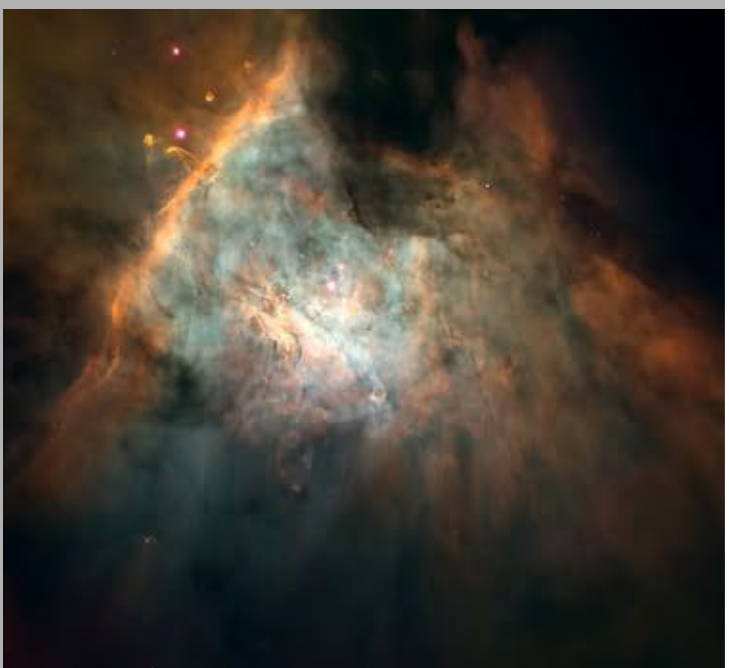
[b]



[c]



Orion: Hubble frente a VLT



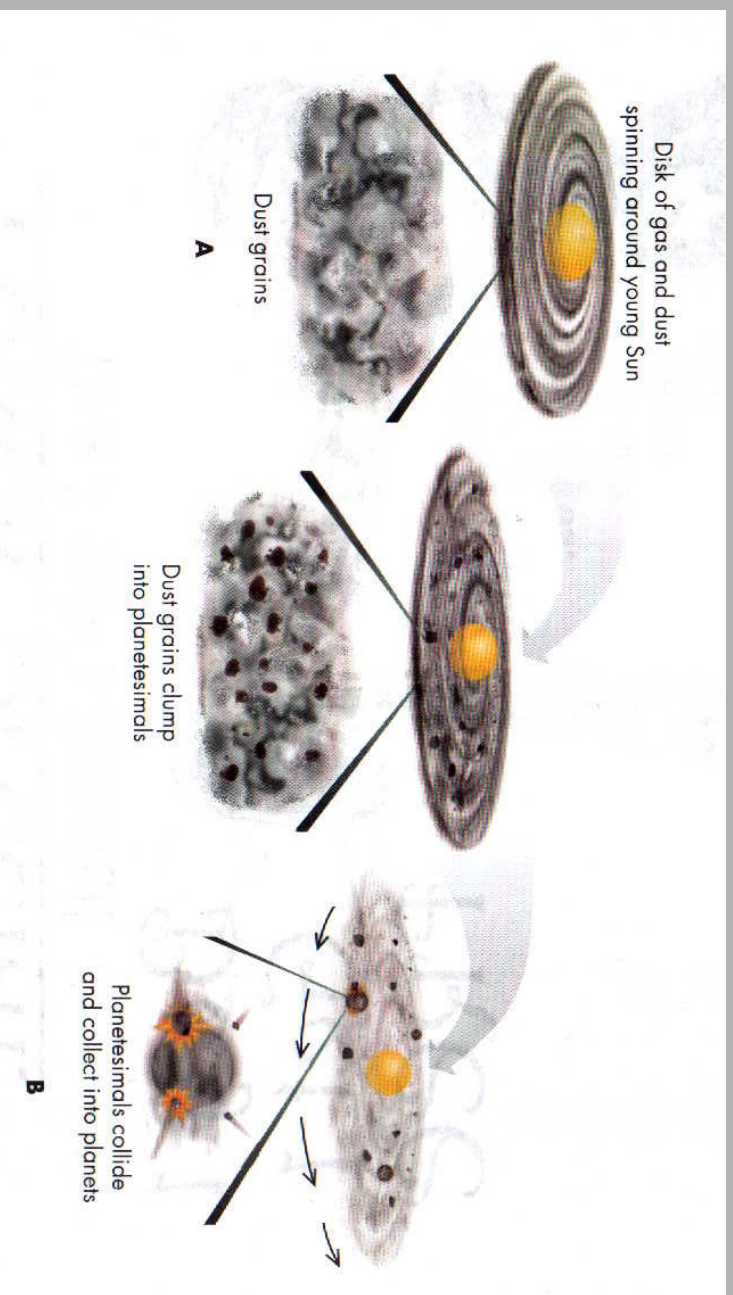
The Orion Nebula and Trapezium Cluster
(VLT ANTU + ISAAC)

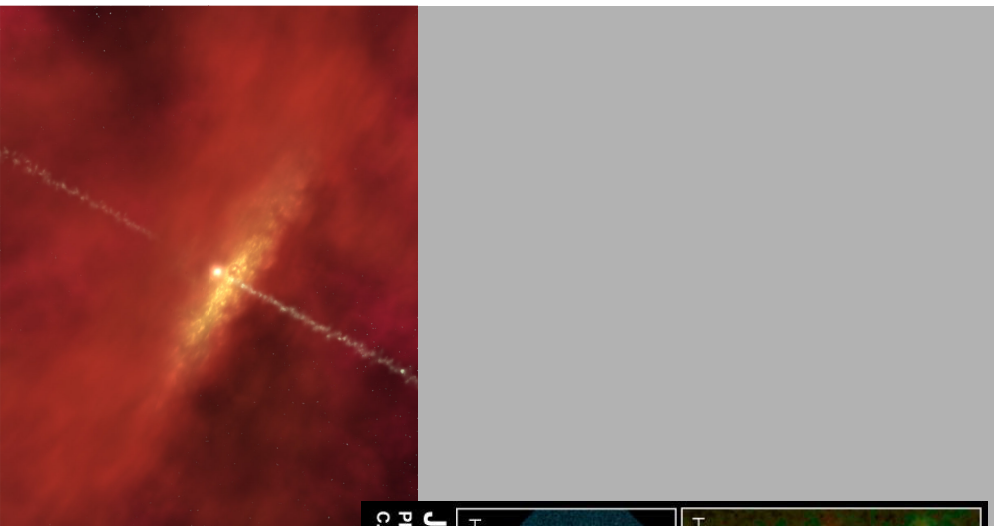
ESO PR Photo 05a/01 (15 January 2001)

© European Southern Observatory



FORMACIÓN PLANETAS





Jets from Young Stars
PRC95-24a · ST ScI OPO · June 6, 1995
 C. Burrows (ST ScI), J. Hester (AZ State U.), J. Morse (ST ScI), NASA

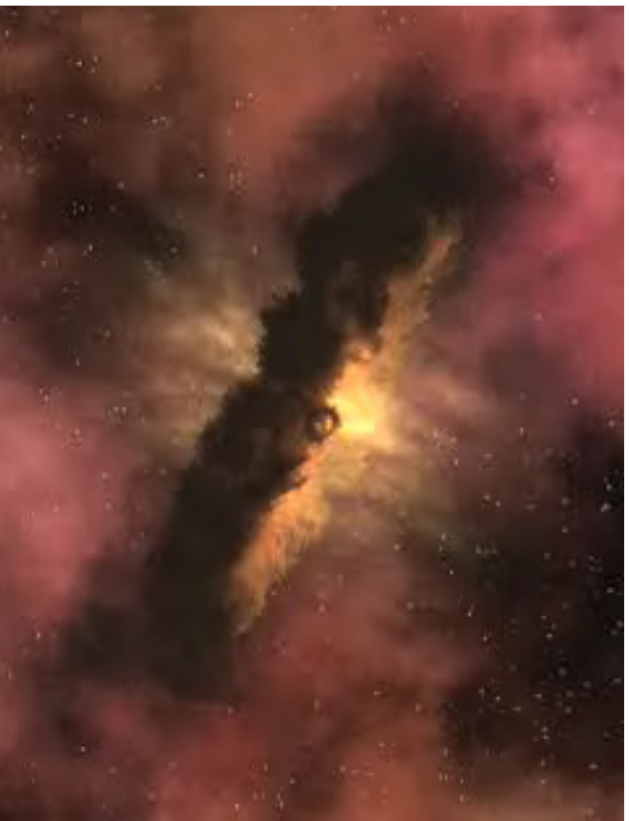
HH30

HH34

HH47

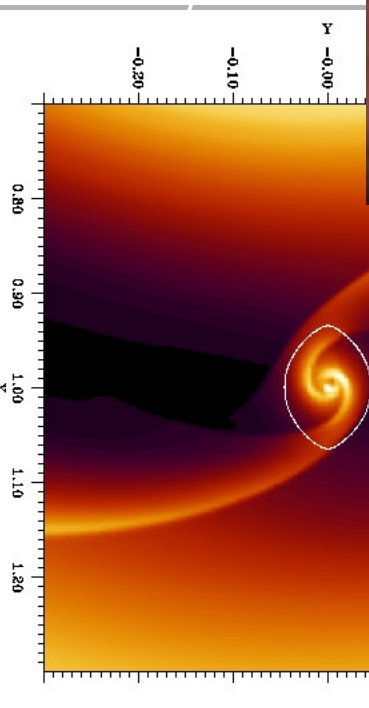
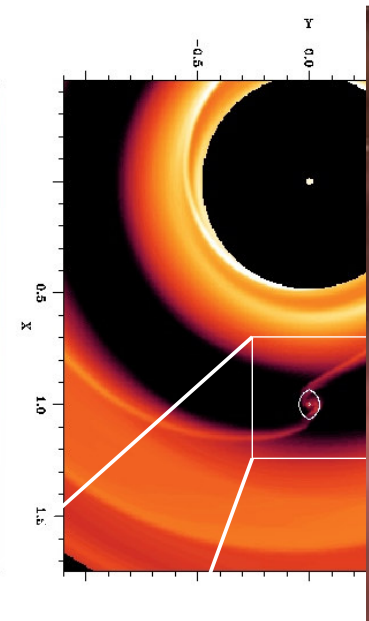
HST · WFPCC2

La evolución de un
 disco de acrecimiento



FORMACIÓN

✿

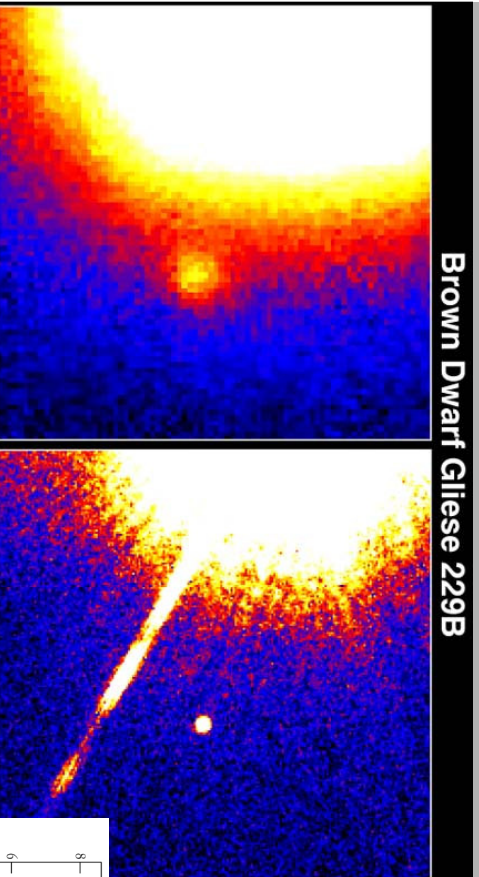


ENANAS MARRONES

- ¿Qué es una enana marrón? 0.072 M(sol)
- Mecanismos de formación
- Propiedades
- ¿Dónde buscar? En el campo y en asociaciones estelares

Las Observaciones

¿Qué dicen las observaciones?



Brown Dwarf Gliese 229B

Palomar Observatory

Discovery Image

October 27, 1994

PRC95-48 • ST ScI OPO • November 29, 1995

T. Nakajima and S. Kulkarni (CalTech), S. Durrance and D. Golimowski (JHU), NASA

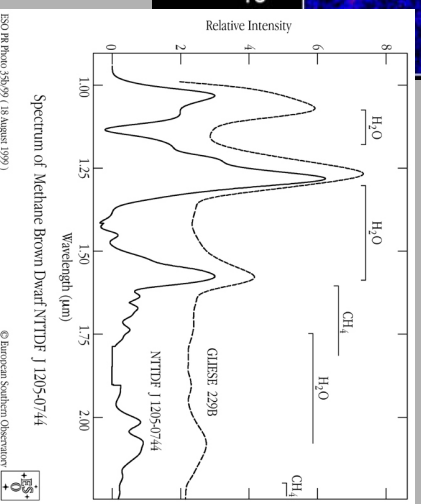
Hubble Space Telescope

Wide Field Planetary Camera 2

November 17, 1995

Primeras enanas marrones:

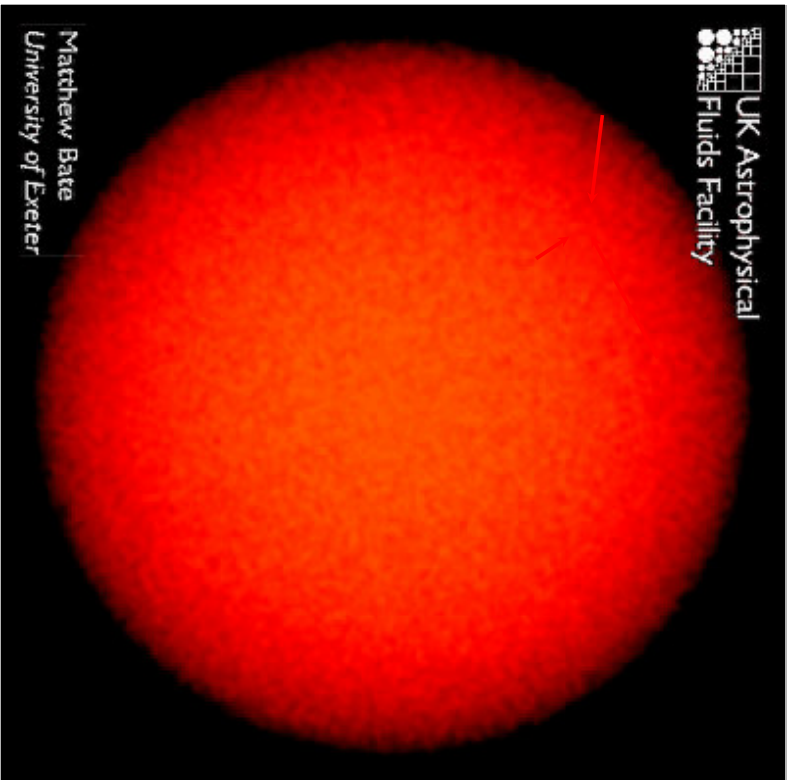
T, un nuevo tipo espectral



Mecanismos de formación



UK Astrophysical
Fluids Facility



Matthew Bate
University of Exeter

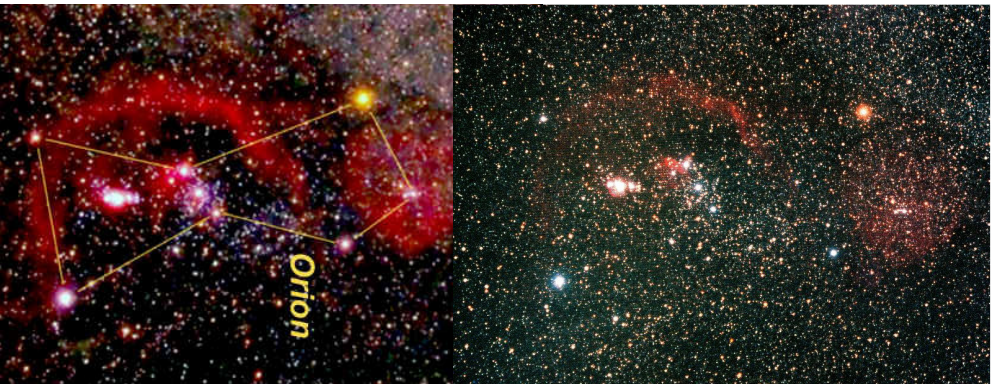
Fragmentación tubulenta
Padoan y Nordlund 2004

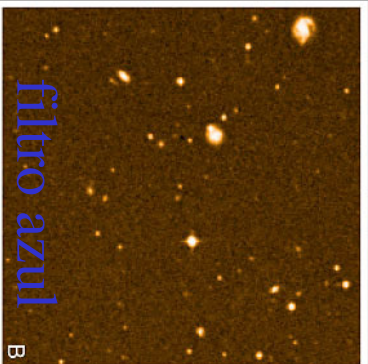
Expulsión en sistemas múltiples
Reipurth & Clarke 2001,
Bate 2004

Fotoevaporación
Whitworth & Zinnecker 2004

Alrededor de estrellas, en
discos circunestelares
Mayer et al. 2003

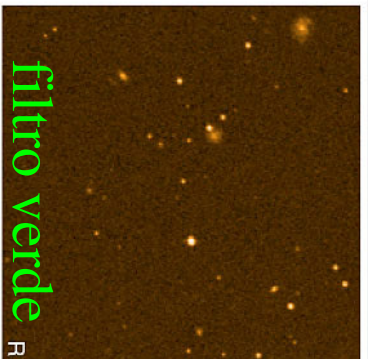
¿Dónde buscar?





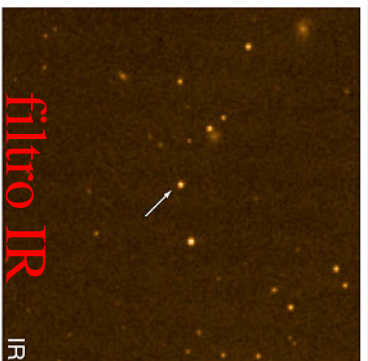
filtro azul

B



filtro verde

R



filtro IR

IR

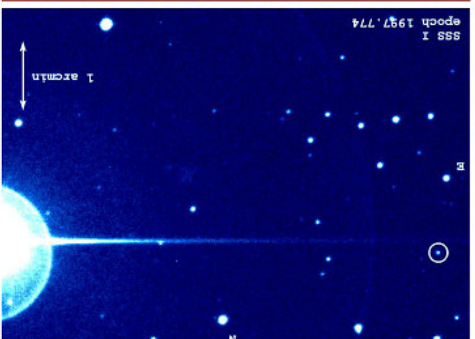
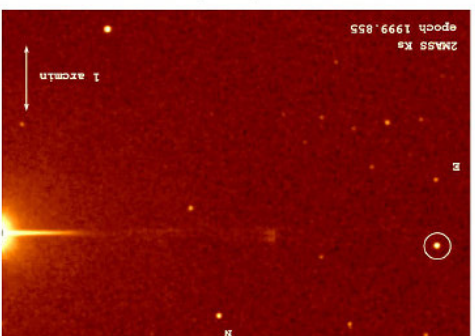
ESO PR Photo 17a/02 (1 August 2002)

The Brown Dwarf LP 944-20
filtro IR (SuperCOSMOS + Two Micron All Sky Survey)

Identificación:

Búsquedas
fotométricas

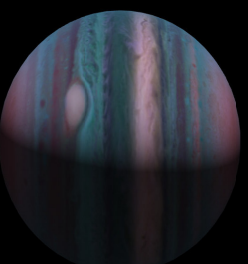
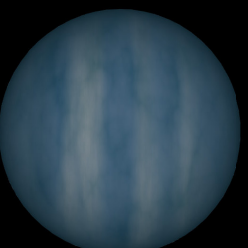
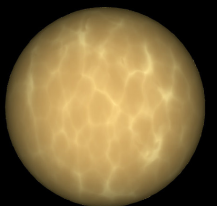
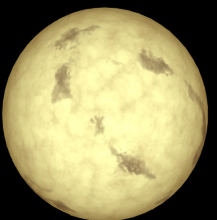
ESO PR Photo 03a/03 (13 January 2003) © European Southern Observatory



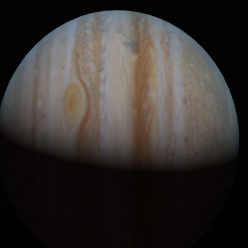
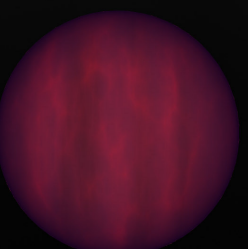
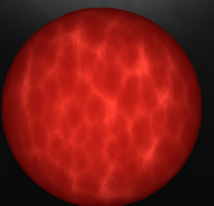
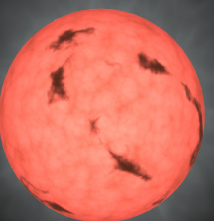
filtro azul



Infrarrojo



Enanas marrones Jupiter

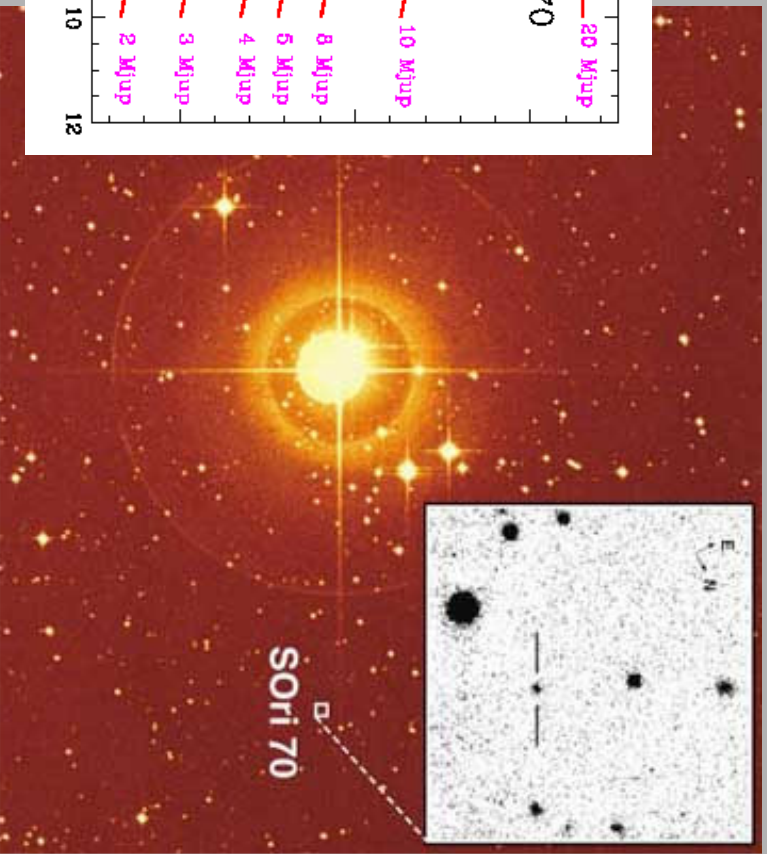
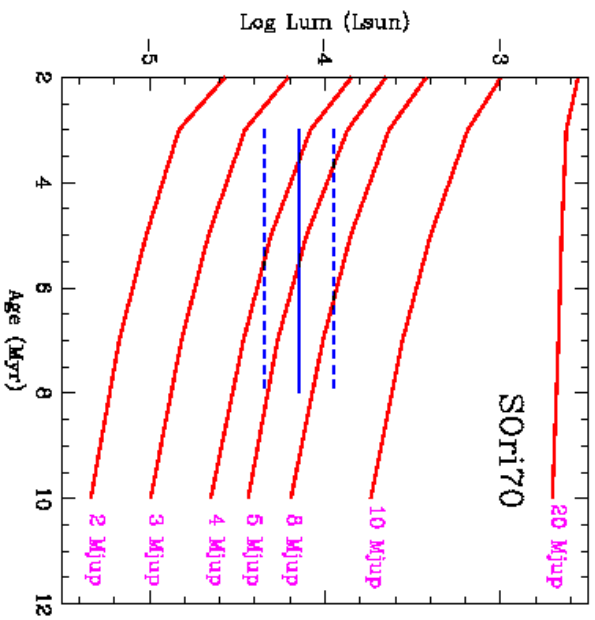


Optico

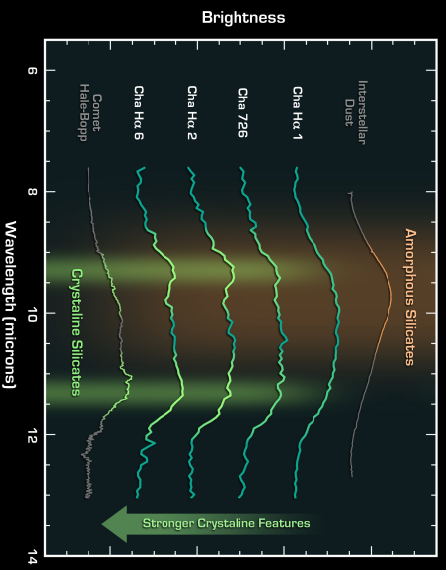
SORi70

El objeto aislado menos masivo

3 M_{Jup}, 1.6 R_{Jup}, 1100 K



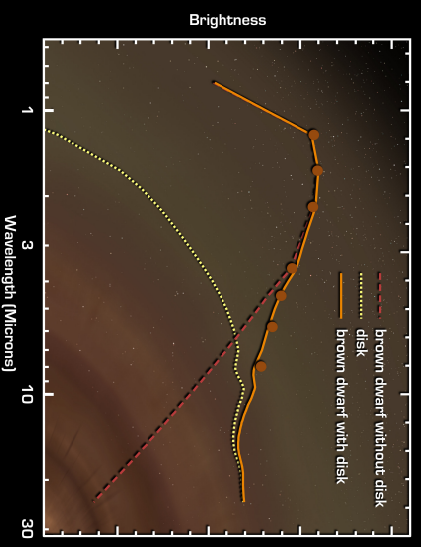
Enanas marrones: DISCOS



Crystalline Dust in Brown Dwarf Disks
NASA / JPL-Caltech / D. Apai (University of Arizona)

Spitzer Space Telescope • IRS

SR220521a

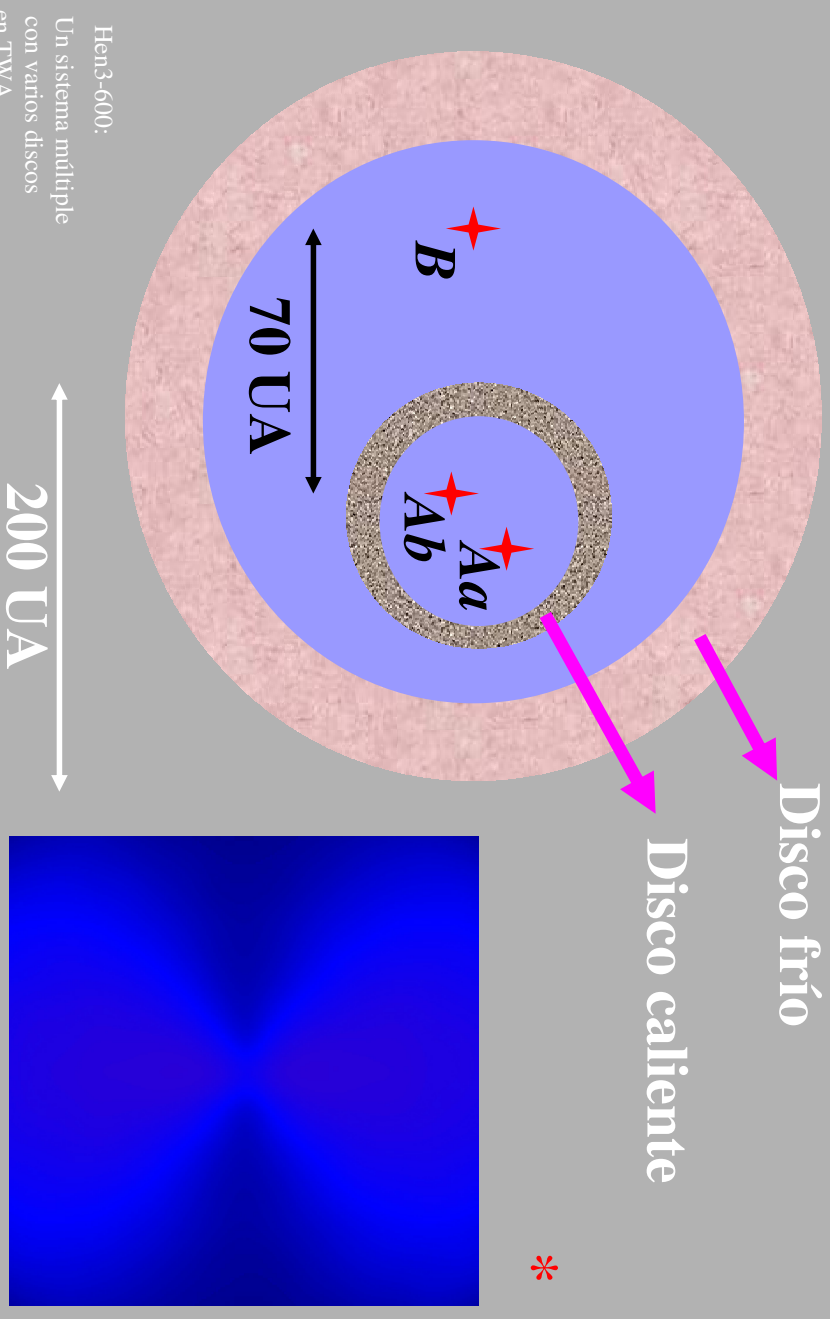


Brown Dwarf With Protoplanetary Disk
NASA / JPL-Caltech / K. Luhman (Harvard-Smithsonian CfA)

Spitzer Space Telescope • IRAC

SR220521a

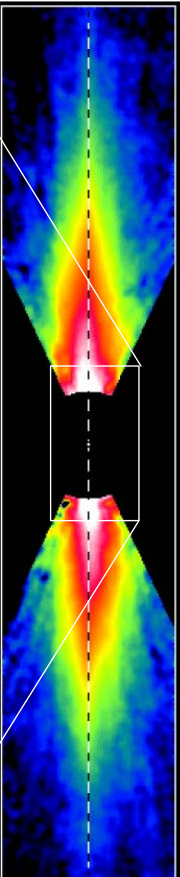
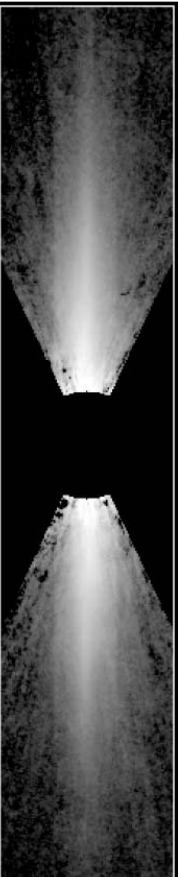
Multiplicidad y discos



SISTEMAS PROTOPLANETARIOS

Beta Pic: el prototipo de sistema protoplanetario

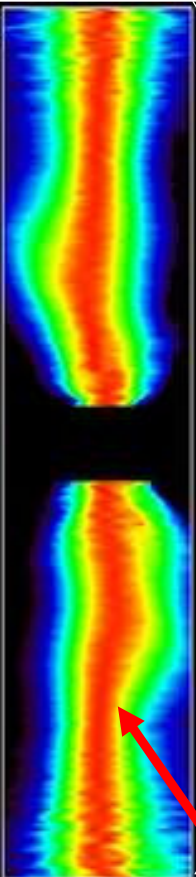
Disco descubierto por el satélite IRAS en 1983



Warped Disk · Beta Pictoris

HST · WFPCC2

PRC96-02 · ST ScI OPO · January 17, 1995 · C. Burrows and J. Krist (ST ScI), WFPCC2 IDT, NASA

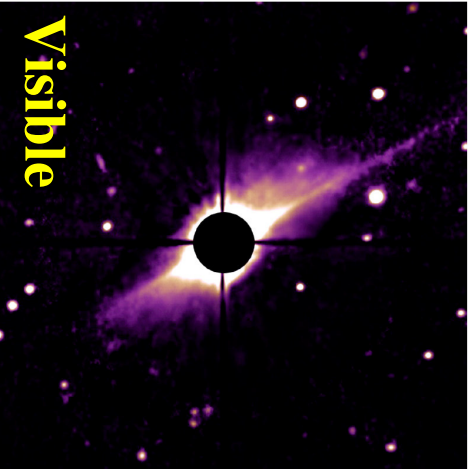


STS

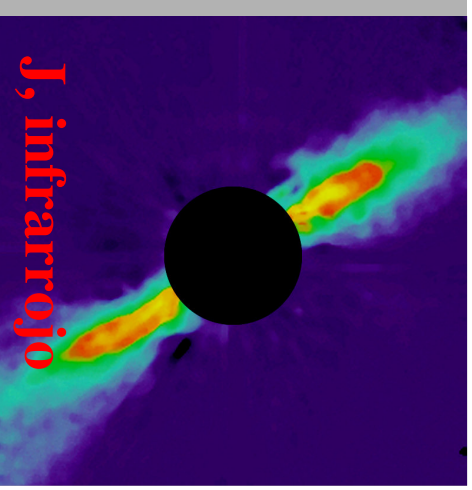


Solar System to Scale

Distorsion.
¿Existe un planeta formándose?



Visible

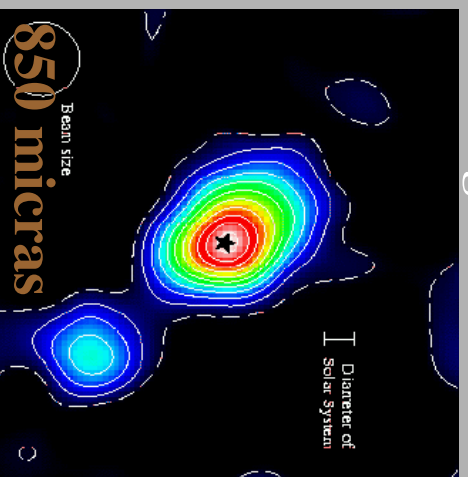


J, infrarrojo

Beta Pic: cómo se ve en diferentes longitudes de onda



10 micras

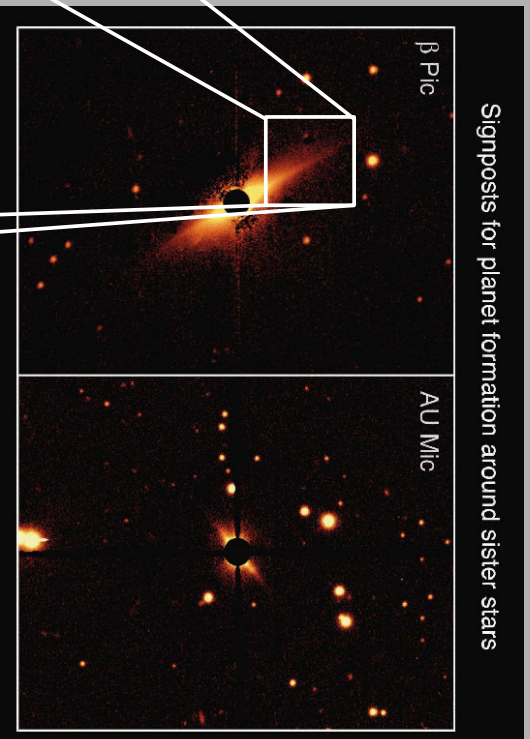


850 micras

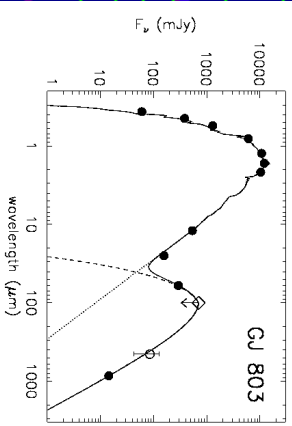
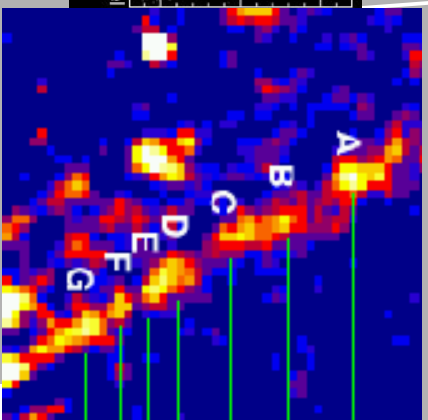
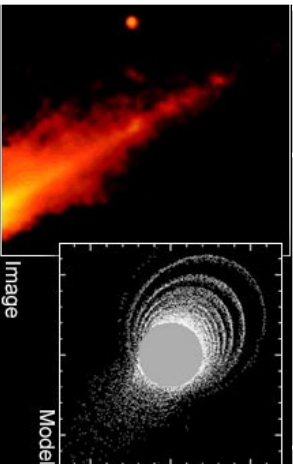
Diameter of Solar System

Beam size

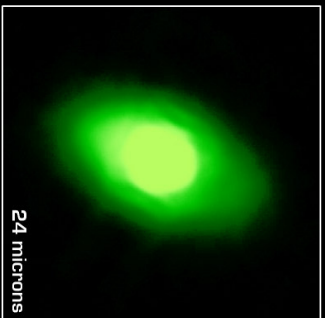
Signposts for planet formation around sister stars



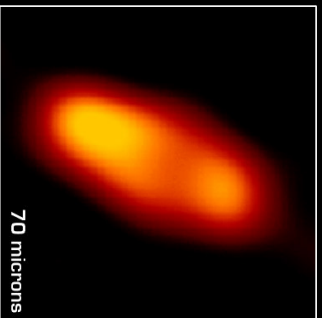
Beta Pic
y AU Mic



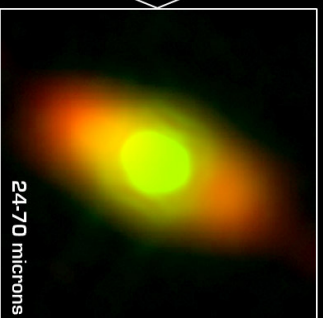
Fomalhaut



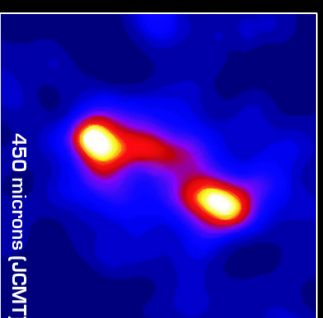
24 microns



70 microns



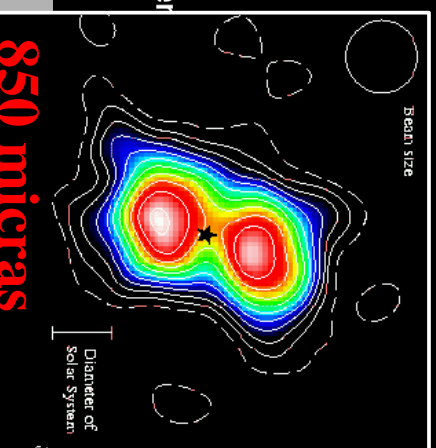
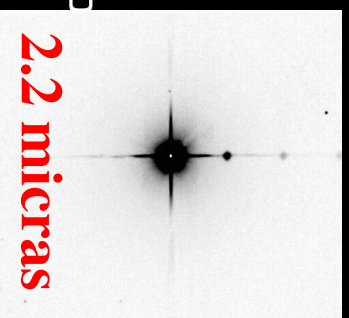
24-70 microns



450 microns (JCMT)

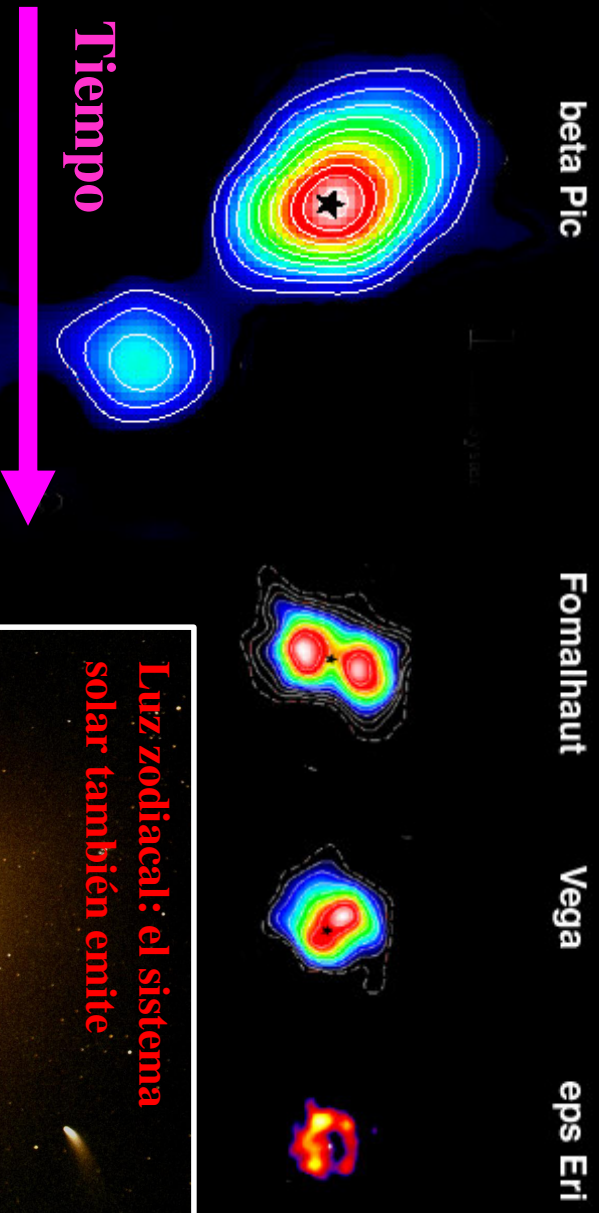
Fomalhaut Circumstellar Disk
NASA / JPL-Caltech / K. Stapelfeldt (JPL)

2.2 micras

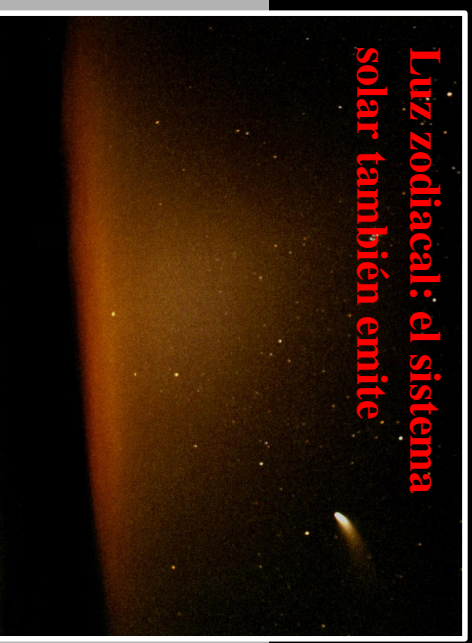


850 micras

La evolución de los discos protoplanetarios con el tiempo

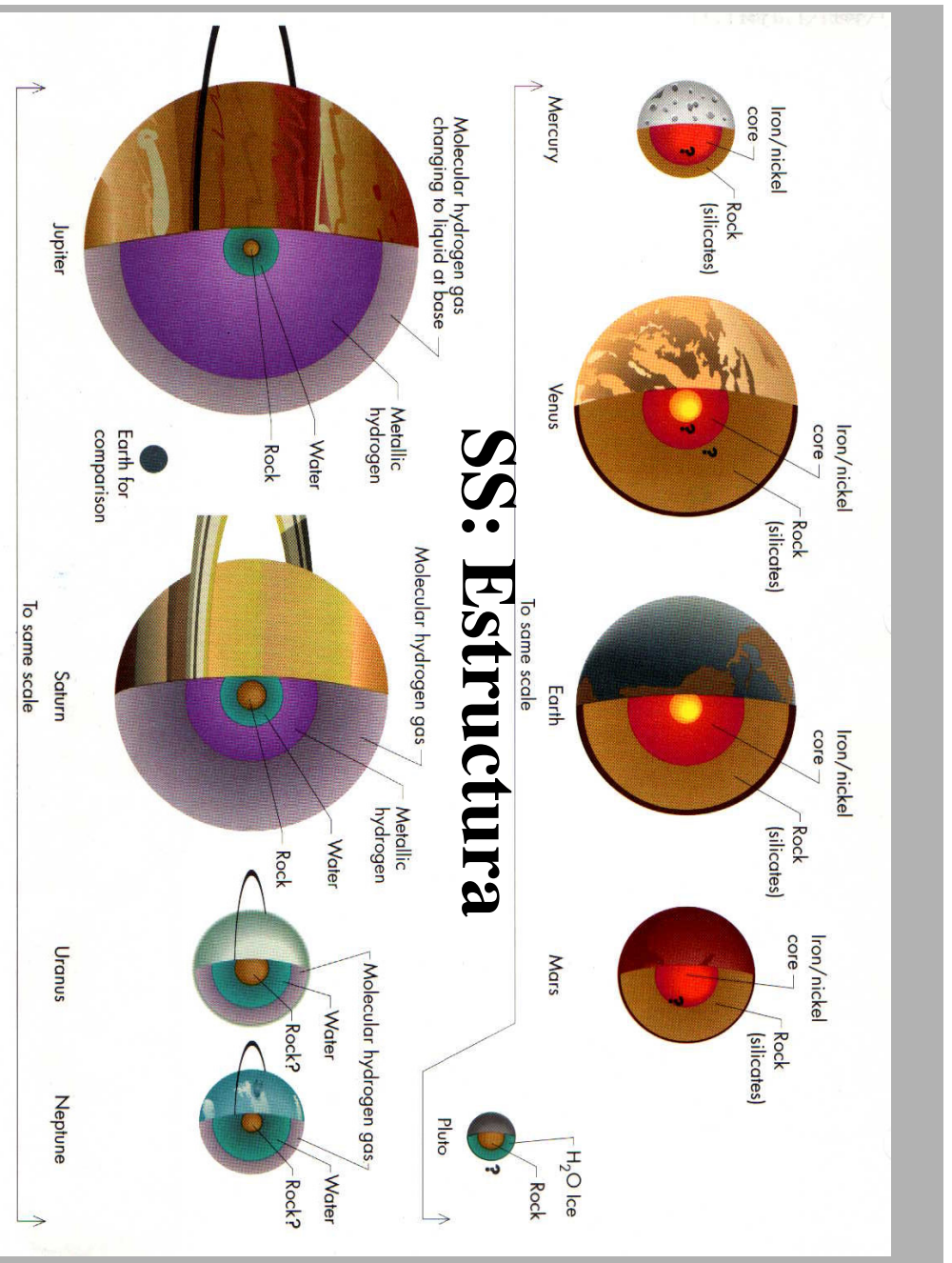


Imágenes a 850 micras

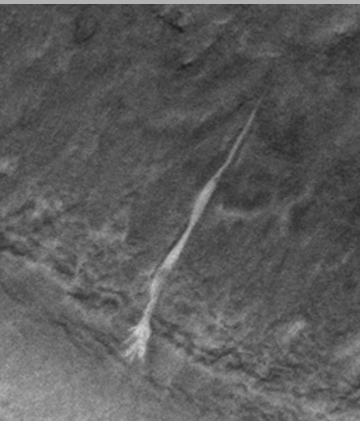
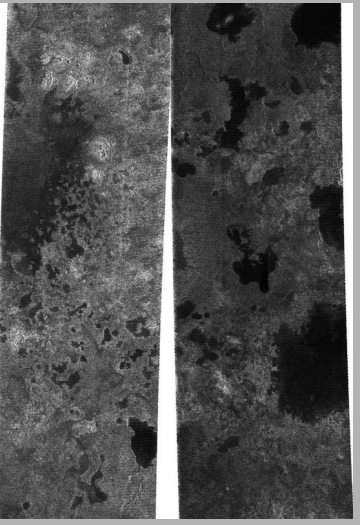
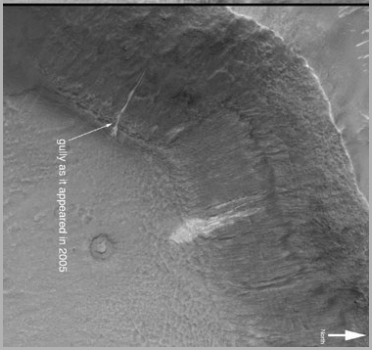
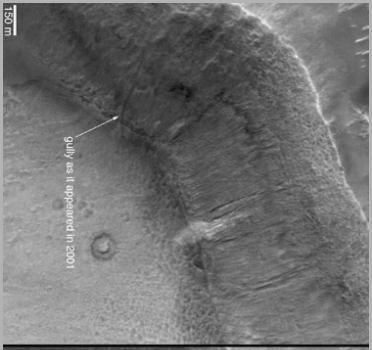
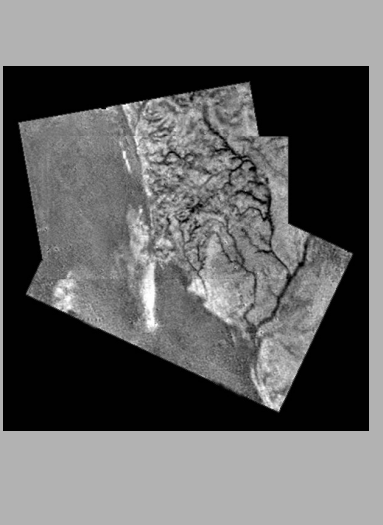


¿Qué es un planeta?

EL SISTEMA SOLAR



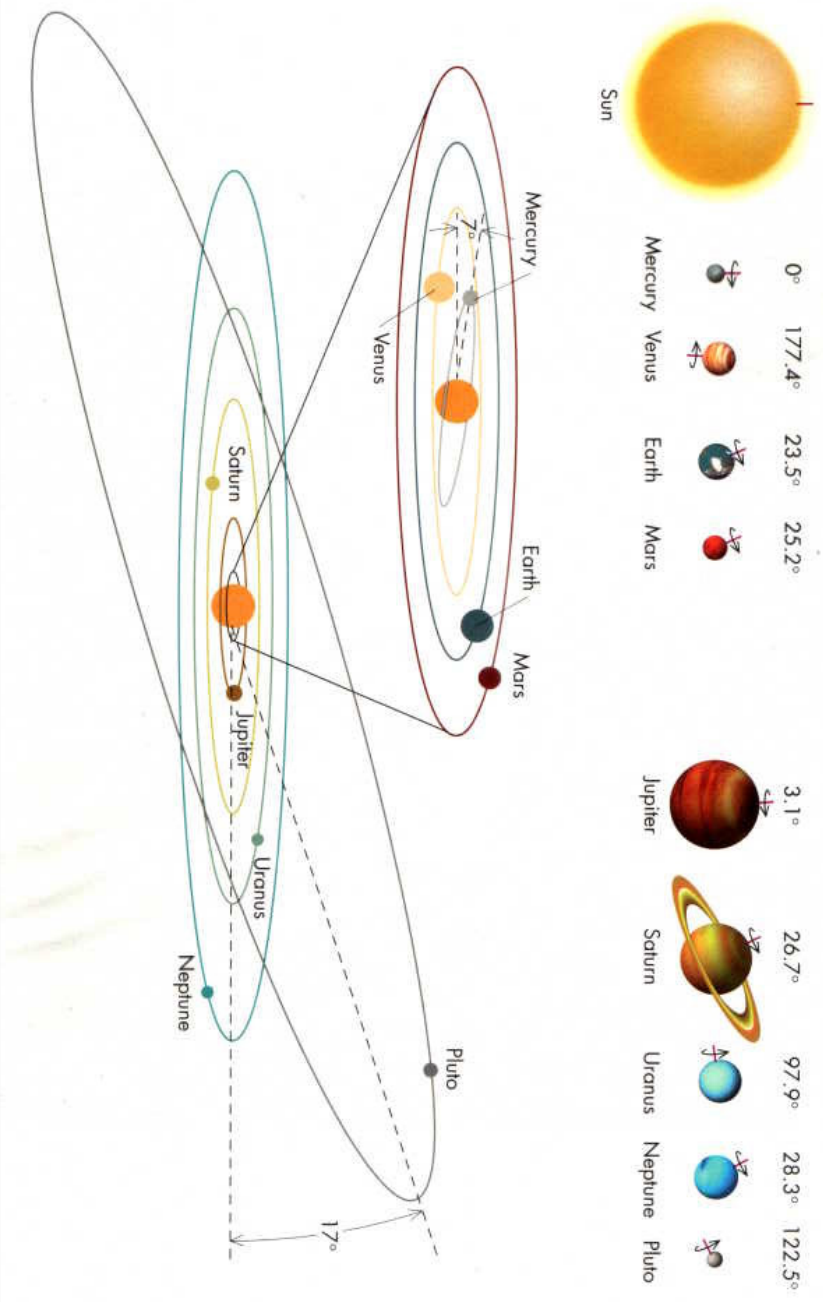
Hidrografía



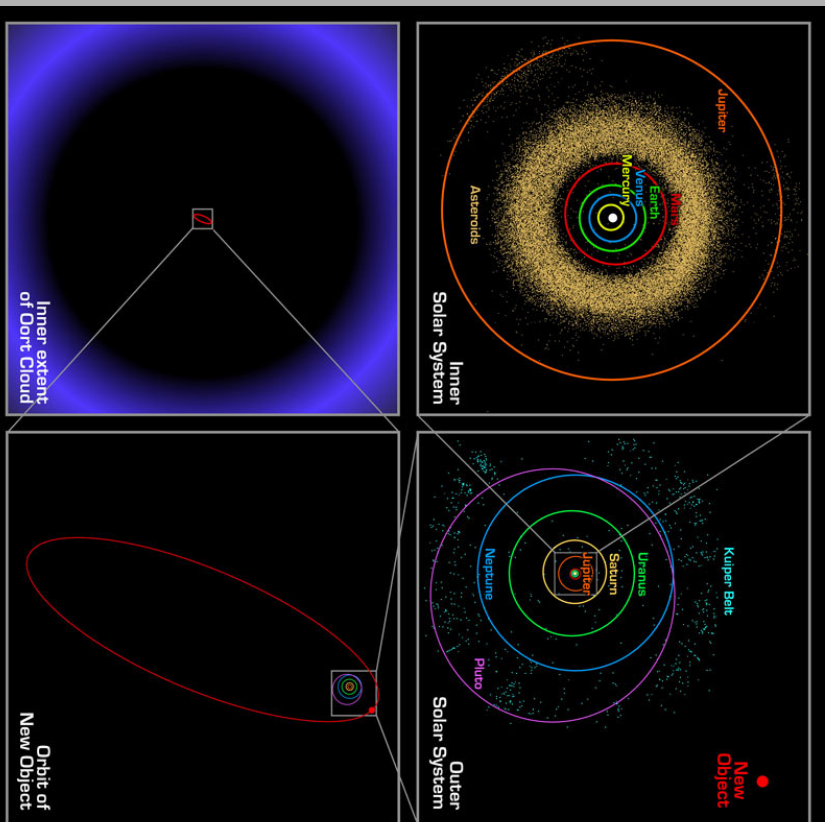
Metano en Titán (Cassini)

Agua o CO₂ en Marte (MGS)

Sistema Solar: ocho planetas

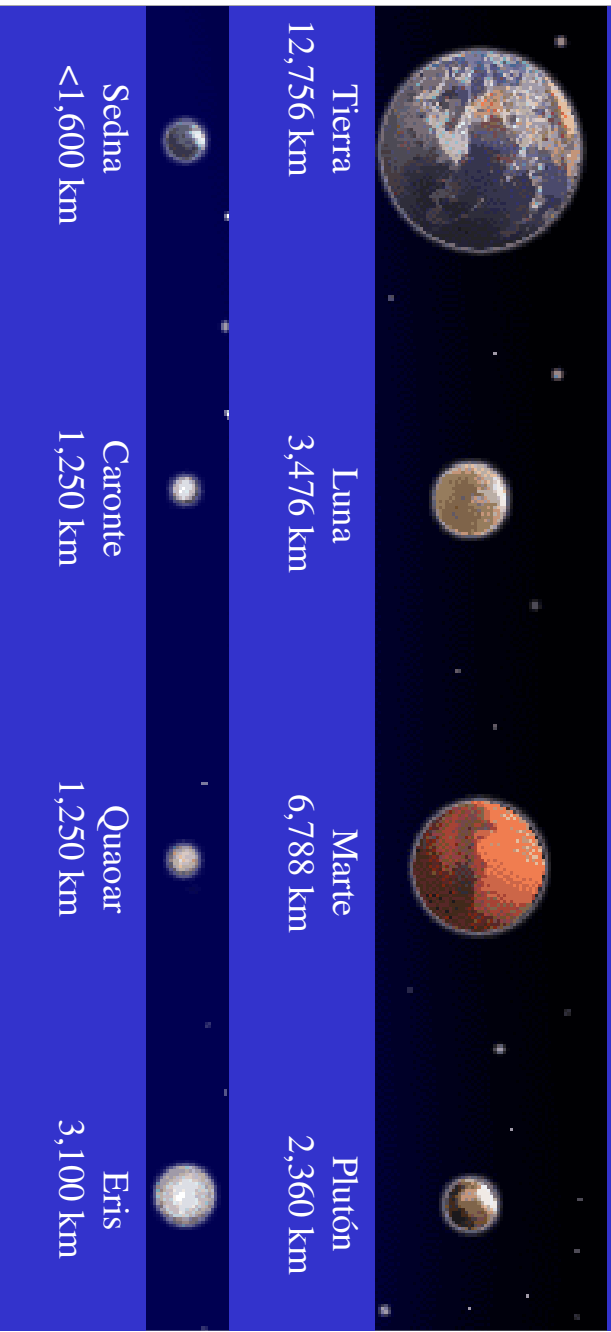


Sistemas Solar: TNO (objetos transneptunianos)



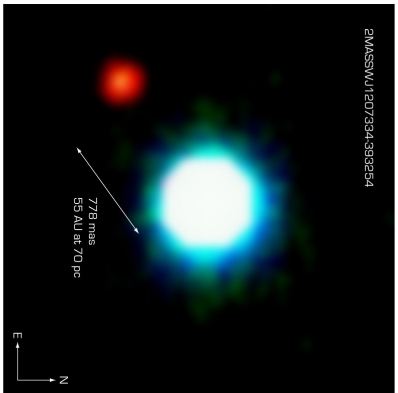
El Sistema Solar: Tamaños de los TNOs

Comparación de los tamaños



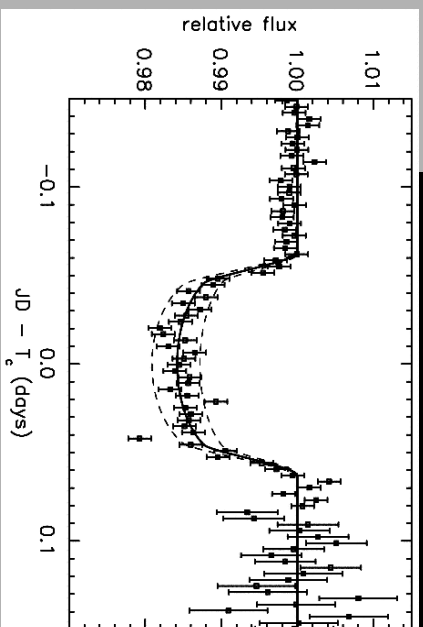
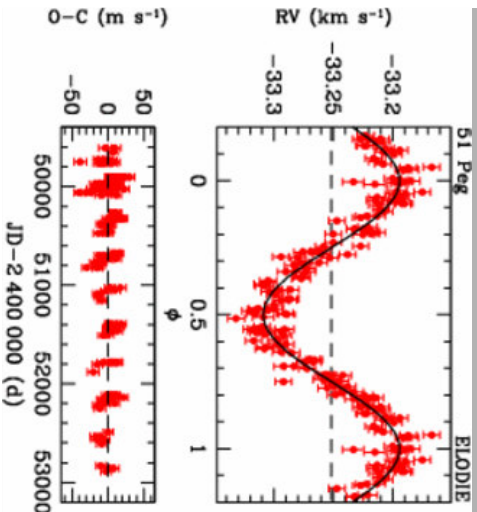
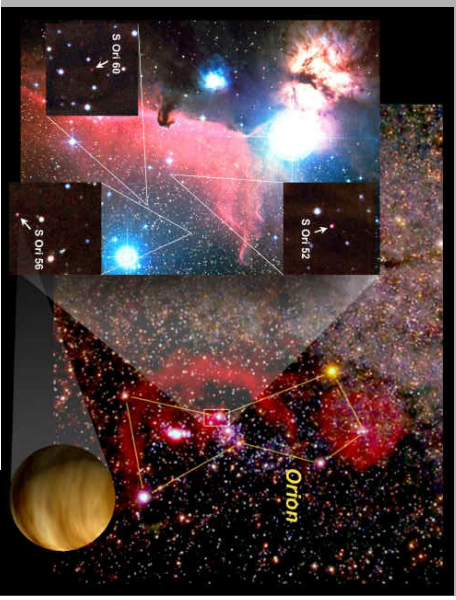
OTROS SISTEMAS PLANETARIOS

EMASSWU1FD7934-389854

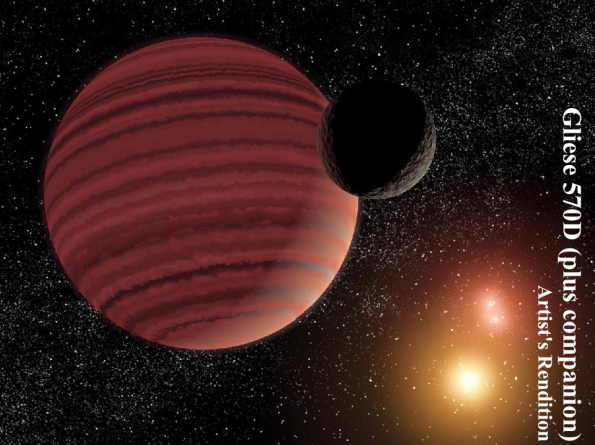
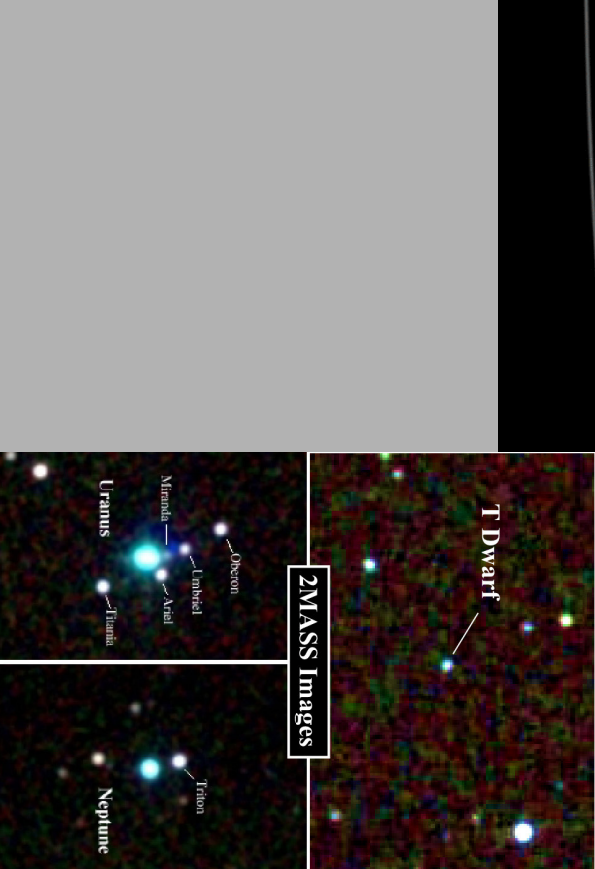
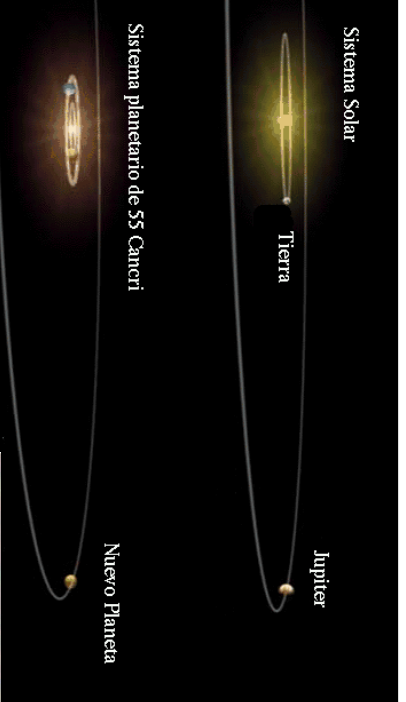


NACO image of the Brown Dwarf Object 2M11207 and GPC

EXOPLANETAS



Exoplanetas: Analogías



Exoplanetas: rangos

Número de planetas: ~209

- 197: Vel. Radiales (169 sistemas, 20 múltiples)
- 9: tránsitos
- 4: microlensing
- 4: imagen directa (2M1207, GQ Lup, AB Pic, SCR 1845)
- 4: púlsares (en dos sistemas, 3+1)
 - M_2 *sini*: 0.05 - 17 M_J
 - *a sini*: 0.02 - 5 AU
 - *e*: 0.0 - 0.9
 - *P*: 1.5días - 4 años

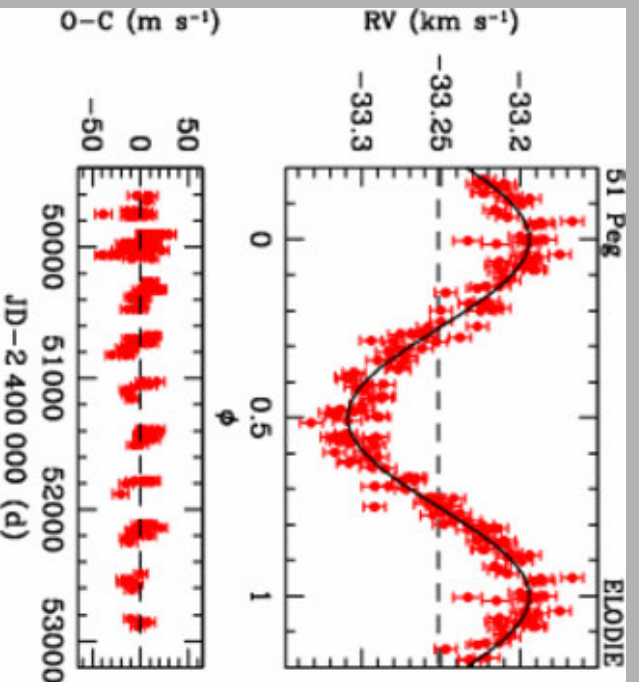
Sesgos claros: método RV

escala de tiempos

Muy distintos al Sistema Solar

<http://vo.obspm.fr/exoplanetes/encyclo/encycl.html>

3 objetos planetarios aislados (confirmados)

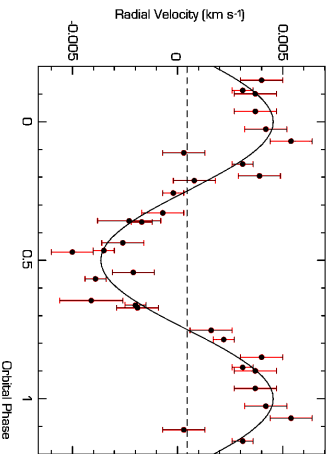
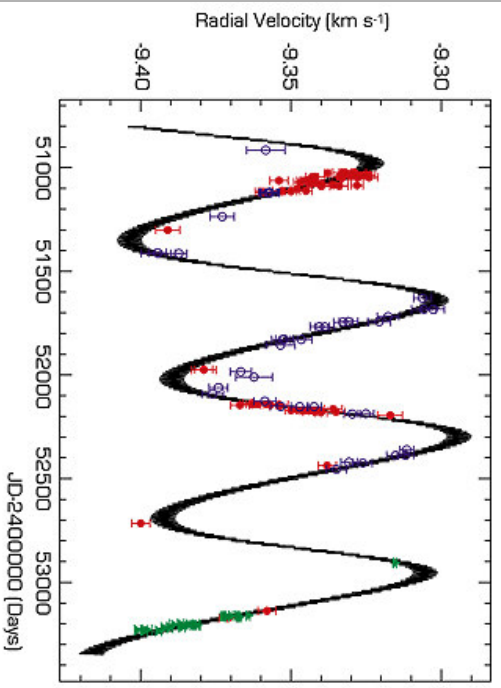
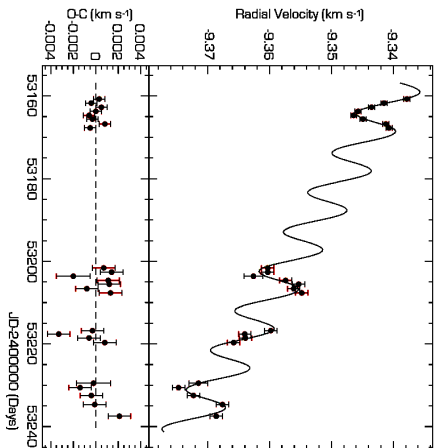


51 Pegasi: Primer exoplaneta



M_2 *sini* = 0.5 M_J
a sini = 0.05 AU
P = 2.32 días
 T_{eq} = 1300 K

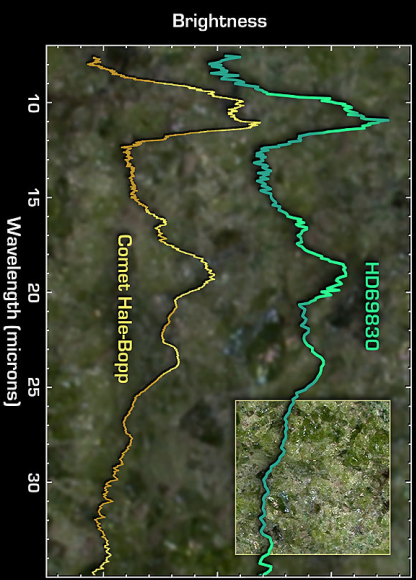
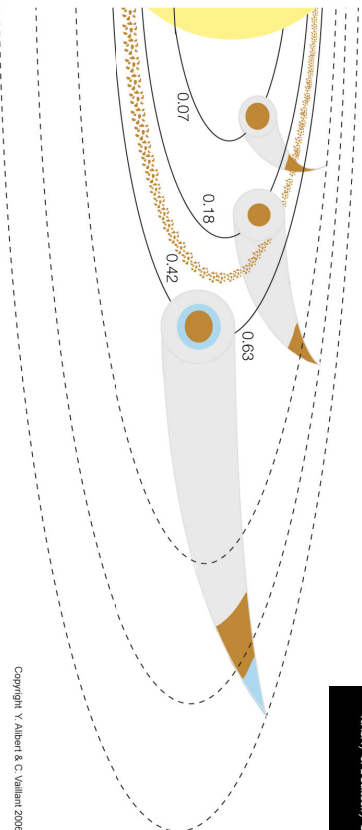
μ Arae: 2 planetas



Parámetros planeta menor:

M_2 *sini* ~ 1 M_{JU} ~ 14 M_{\oplus}
 P = 9.5 días

Diversidad Sistemas Planetarios

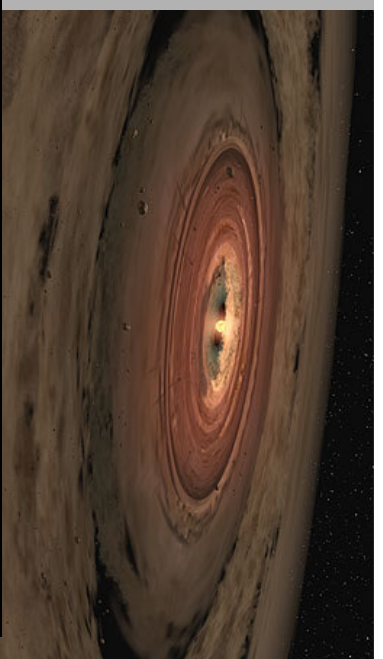
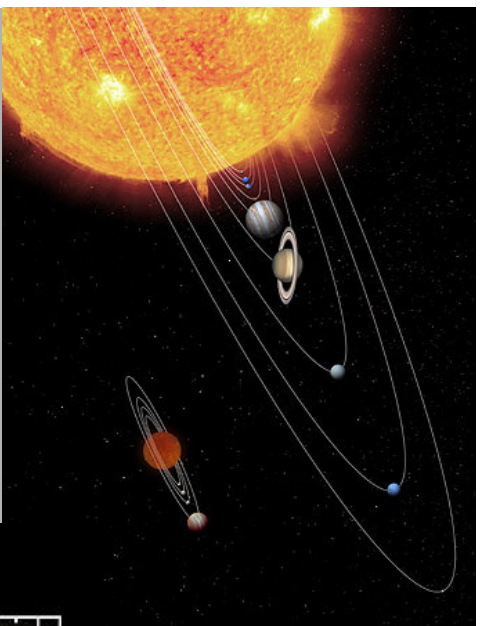


HD 69830 Zodiaccal Disk Spectrum Sptizer Space Telescope • IRS
 NASA/JPL-Caltech / C. Beichman (PI)

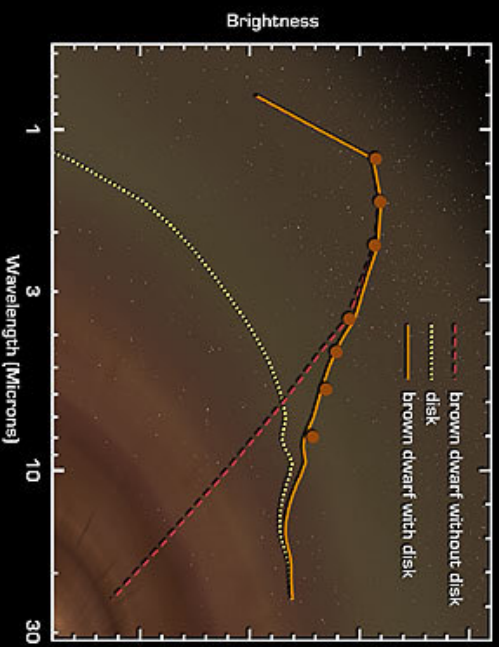
Hale-Bopp Spectrum ISO
 SSC2005-10a

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Formation Process of Planetary System around HD 69830



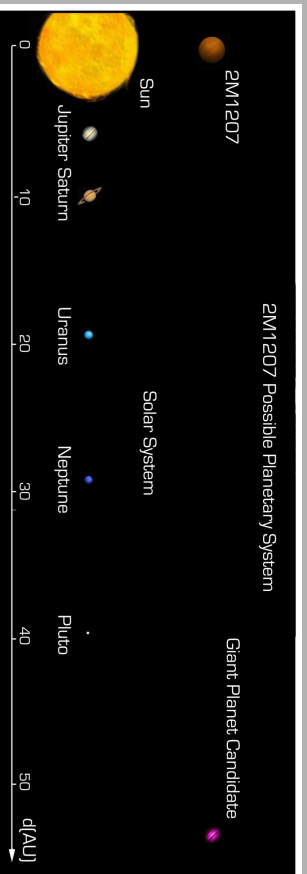
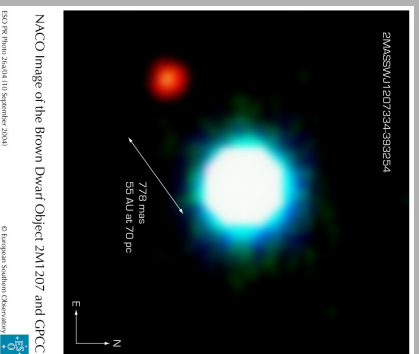
OTS44: masa planetaria + disco



Brown Dwarf With Protoplanetary Disk Spitzer Space Telescope • IRAC
NASA / JPL-Caltech / K. Luhman (Harvard-Smithsonian CfA)

ISS2005-05a

2M1207: primera imagen

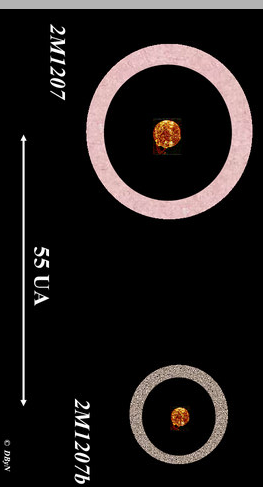


Comparison between the possible 2M1207 System and the Solar System

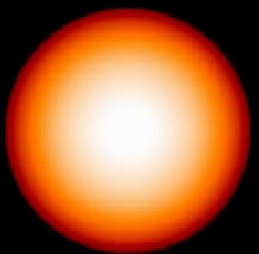
ESO PR Photo 26c/04 (14 September 2004)

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¿Un sistema planetario múltiple en formación?



© IBM



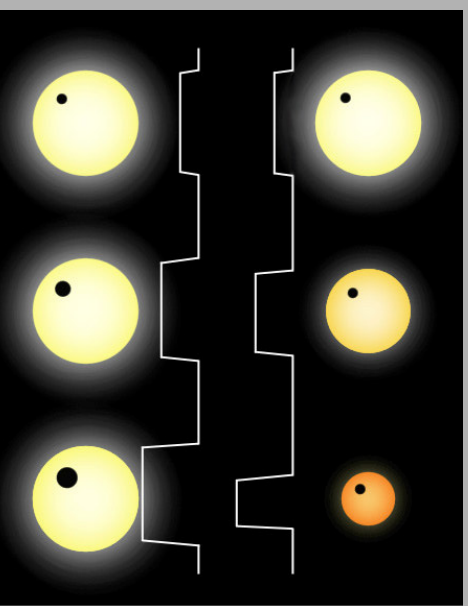
Hydrex

Tránsitos planetarios

- Masas
- Radios
- Inclinción órbita

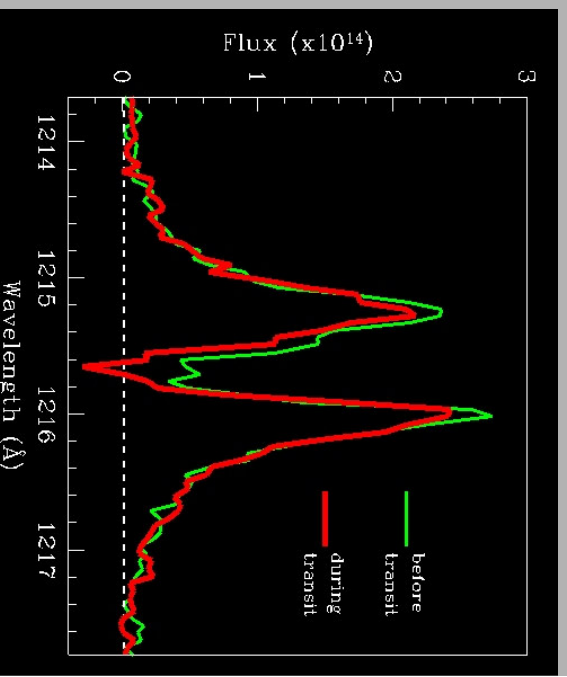
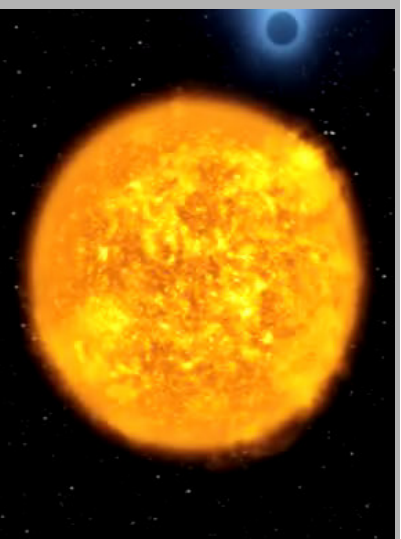
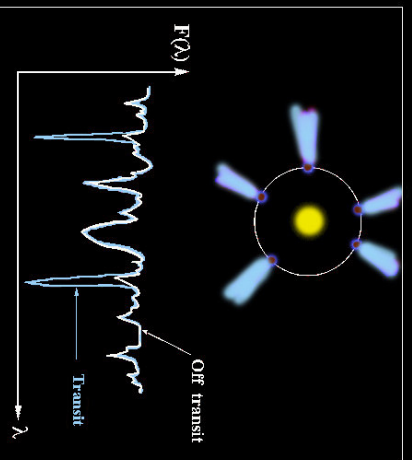
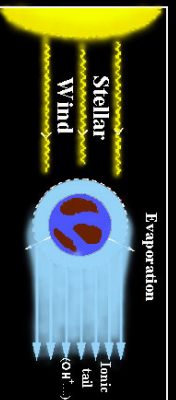


Tránsito de Mercurio del 2004
Visto por SOHO

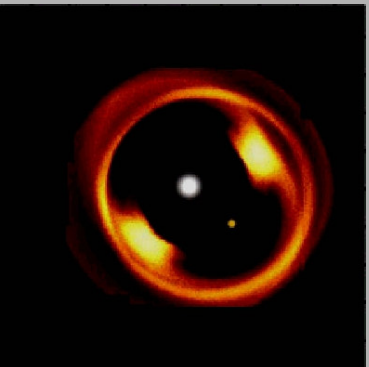


El efecto de la atmósfera

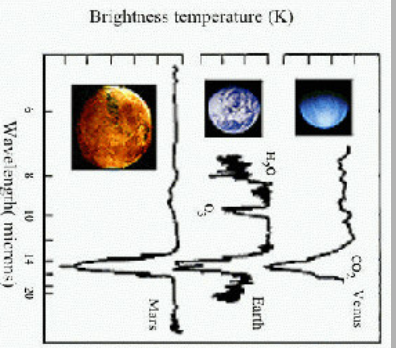
Tail
Close orbit planet (51 Peg)



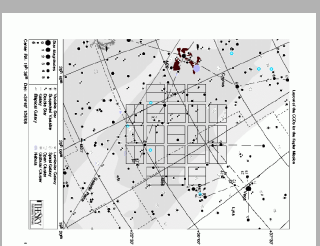
Los próximos 20 años



JWST: el nuevo telescopio espacial.
Imagen directa

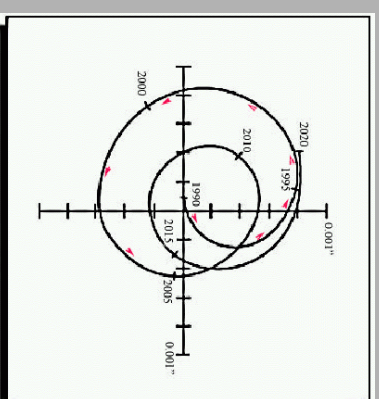


Terrestrial Planet Finder
y Darwin:
Exobiología



Corot, y Kepler: tránsitos

SIM y Gaia: astrometría



Cuaderno de bitácora estelar



PORTADA CONTACTO ADMIN RSS
diciembre 2006 Entradas

Marte: ¿planeta agua?
09/12/2006 | Enviar comentario (3) |

¿Puede ocurrir un maremoto, un tsunami, en el Sol?
08/12/2006 | Enviar comentario (1) |

Datos, descubrimientos y publicaciones: Las pequeñas alegrías de los astrónomos
08/12/2006 | Enviar comentario (1) |

Tormentas solares: un comienzo movido del nuevo ciclo solar
08/12/2006 | Enviar comentario (1) |

Ecos de soles pasados y distantes: el efecto de las explosiones de rayos gamma en la atmósfera terrestre
07/12/2006 | Enviar comentario (3) |

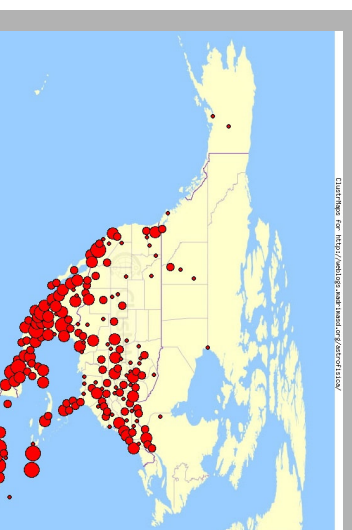
ESAC, puerta de entrada al espacio para futuros investigadores
01/12/2006 | Enviar comentario (0) |

PORTADA	nov	diciem
1	m	m
27	28	29
4	5	6
11	12	13
18	19	20
25	26	27
1	2	3

El objetivo de dar una visión de la Astronomía desde el punto de vista pedagógico, manteniendo científico. Se notifica diva científicos y comunicador proporcional adecuado para Se hablará de galaxias, del Sol y de la Sábana de los cometas de diferentes mit de otras agen Tecnomos Ir culturales y c Ciencia, y el sobre manera tioner los dei astronomos recursos un y regilan de la h. Es inclosa si que una acion viaje.

David Barne (LAEF-INT) Morreosat son científico. Externos y E. Español y E. Fundacional

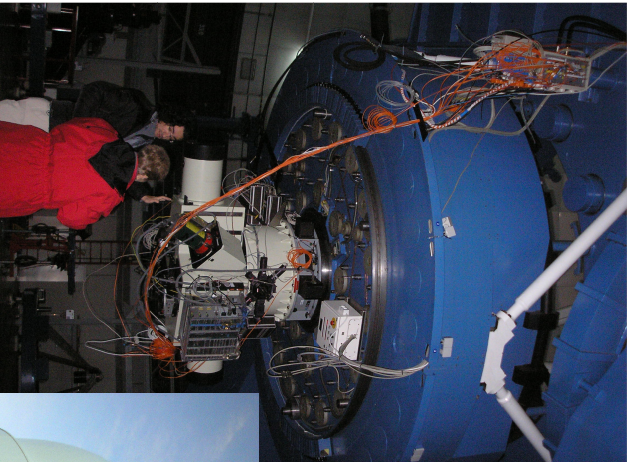
Cuaderno de Bitácora Estelar



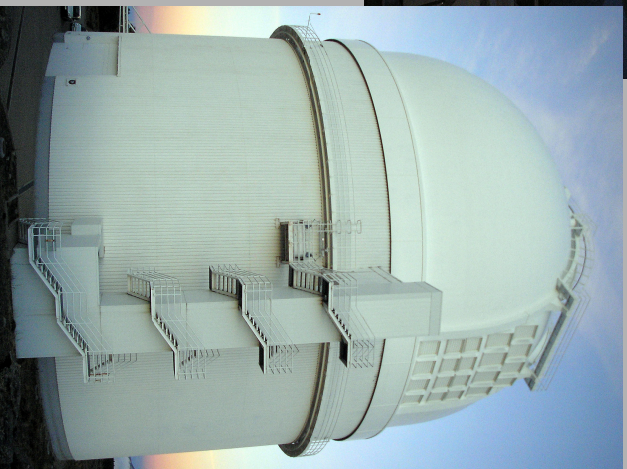
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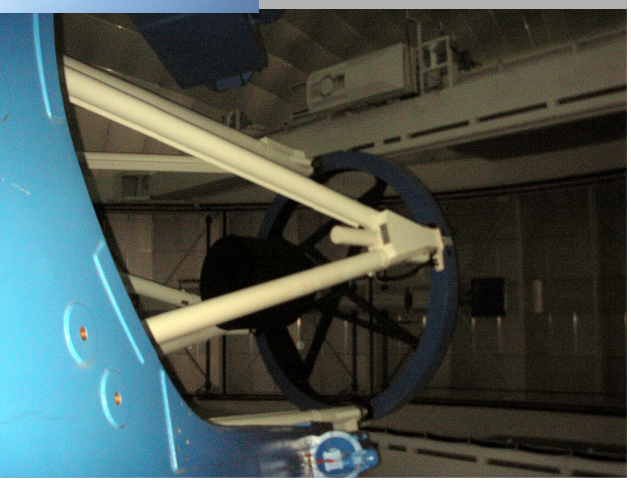
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Telescopio 2.2m



Telescopio y
edificio del 3.5 m



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