CHARACTERIZATION OF THE VARIABLE STAR EPIC 246257206 DISCOVERED WITH K2-C12-FOV OBSERVATIONS MADE BY THE KEPLER SPACE TELESCOPE

Jorge Pérez González
IES Real Instituto de Jovellanos
Gijón - Asturias
María Victoria Perandones Moreno

MILKY WAY FROM THE OLD VEGARREDONDA SHELTER
Picos de Europa
7 August 2020

Prepared by the author

ORION NEBULA
Angliru - Asturias
7 January 2021

Prepared by the Author

COMET C/2020 F3 NEOWISE
“Poo” Beach - Llanes - Asturias
17 July 2020

Prepared by the Author

INTERNATIONAL SPACE STATION
La Fresneda - Asturias
28 May 2020

Prepared by the Author

AIMS

1. Discover a variable star using theKepler Space Telescope database.
2. Find the cause of its variability.
3. Calculate its period and its amplitude.
4. Publish the results in the Variable Star Index (VSX).

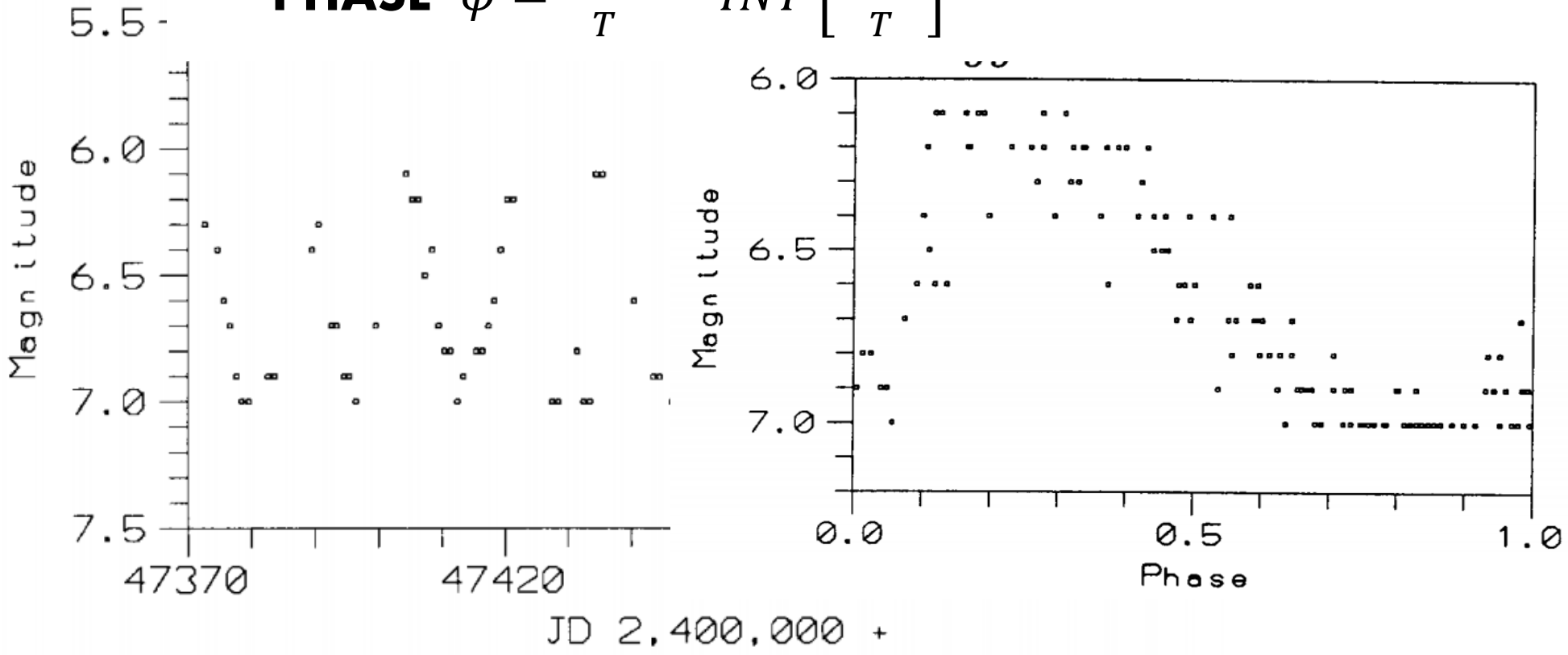
CONTENTS

1. Theory.
2. Experimental Process.
3. Discussion.
4. Limitations of the methodology.
5. VSX webpage.

NEBULA remainder of
SUPERNOVA SN 1604 (de Kepler)
α: 17h 30m 42s
δ: +21° 29′
Distance: 20 000 ly.
Constelation: Ophiuchus

LIGHT CURVES

PHASE $\phi = \frac{t-t_o}{T} - INT\left[\frac{t-t_o}{T}\right]$



ROTATING VARIABLES

ELIPSOIDAL Espiga
α: 13h 25min 11,58s
δ: -11° 09′ 40.8″
Constelation: VIRGO
Distancia: 260 años luz

VARIABLES ECLIPSANTE

ECLIPSING BINARY EA Algol
α: 03h 24min 04,08s
δ: +40° 57′ 20.33″
Distance to Earth: 93 años luz
Constelation: PERSEO
TAKAHASHI EPSILON 180 ED
HYPERBOLIC ASTROGRAPH

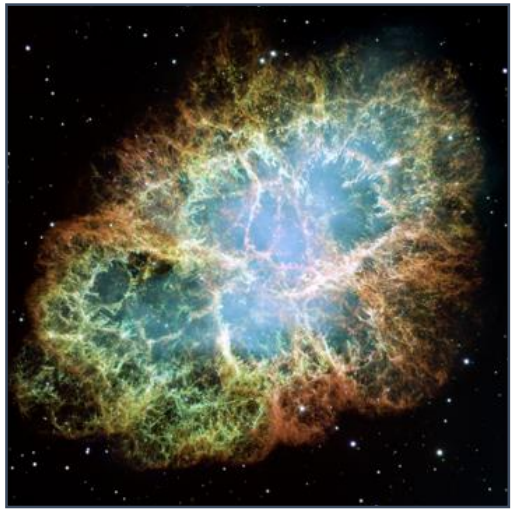
ERUPTIVE VARIABLES

ERUPTIVA V1515 Cyg
α: 20h 23min 48.02s
δ: +42° 12′ 25.78″
Distance to Earth: 3291 años luz
Constelation: CISNE
CAPELLA OBSERVATORY

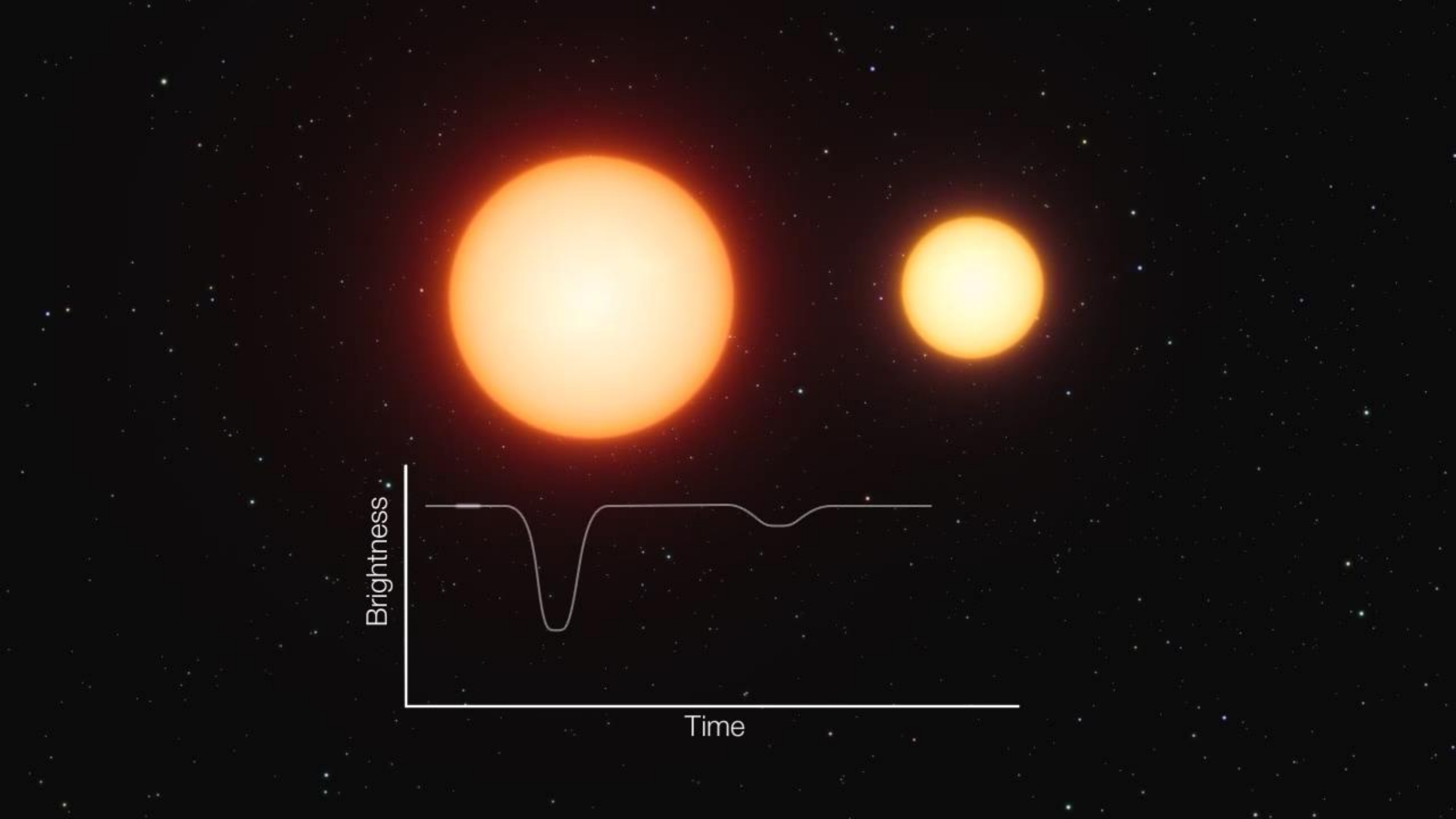
PULSATING VARIABLES

CEFEIDA RS Puppis
α: 08h 13min 04,22s
δ: -34° 34′ 42,7′′
Distance to Earth: 5581 al.
Constelation: POPA
HUBBLE SPACE TELESCOPE

CATACLISMIC VARIABLES

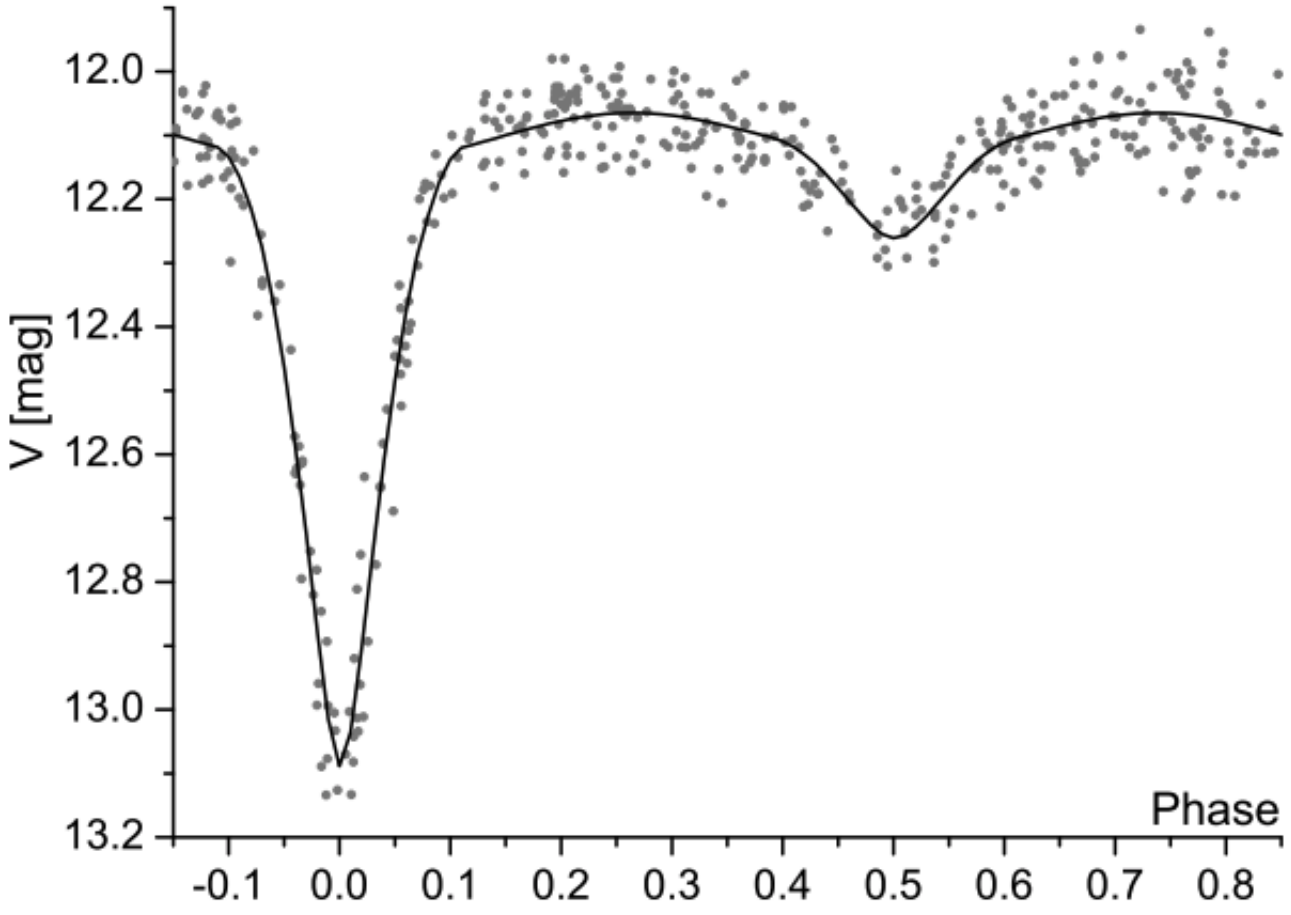


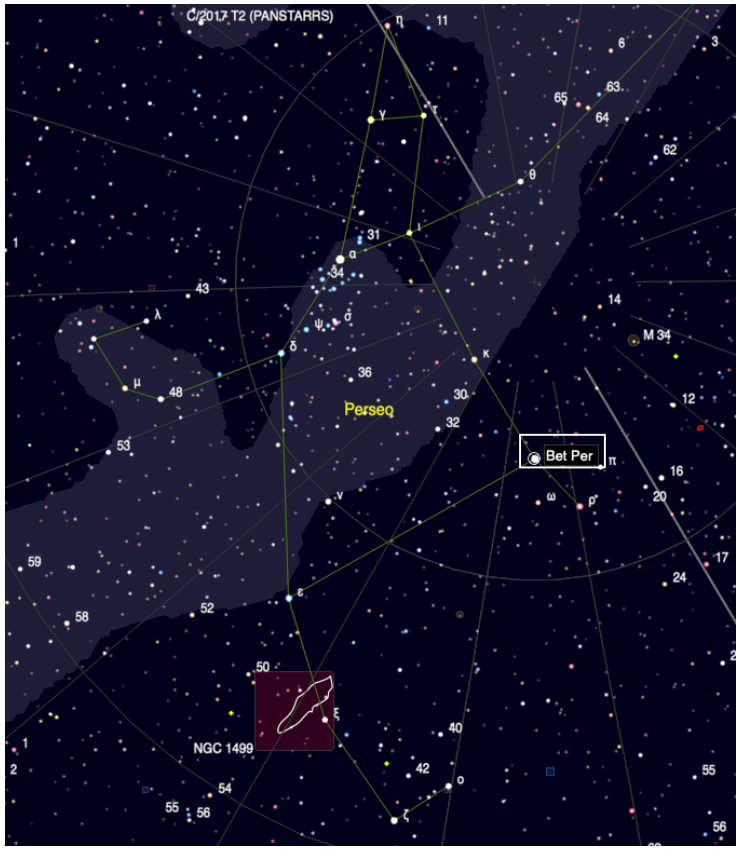
"Crab"
remainder of
SUPERNOVA SN1054
α: 05h 34m 31,97s
δ: +22° 00′ 52,1″
Distance to Earth: 6500 al.
Constelation: TAURO
HUBBLE SPACE TELESCOPE


Brightness
Time

EA TYPE ECLIPSING BINARY

EA LIGHT CURVE MODEL





¿De dónde viene su nombre?

La primera estrella que se descubrió de este tipo fue la estrella *Beta Perseo*. También conocida como *Algol*.

ECLIPSANTE EA *Beta Perseo*

α: 03h 24min 04,08s

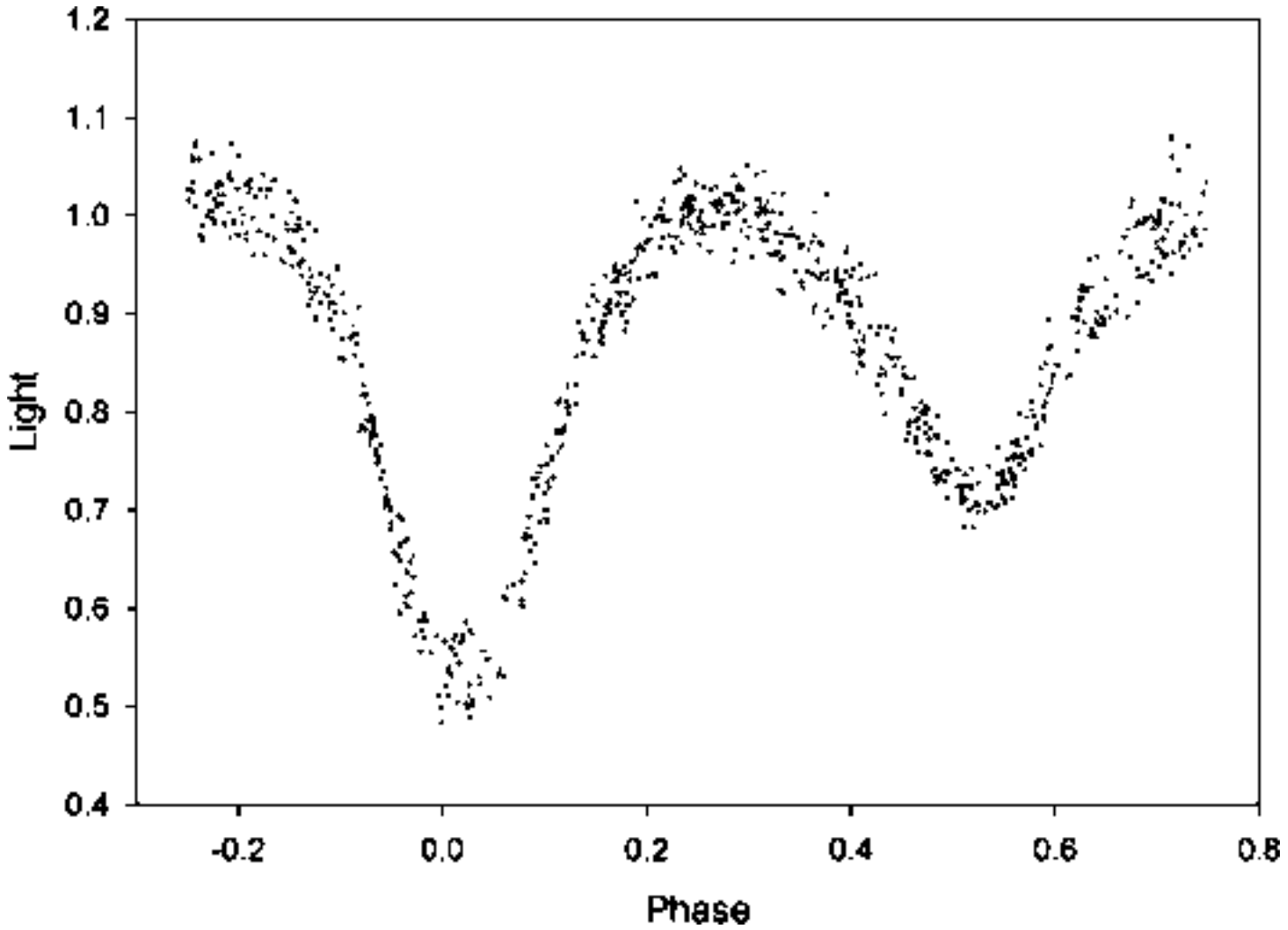
δ: +40° 57′ 20,33″

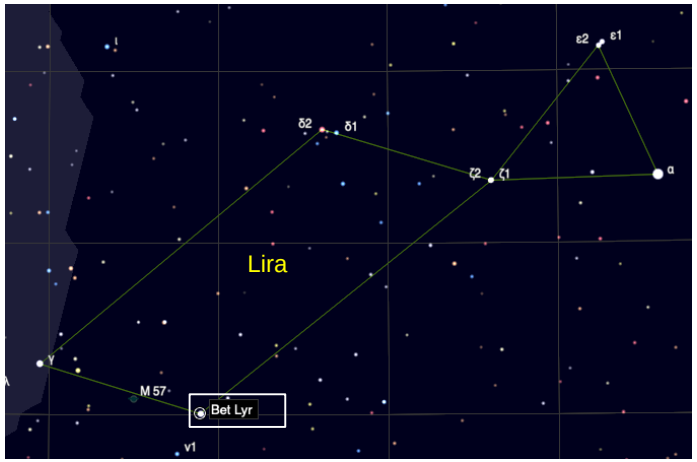
Período: 2d 52h 2min 30sec

Distancia: 93 años luz

EB TYPE ECLIPSING BINARY

EB LIGHT CURVE MODEL

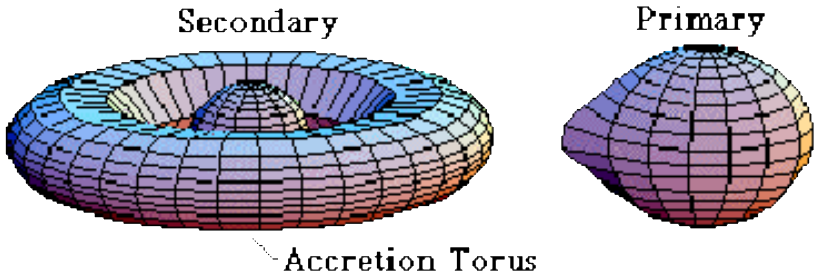




¿De dónde viene su nombre?
La primera estrella que se descubrió de este tipo fue la estrella *Beta Lyrae.*

ECLIPSANTE EB Beta Lyrae

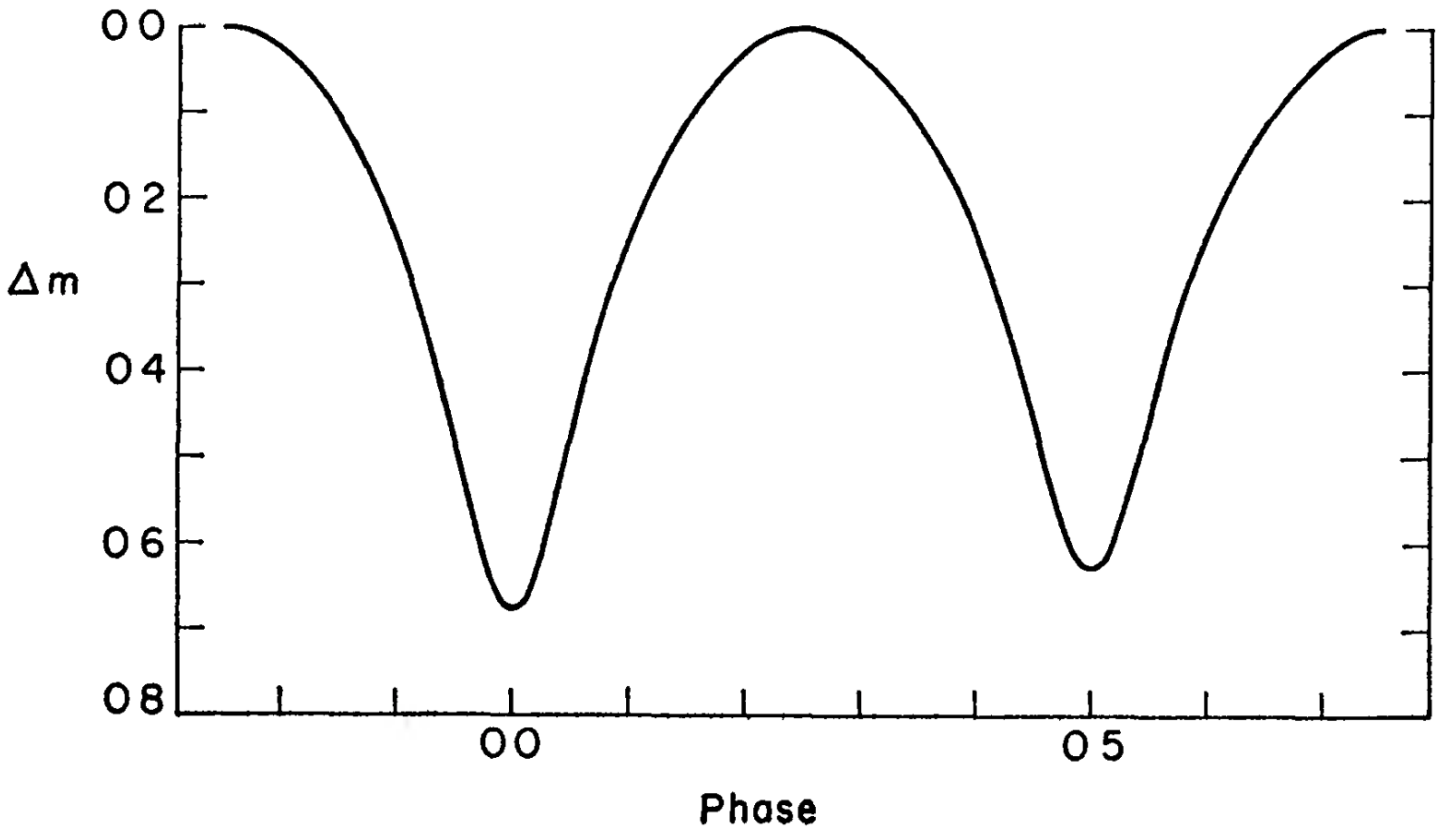
α: 18h 50min 04,79s
δ: +33° 21′ 45.6″
Período: 12d 22h 36min 18sec
Distancia: 962 años luz

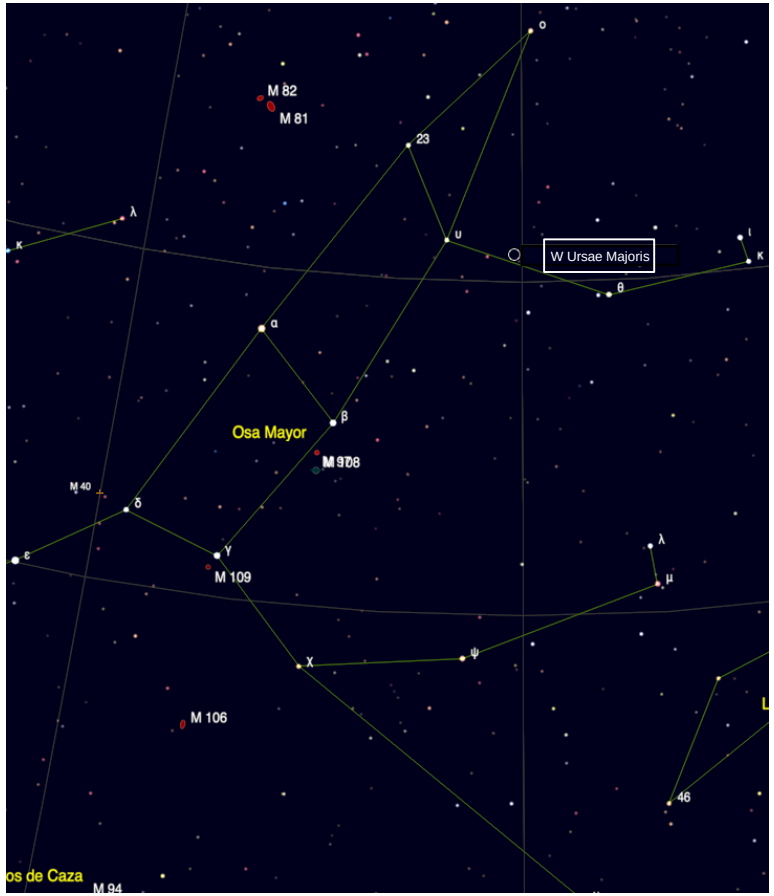


Representación de *Beta Lyrae*

EW TYPE ECLIPSING BINARY

MODELO CURVA DE LUZ ECLPSANTE TIPO EW





¿De dónde viene su nombre?

La primera estrella que se descubrió de este tipo fue la estrella *W Ursae Majoris.*

ECLIPSANTE EW *W Ursae Majoris*

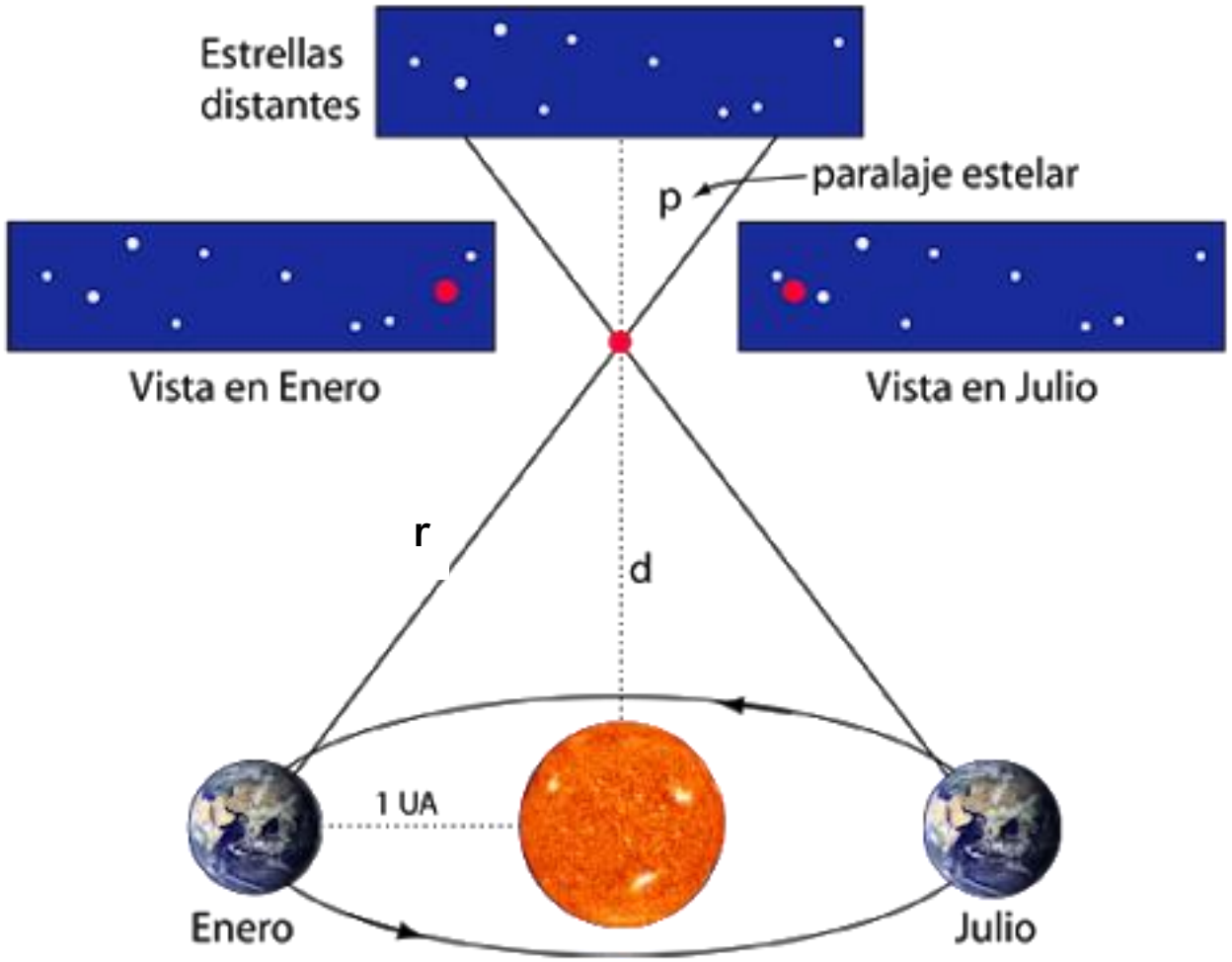
α: 09h 40min 15,39s

δ: +56° 10′ 56.6″

Período: 8 horas

Distancia: 162 años luz

CALCULATING DISTANCES PARALAX



Distance to Earth(r):

$$\tan(\hat{p}) = \frac{d(T,S)}{r} = \frac{1\ \text{AU}}{r}$$

$$r = \frac{1\ \text{AU}}{\tan(\hat{p})}$$

Uncertainty (Δr):

$$\Delta r = r \cdot \frac{1}{\tan(\hat{p})} \cdot \frac{1}{\cos^2(\hat{p})} \cdot \Delta\hat{p}$$

Somewhere, something incredible is waiting to be known

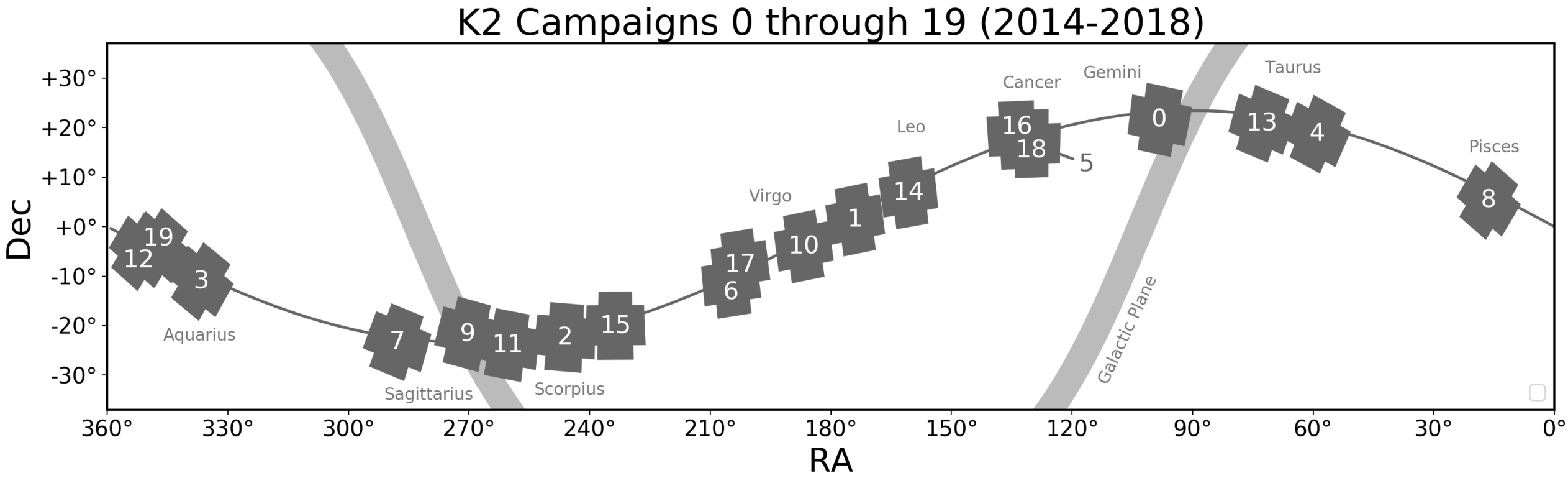
- Carl Sagan -

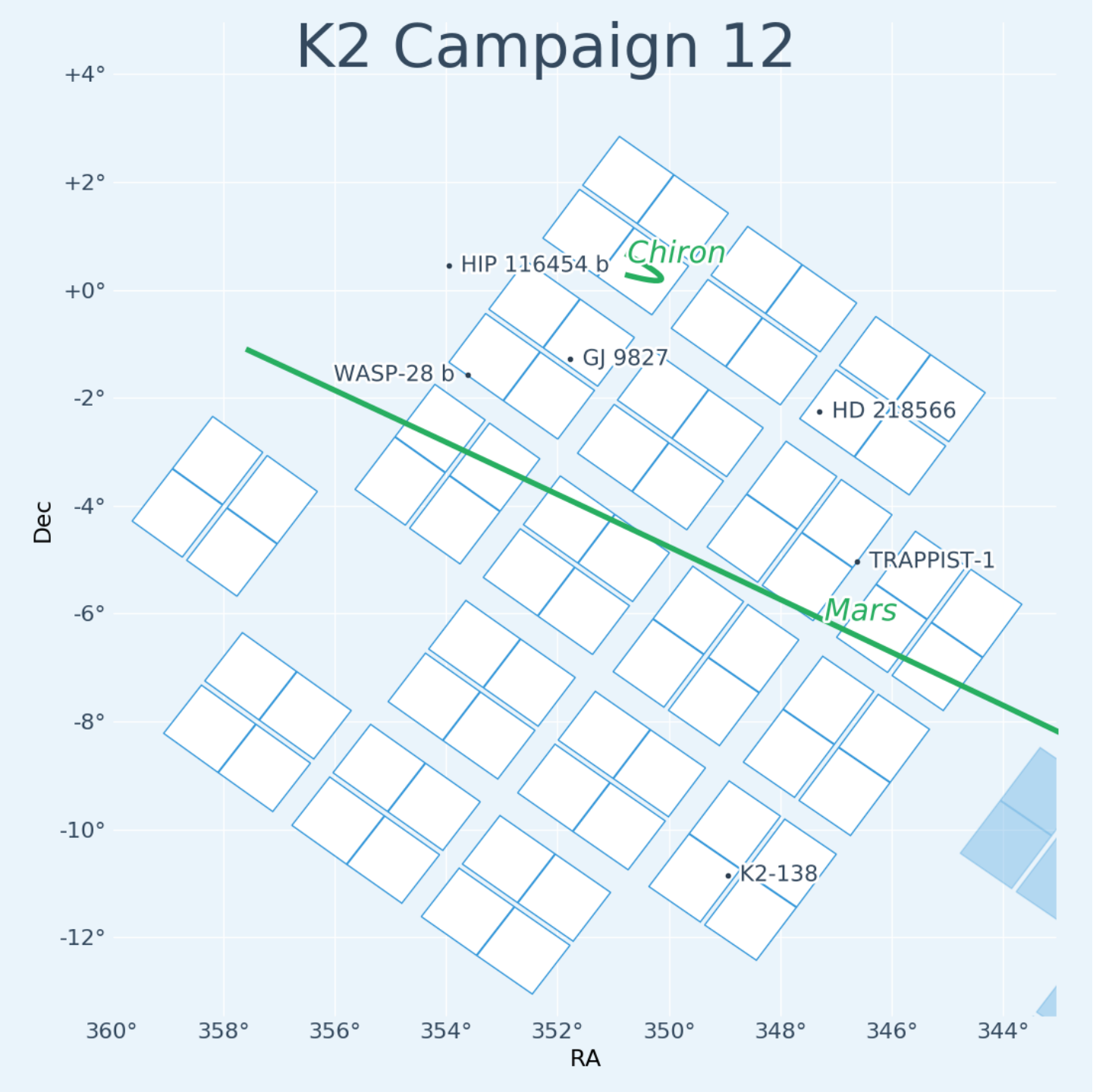
KEPLER SPACE TELESCOPE

Preparing the telescope to launch it abord the Delta II rocket.

Delta II Launch (United Launch Alliance) with the Kepler telescope aboard [March 7, 2009]

K_2 MISSION OBSERVATION CAMPAIGNS



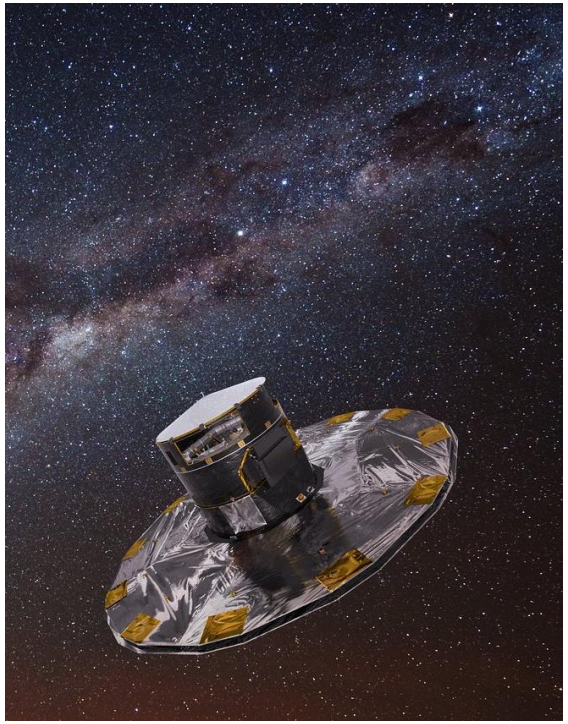


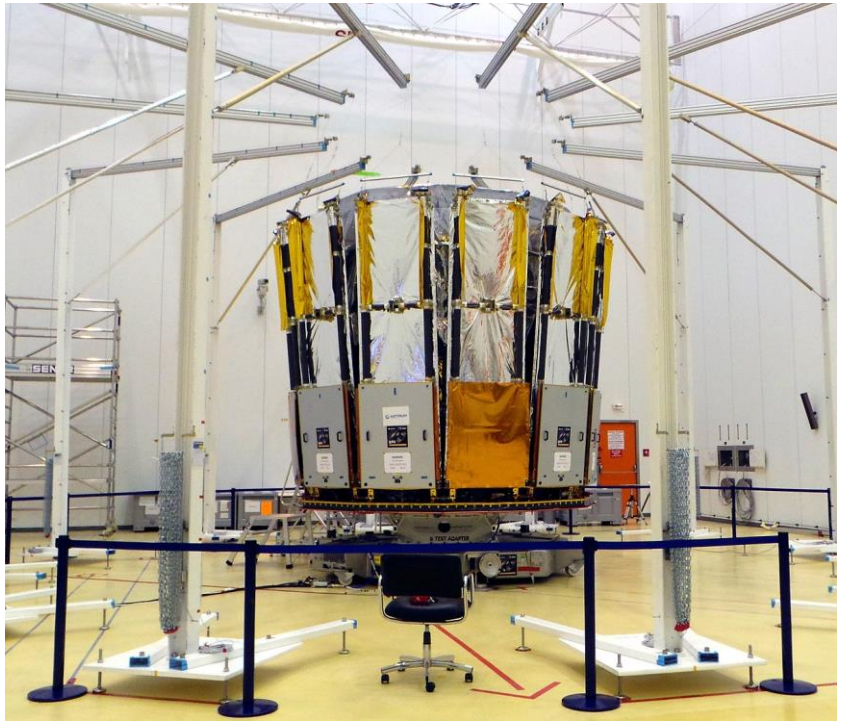
CAMPAIGN 12

DATA MINING

CRIBADO DE DATOS

1. Campo de visión K2-C12-FOV.
2. Suficientemente brillante para poder observarla desde la Tierra y con el equipo disponible.
3. No catalogada (base de datos *VizieR*).
4. Periodo no mayor a una noche





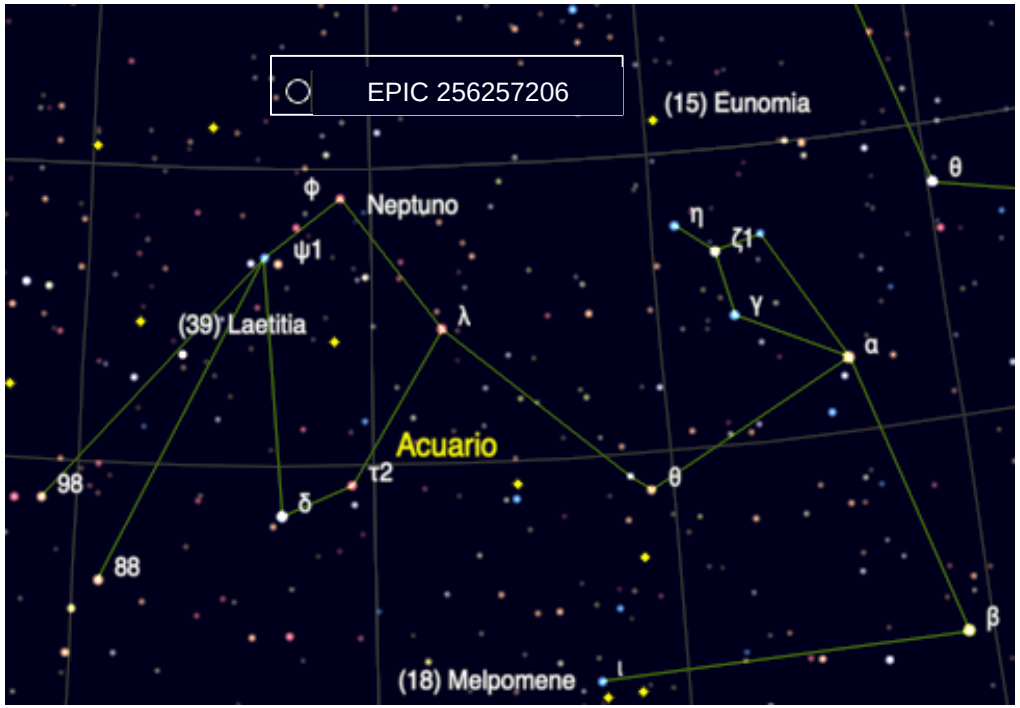
CAMPAÑA 12

EPIC 256257206

α: 23h 27min 18.14s

δ: -03° 54′ 37.5′′

Distance to Earth: (7,0832 ± 0,0002) · 10^2 ly



OBJETIVOS MISIÓN ESPACIAL GAIA

- Obtener medidas astrométricas (de posición) de mil millones de estrellas hasta magnitud 20.
- Obtener medidas fotométricas de mil millones de estrellas hasta magnitud 20.
- Obtener medidas de velocidad radial de de mil millones de estrellas hasta magnitud 20.

Todo para obtener un mapa tridimensional de las estrellas de la Vía Láctea.

NOTA: BRILLO EN K_2

Objeto	Magnitud aparente (m)	Magnitud Absoluta (V)
Vega	0,03	0,60
Andrómeda	4,40	- 21,9
Sol	- 26,74	4,83
Deneb	1,25	- 7,2
Galaxia del Sombrero	8	- 22,6
Sirio B	8,3	11,2
Canopus	-0,6	- 5,5
Omega Centauri	3,8	-9,9

Flujo: Luminosidad por unidad de superficie.

$$F = \frac{L}{4\pi r^2}$$

Flujo a magnitudes absolutas:

$$V_k = \overline{V} - 2,5 \log (F_k) = 13,710 - 2,5 \log (F_k)$$

ASAS SN

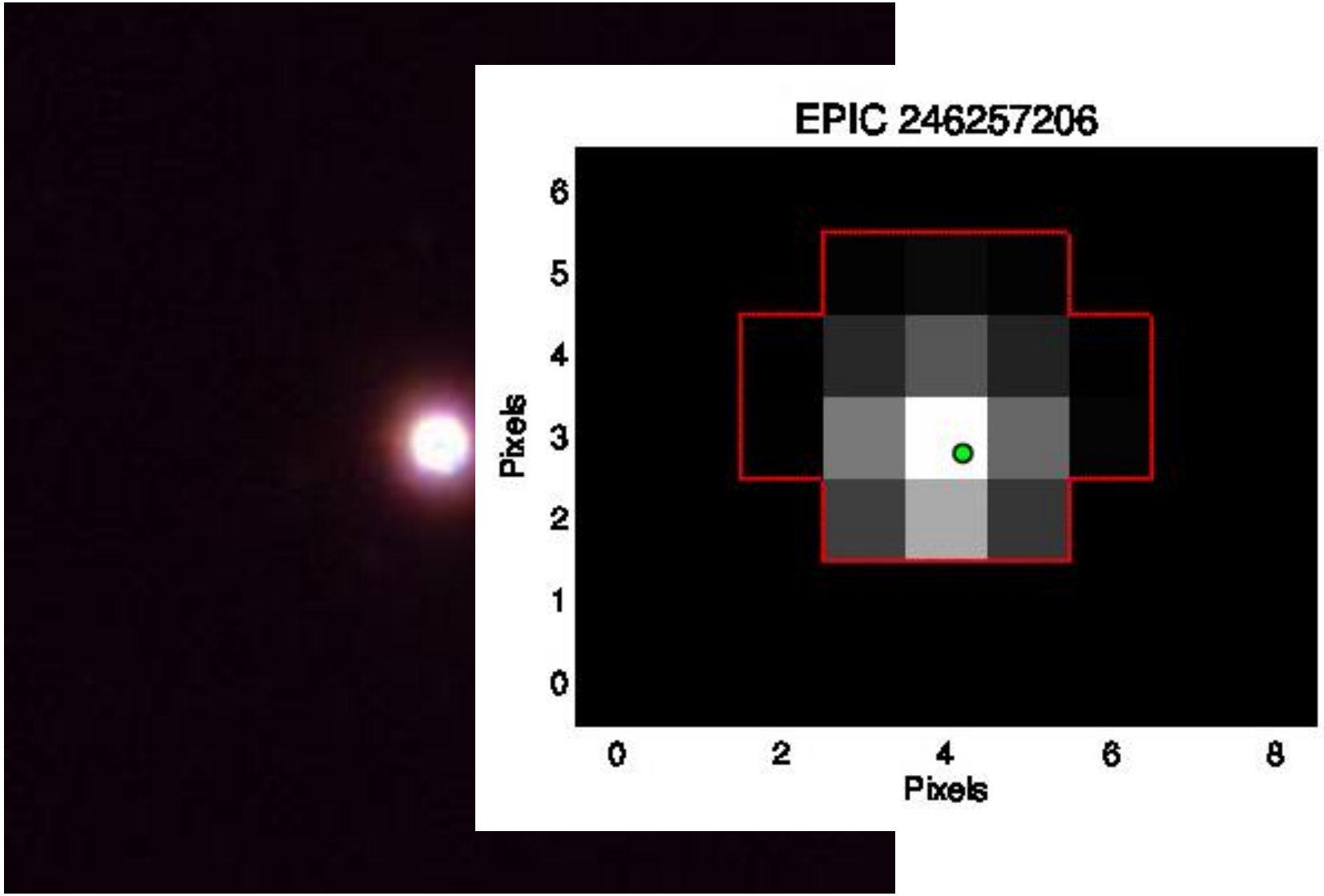
All Sky Automated Survey for SuperNovae

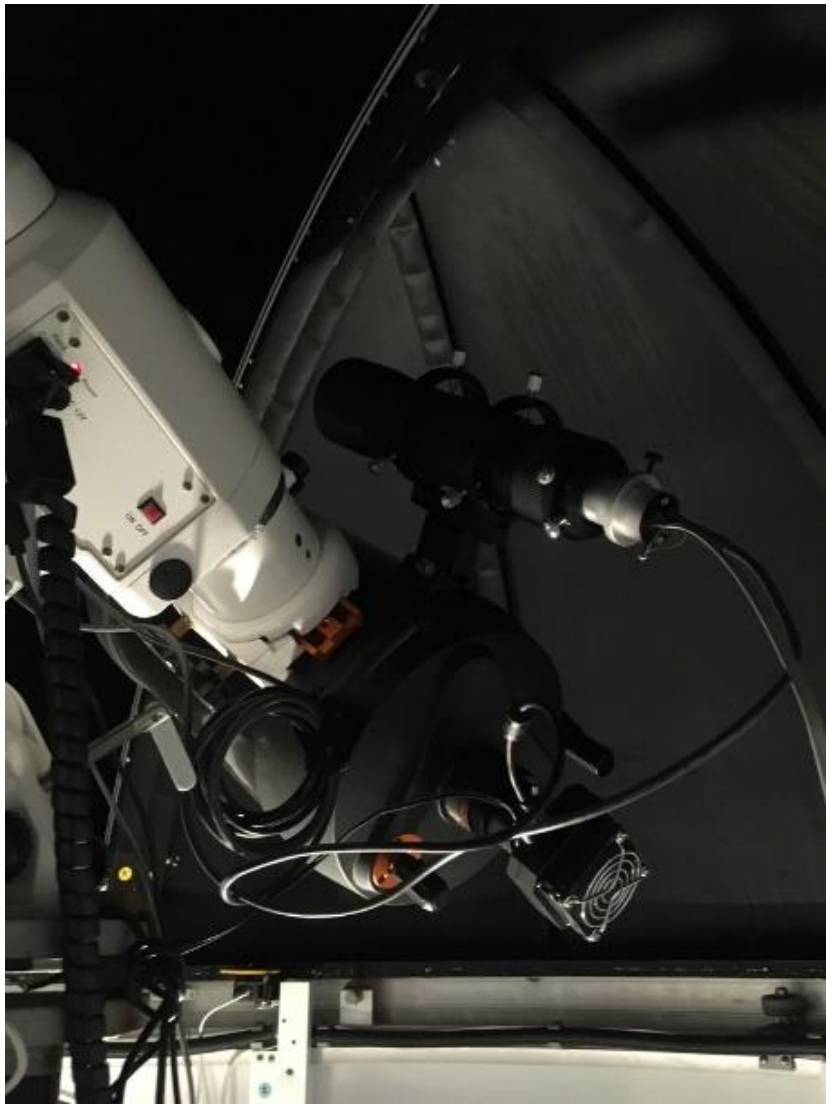
PAN-STARRS HAWÁI

Minor Planet Center

F51

IMAGEN PAI MÁSCARA KEPLER





Minor Planet Center
L94

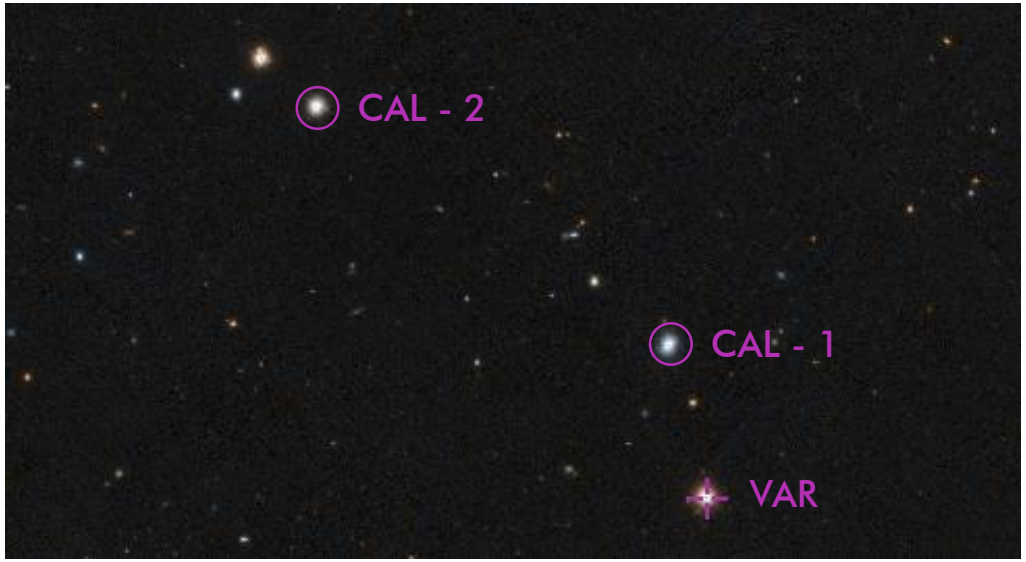
OBSERVATORIO ICTEA

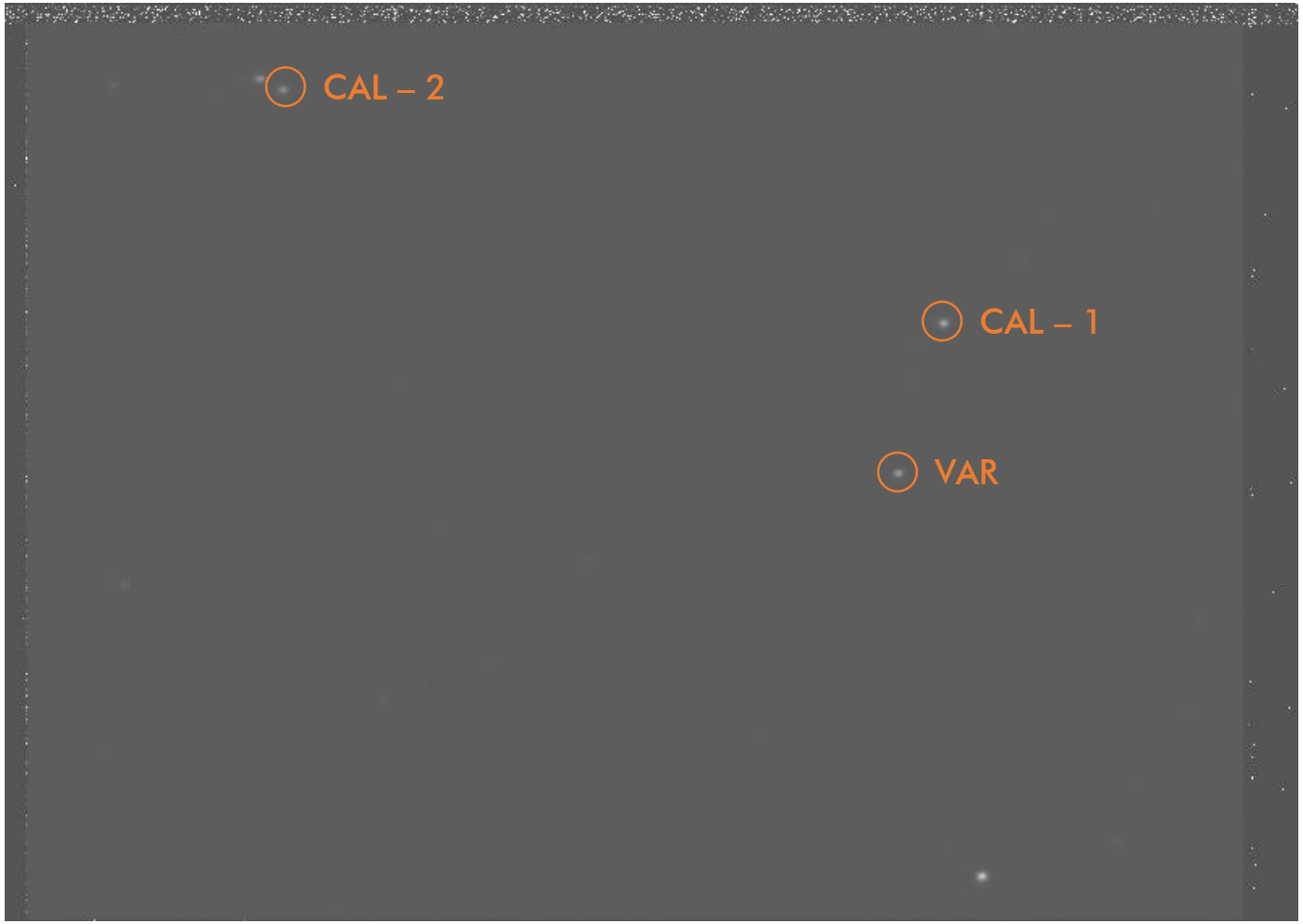
ESTRELLAS DE CALIBRADO

Barbara A. MIKULSKI ARCHIVE FOR SPACE TELESCOPES

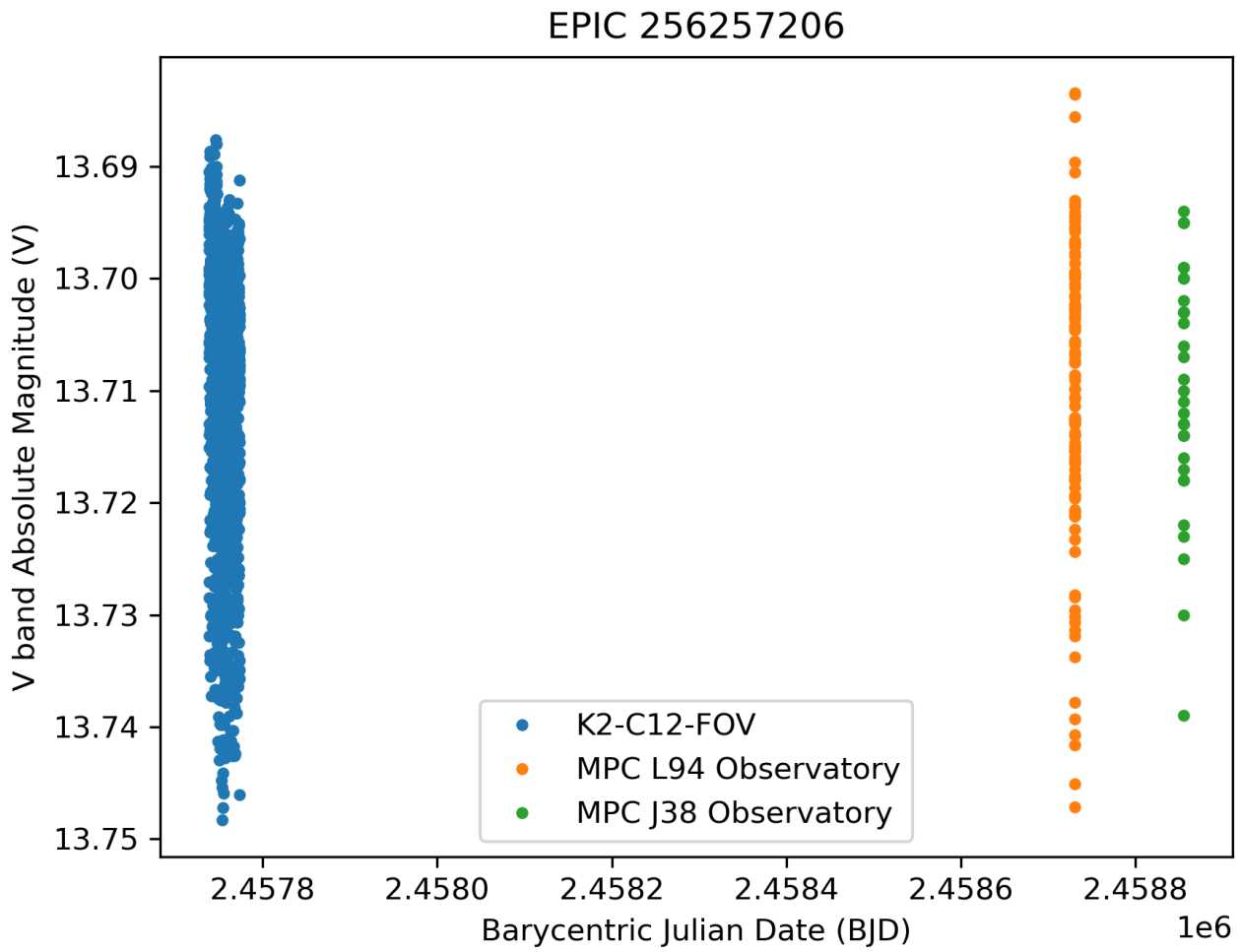
VizieR

	Estrella de Calibrado	Coordenadas (MAST)	Magnitud Banda V (VizieR)
1	EPIC 246258498	α: 23h 27min 19,50s δ: -03° 53′ 13,80″	13,253
2	EPIC 246260481	α: 23h 27min 32,80s δ: -03° 50′ 58,46″	13,824

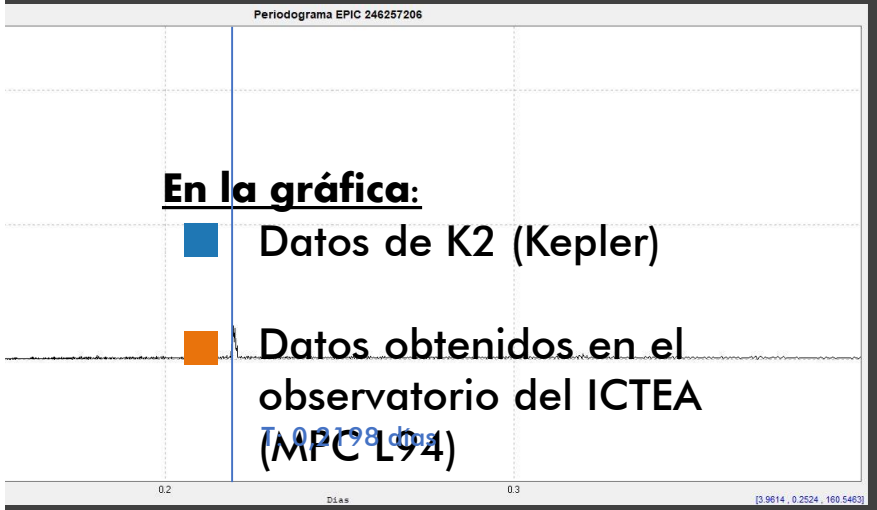




CURVA DE LUZ



DOGRAMA LOMB-SCARGLE



En la gráfica:

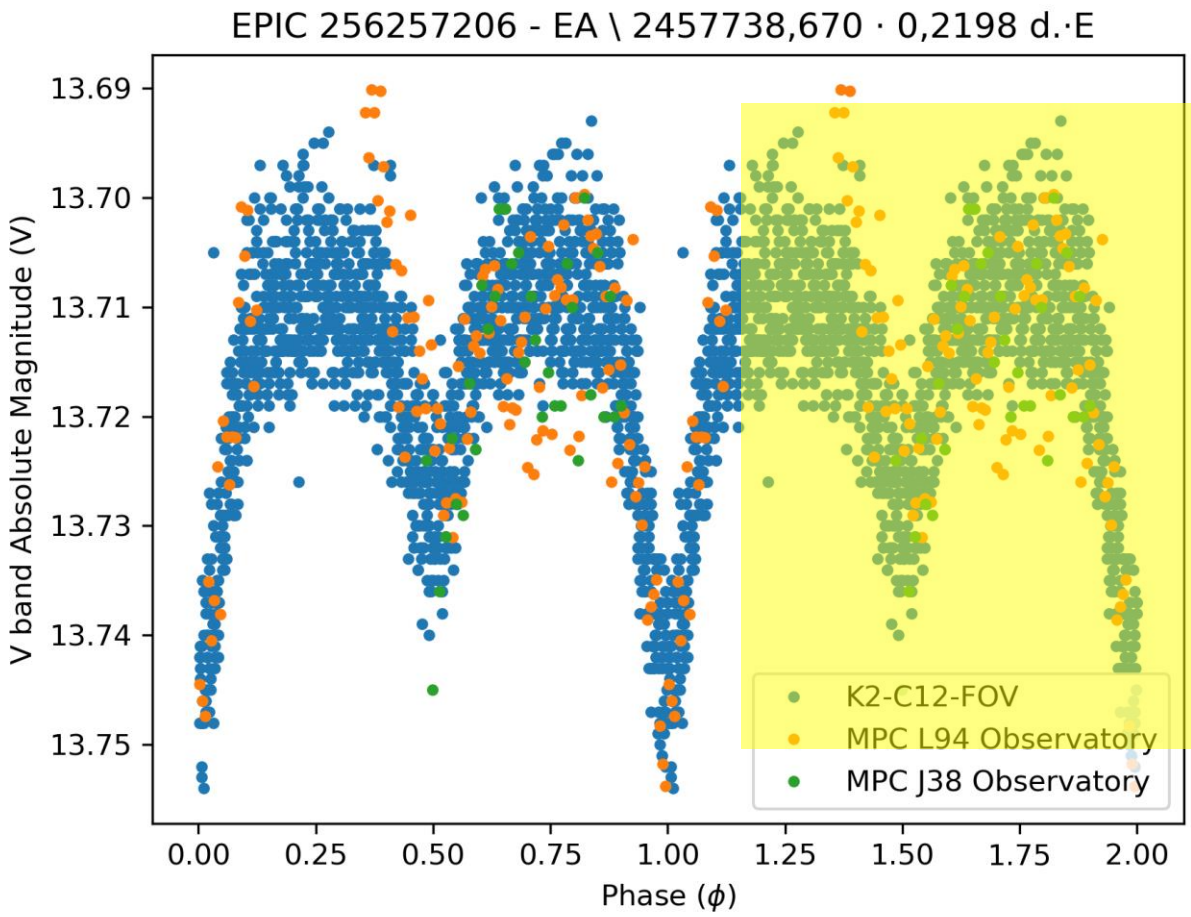
- Datos de K2 (Kepler)
- Datos obtenidos en el observatorio del ICTEA (MPC L94)
- Datos obtenidos en el observatorio *La Vara* (MPC J38)

omb - Scargle:

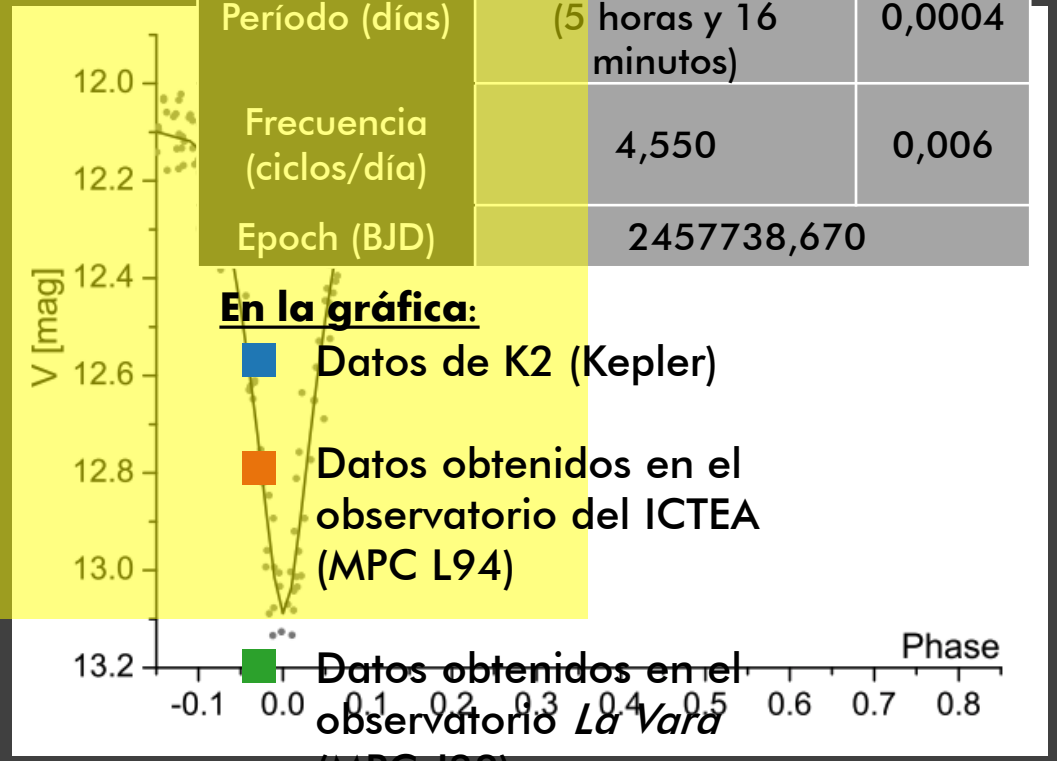
MPC: Minor Planet Center

$$\left(\frac{\{\sum_j X_j \cos[T^{-1}(t_j-\tau)]\}^2}{\sum_j X_j \cos^2[T^{-1}(t_j-\tau)]} + \frac{\{\sum_j X_j \sin[T^{-1}(t_j-\tau)]\}^2}{\sum_j X_j \sin^2[T^{-1}(t_j-\tau)]}\right)$$

CURVA DE LUZ EN FASE



	Valor	Error
Período (días)	0,2198 (5 horas y 16 minutos)	0,0004
Frecuencia (ciclos/día)	4,550	0,006
Epoch (BJD)	2457738,670	



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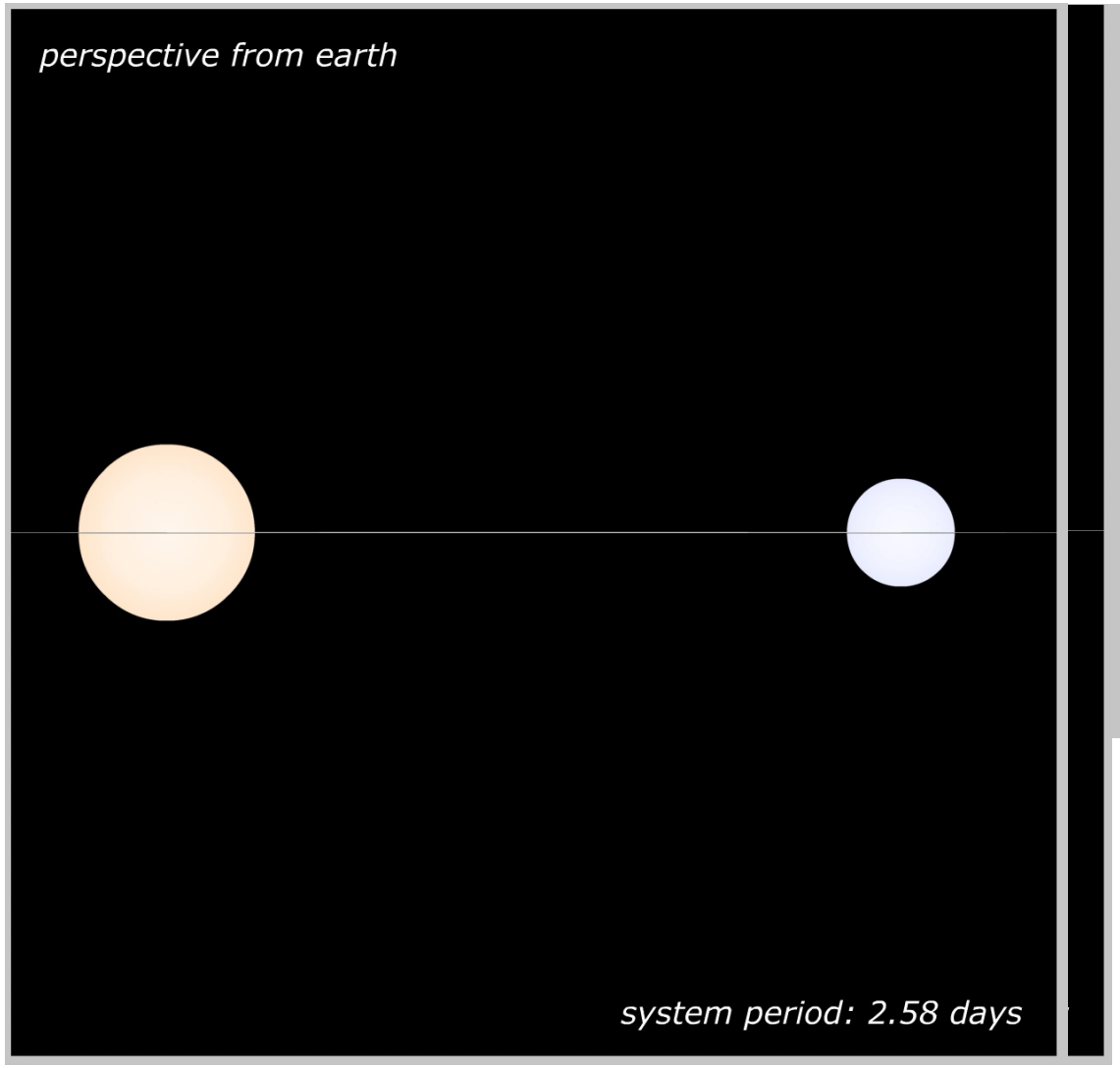
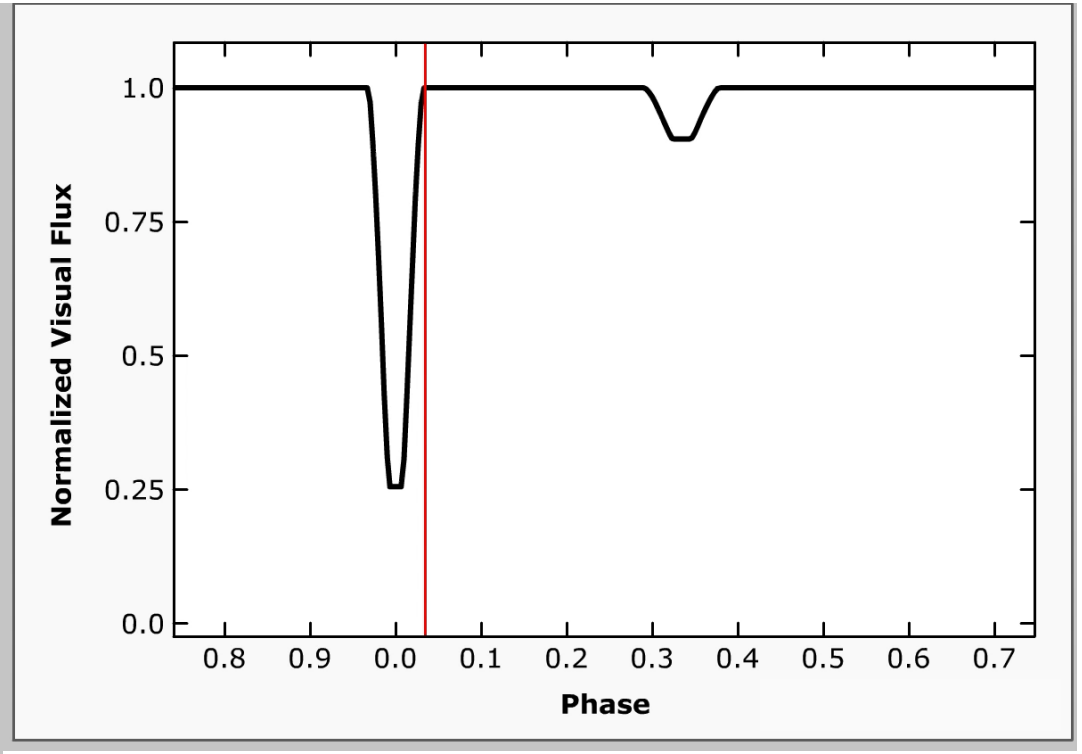
MPC: Minor Planet Center

GRAZING ECLIPSES

"ECLIPSES GRASANTES"





The International Variable Star Index

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Jorge Pérez González, you are logged in.

» My Submissions » Preferences » Log out

» Revise » New Search

Latest Details

Inclusion of aliases from SIMBAD may be set from Preferences.

Name	V **ATO J351.8258-03.9104**
Personal alias	Gopejo » Edit personal alias
AAVSO UID	000-BNK-328 (No observations)
Constellation	Aquarius » Sequence
J2000.0	23 27 18.14 -03 54 37.5 (351.82558 -3.91042) » Search nearby
B1950.0	23 24 43.72 -04 11 08.8
Galactic coord.	78.395 -59.300
Other names (Internal only)	EPIC 246257206 USNO-A2.0 0825-19945072 » Add name
Variability type	EA
Spectral type	--
Mag. range	13.66 - 13.71 CV
Discoverer	Jorge Pérez González, ATLAS team
Epoch	16 Dec 2016 (HJD 2457738.66633) » Ephemeris
Outburst	--
Period	0.2189 d (5.25 h)
Rise/eclipse dur.	--

MUCHAS GRACIAS POR SU ATENCIÓN

Contacto: jorper.gonzalez@gmail.com

ICTEA
Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias

OMEGA
SOCIEDAD ASTRONÓMICA ASTURIANA

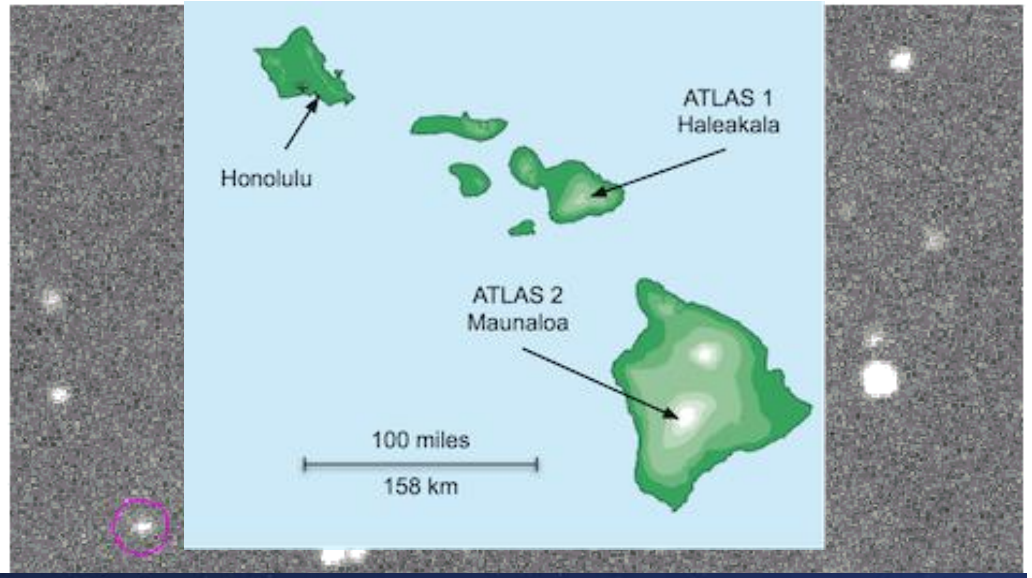
Universidad de Oviedo
Universidá d'Uviéu
University of Oviedo

Real Instituto de Náutica Mineralogía Matemáticas Jovellanos

Fotografía (Hubble): NASA; ESA; G. Illingworth, D. Magee, and P. Oesch, University of California, Santa Cruz; R. Bouwens, Leiden University; and the HUDF09 Team

Asteroid Terrestrial-impact Last Alert System (ATLAS)

Observatorio ATLAS 1
Haleakala

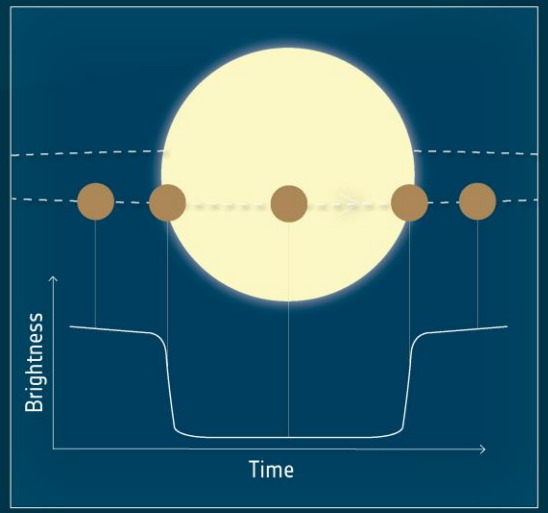


Ultima vista completa del campo estelar de Kepler

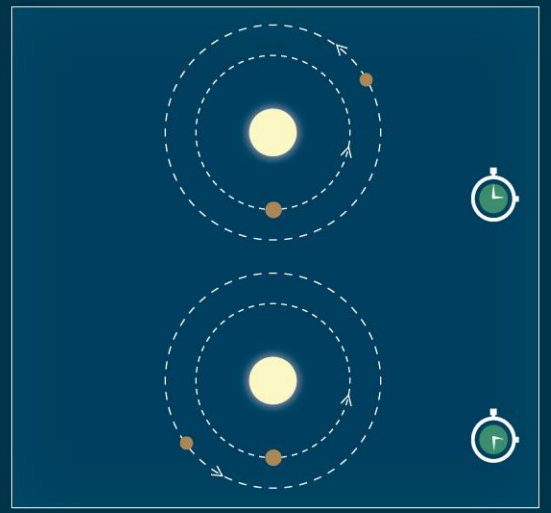
MISIÓN ESPACIAL KEPLER

→ EXOPLANET DETECTION METHODS

Transit photometry



Transit-timing variation

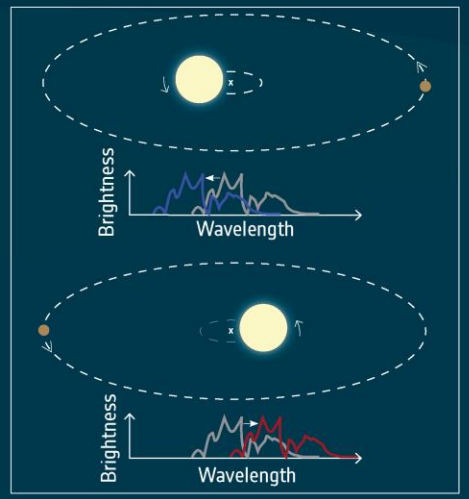


Transit photometry is one of the main techniques used to **discover** exoplanets. Cheops will use this technique to **measure the sizes** of known exoplanets and to start to **characterise** them.

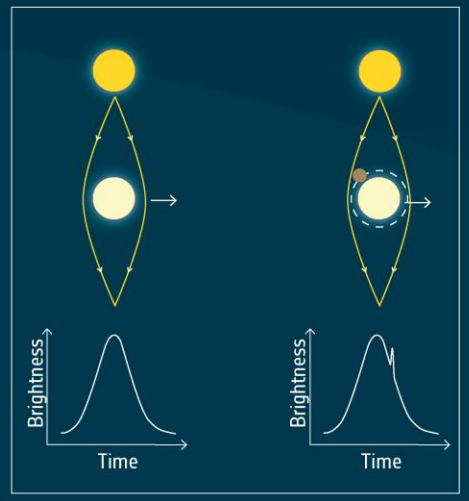
By using the **transit-timing variation** technique, Cheops will be able to **discover** additional, previously unknown planets around some stars, and also determine the planet **masses**.

Other techniques used to discover new exoplanets (not employed by Cheops) are: radial velocity, microlensing, astrometry and direct imaging.

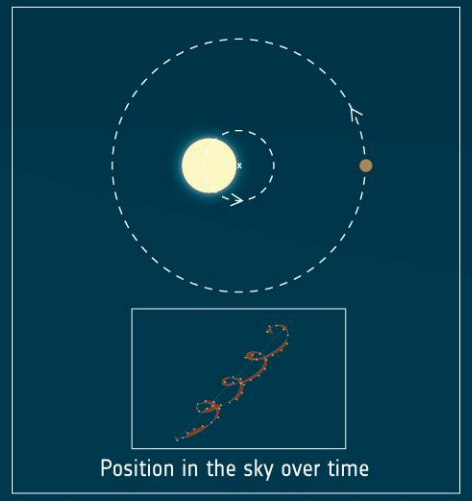
Radial velocity



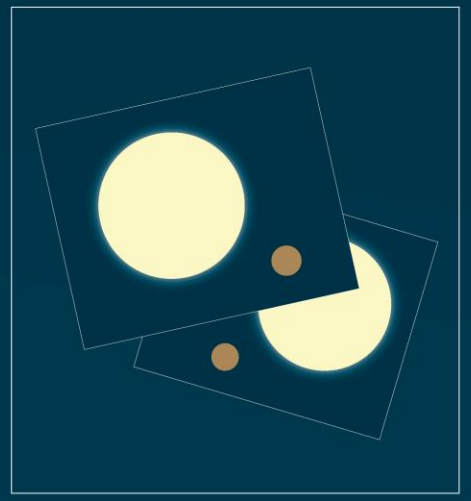
Microlensing



Astrometry

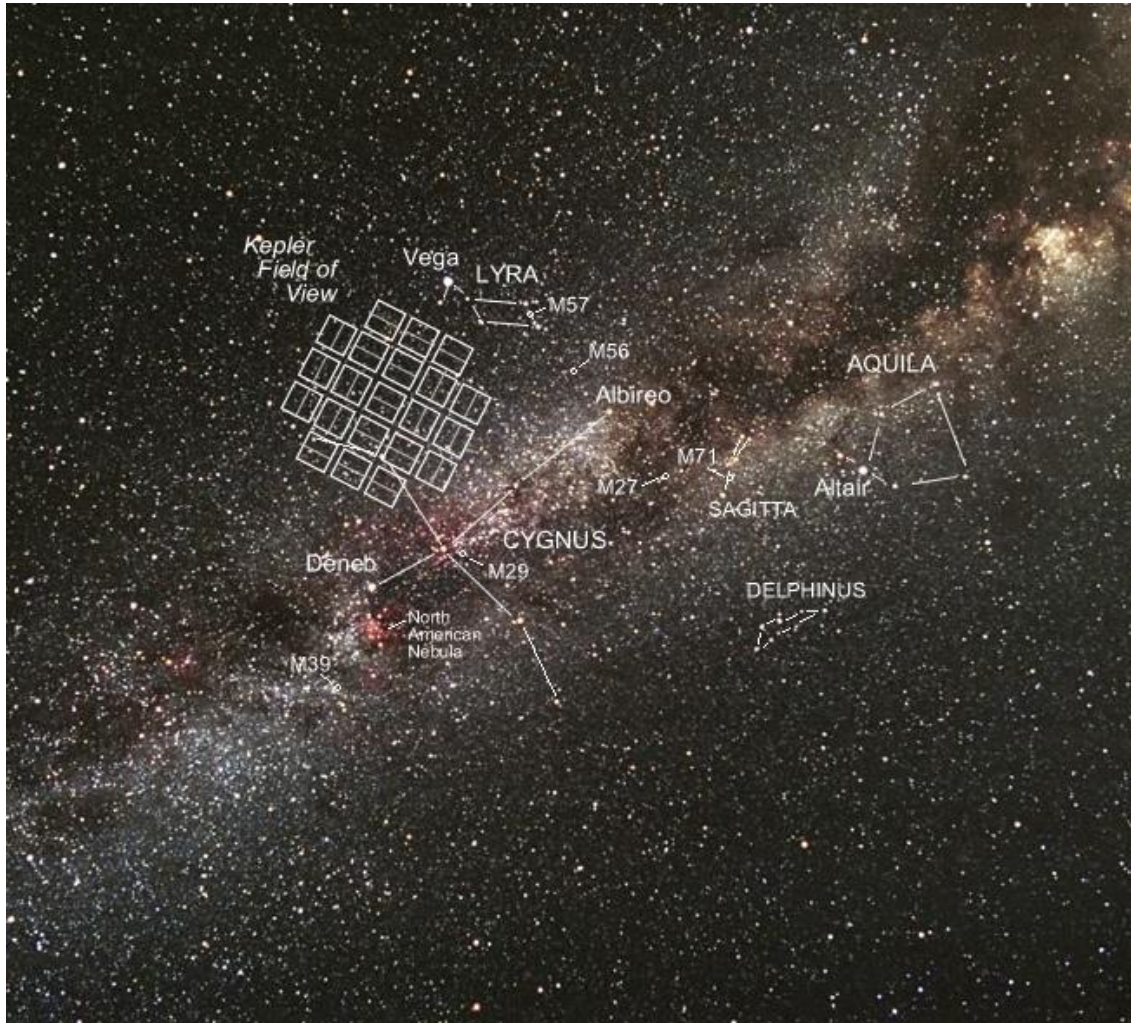


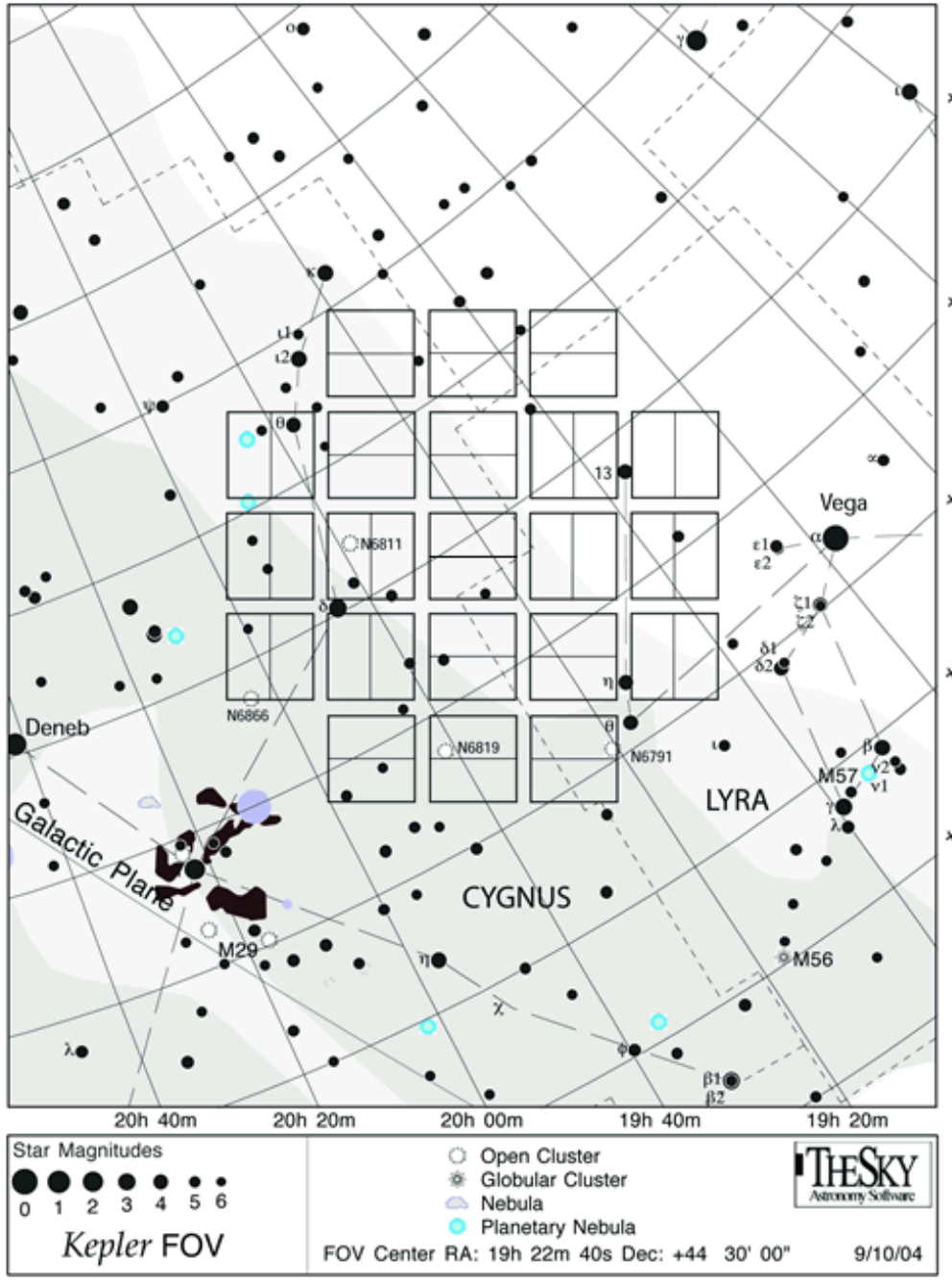
Direct imaging

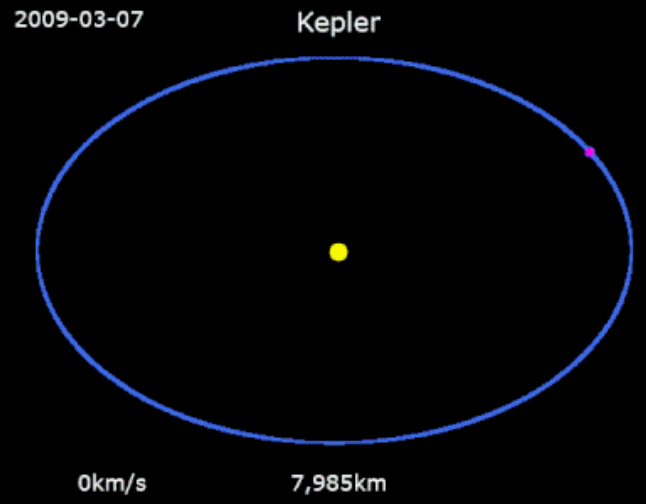


#cheops

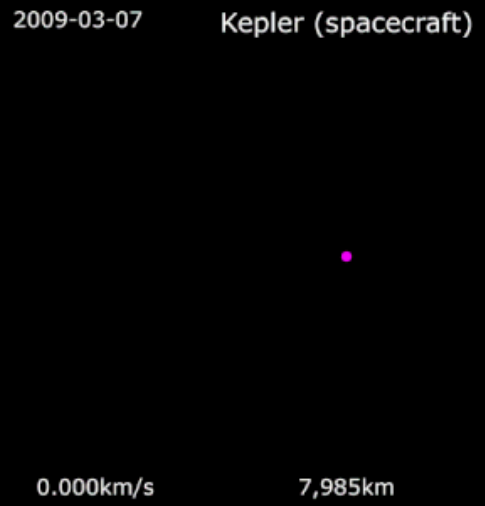
CAMPO DE VISIÓN DE LA MISIÓN KEPLER





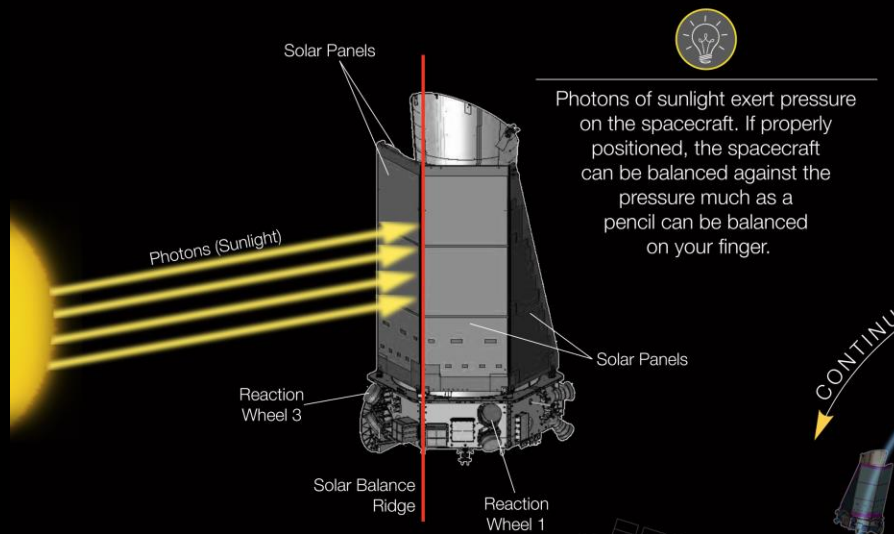


KEPLER Y LA TIERRA CON RESPECTO AL SOL

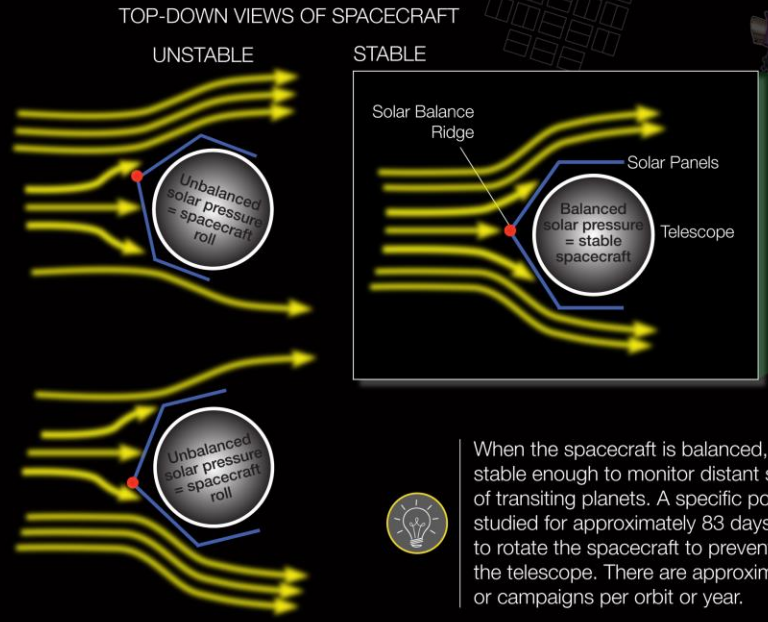


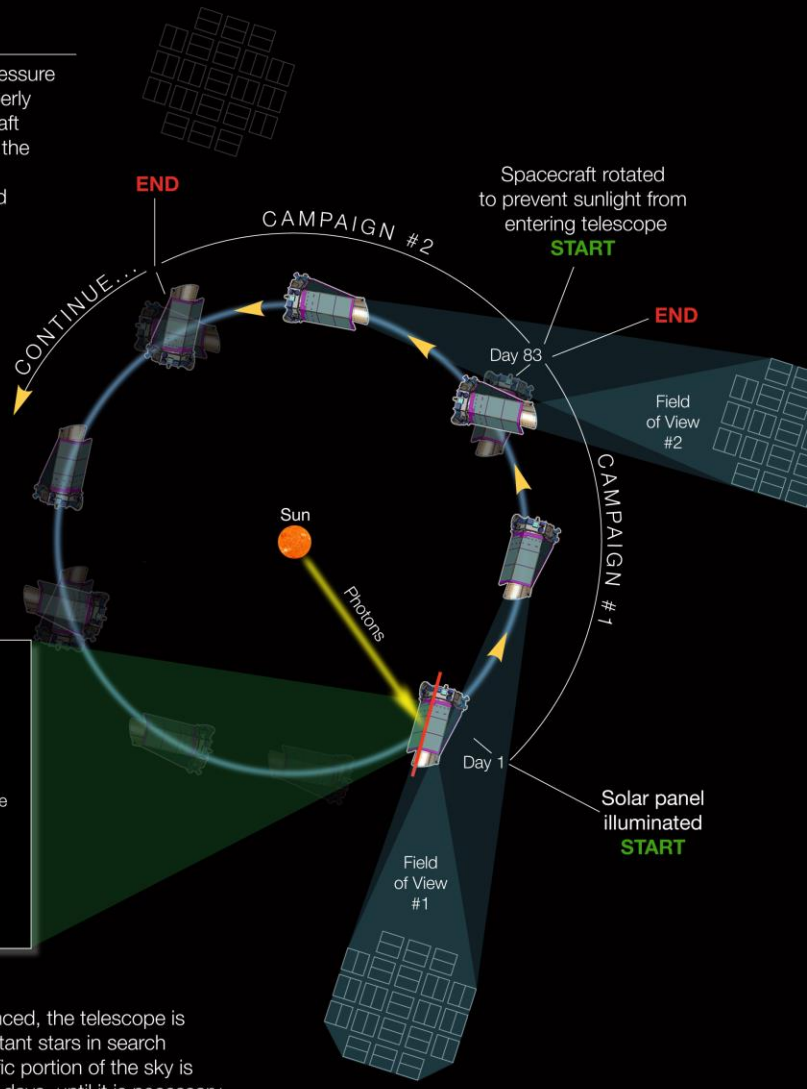
KEPLER CON RESPECTO A LA TIERRA

Kepler's Second Light: How K2 Will Work



Photons of sunlight exert pressure on the spacecraft. If properly positioned, the spacecraft can be balanced against the pressure much as a pencil can be balanced on your finger.





When the spacecraft is balanced, the telescope is stable enough to monitor distant stars in search of transiting planets. A specific portion of the sky is studied for approximately 83 days, until it is necessary to rotate the spacecraft to prevent sunlight from entering the telescope. There are approximately 4.5 viewing periods or campaigns per orbit or year.

CONCEPTUAL ILLUSTRATION OF SPACECRAFT SOLAR DISTURBANCE. THE ACTUAL DISTURBANCE IS DUE TO PHOTON PRESSURE, NOT SOLAR WIND.