

# Conceptos básicos Astronomía de Posición

18/08/22



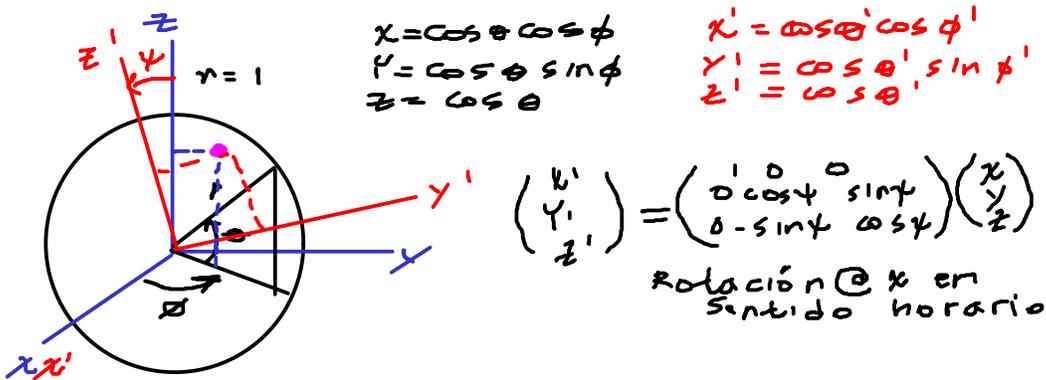
- Sistemas de coordenadas celestes
- El paralaje estelar y el movimiento propio
- "The GAIA Celestial Reference Frame"



ELEMENTOS DE FORMACIÓN ESTELAR Y PLANETARIA

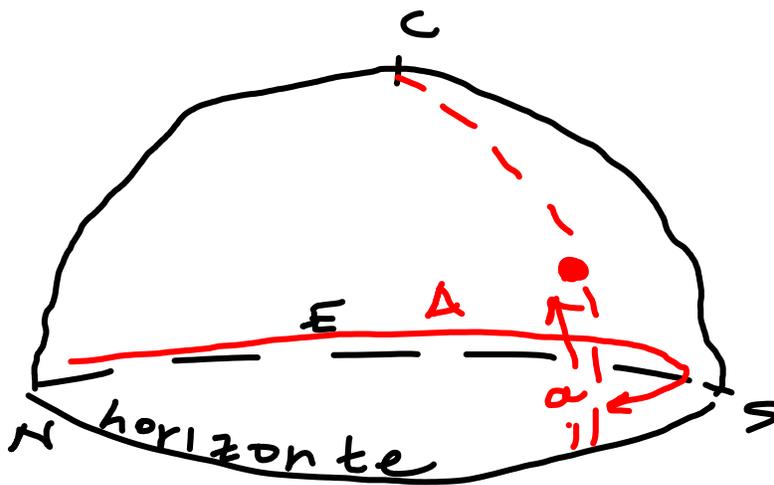


Sistemas de coordenadas celestes (Horizontales y ec. horarias)



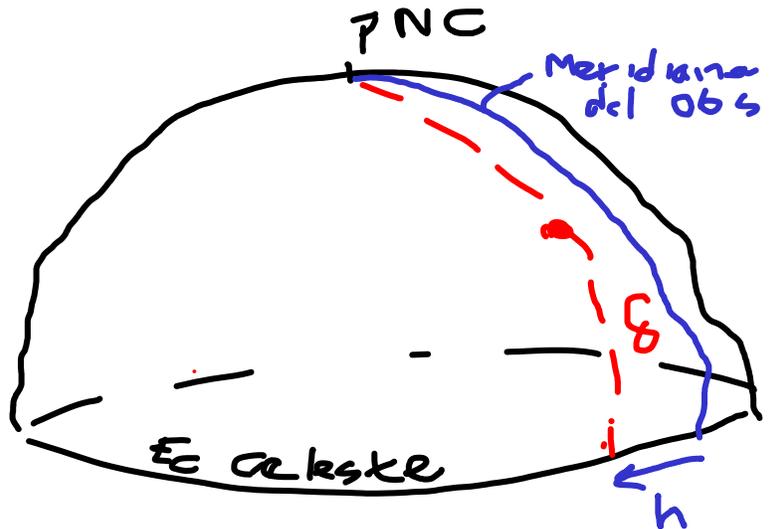
Coordenadas horizontales

Coordenadas ecuatoriales horarias



$$0 \leq A \leq 360^\circ$$

$$-90^\circ \leq \alpha \leq 90^\circ$$



$$0 \leq h \leq 24^h$$

$$-90^\circ \leq \delta \leq 90^\circ$$

De horizontales a ecuatoriales :

$$\psi = 90^\circ - A, \quad \theta = a,$$

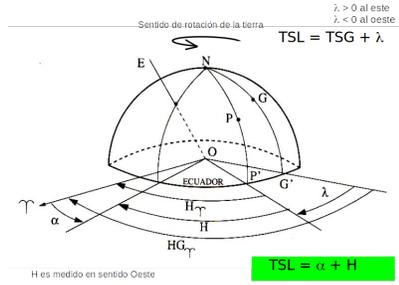
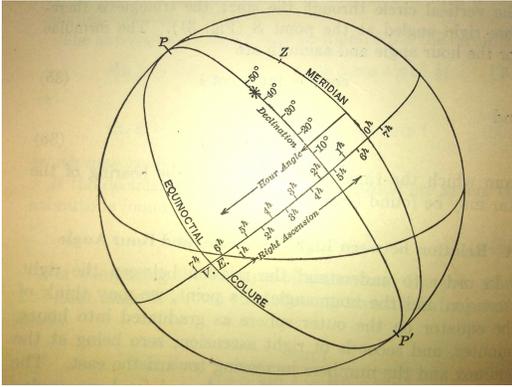
$$\psi' = 90^\circ - h, \quad \theta' = \delta, \quad \chi = 90^\circ - \phi.$$

$$\sin h \cos \delta = \sin A \cos a,$$

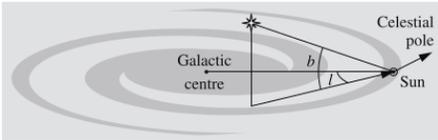
$$\cos h \cos \delta = \cos A \cos a \sin \phi + \sin a \cos \phi,$$

$$\sin \delta = -\cos A \cos a \cos \phi + \sin a \sin \phi$$

# Coordenadas Ecuatoriales Absolutas



# Coordenadas Galácticas



$$\sin(l_N - l) \cos b = \cos \delta \sin(\alpha - \alpha_P) ,$$

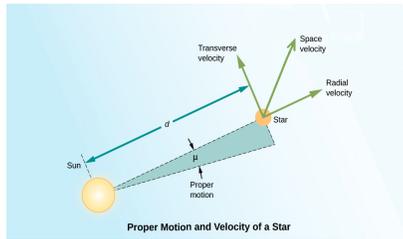
$$\cos(l_N - l) \cos b = -\cos \delta \sin \delta_P \cos(\alpha - \alpha_P) + \sin \delta \cos \delta_P ,$$

$$\sin b = \cos \delta \cos \delta_P \cos(\alpha - \alpha_P) + \sin \delta \sin \delta_P ,$$

where the direction of the Galactic north pole is  $\alpha_P = 12 \text{ h } 51.4 \text{ min}$ ,  $\delta_P = 27^\circ 08'$ , and the galactic longitude of the celestial pole,  $l_N = 123.0^\circ$ .

# El movimiento propio

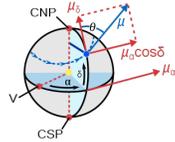
Desplazamiento angular aparente durante el año debido a su movimiento en el espacio respecto al sol.



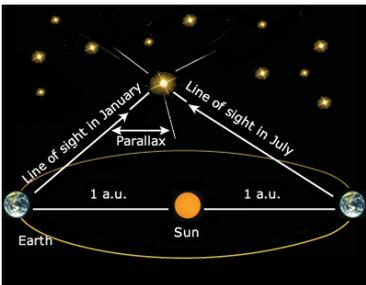
$$v_{space} = \sqrt{v_{radial}^2 + (4.74 \mu \cdot d)^2}$$

La magnitud del movimiento propio:

$$\mu^2 = \mu_\delta^2 + \mu_\alpha^2 \cdot \cos^2 \delta ,$$



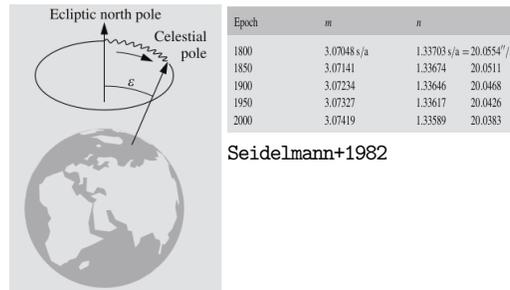
# El paralaje estelar



# La búsqueda de un sistema de referencia inercial universal

1991 IAU "Rotation Free". Coordenadas precisas de objetos extragalácticos  
 Origen : Baricentro del sistema solar con ejes fijos con respecto a objetos extragalácticos.

ICRF (International Celestial Reference Frame) J2000.0



## ICRF3 datasets

- ICRF3 includes solutions at **three different radio bands**: X/S, K and Ka/X-bands

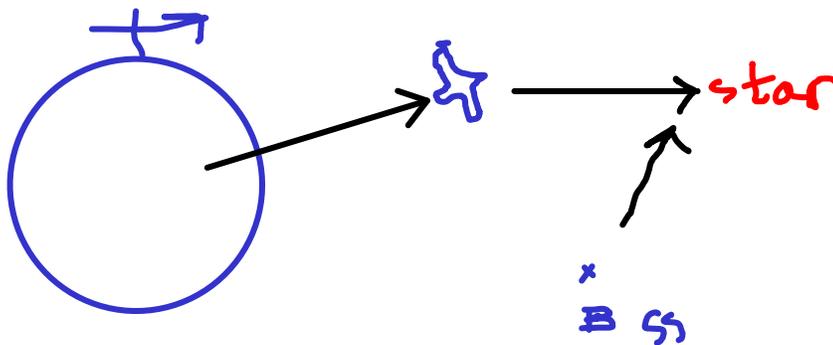


Band	Frequency (GHz)	Nb of obs. (millions)	Fraction of observations (%)					Data span
			IVS	VLBA	Ht-Ho	DSN	ESA	
X/S	8.4 / 2.3	13.2	74	26				1979-2018
K	24	0.5		99	1			2002-2018
Ka/X	32 / 8.4	0.07				87	13	2005-2018



## The GAIA Celestial Reference Frame

IAU 2000 adopta "Post Newtonian Parametrized" PPN version de la RG  
 Los ejes se alinean con ICRF. Gaia toma como referencia el baricentro del SS



# Modelo astrométrico

Permite obtener el movimiento propio para cualquier fuente en un instante  $t$  en términos de variables auxiliares bien conocidas.

## The astrometric core solution for the *Gaia* mission Overview of models, algorithms, and software implementation

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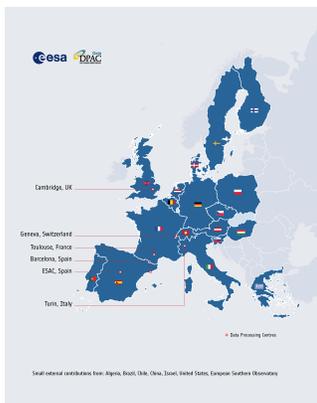
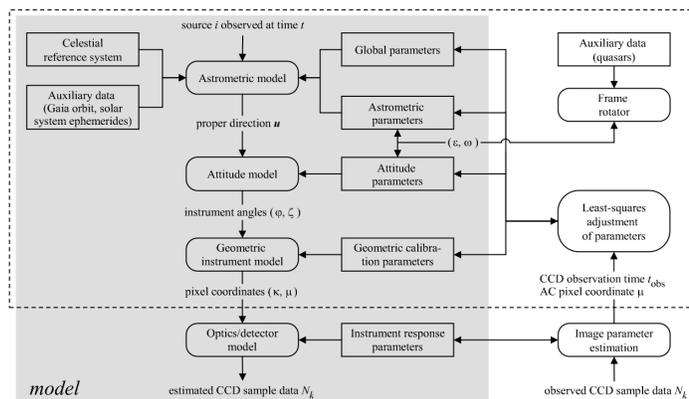
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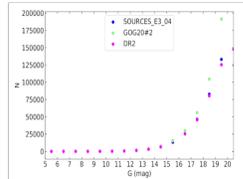
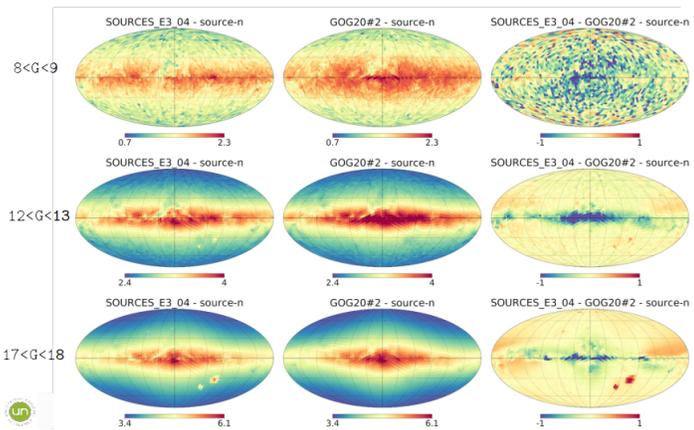
<sup>3</sup> Astronomisches Rechen-Institut, Zentrum für Astronomie der Universität Heidelberg, Mönchhofstr. 12-14, 69120 Heidelberg, Germany

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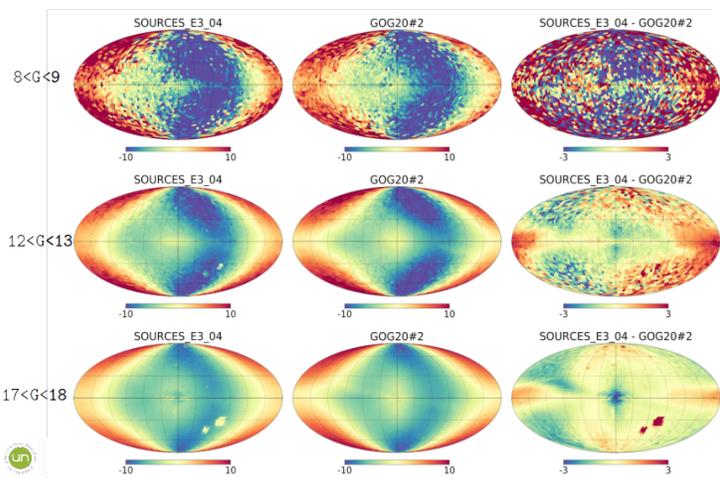
$$\min_{s, n} \|f^{\text{obs}} - f^{\text{calc}}(s, n)\|_M,$$



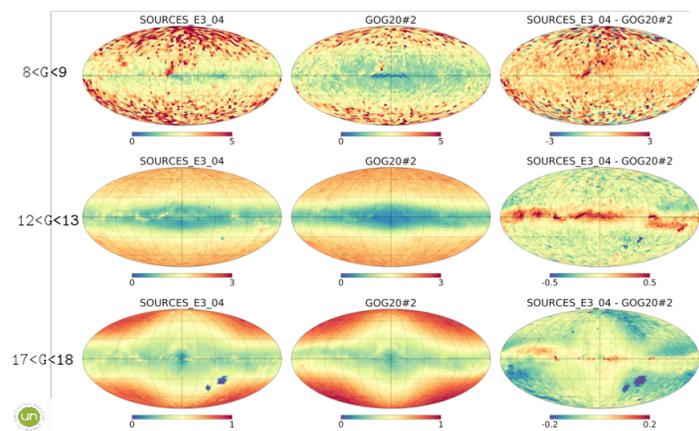
"unknowns" 5e8  
solution uses 10e11 individual obs (70TB)  
DPAC responsable de general el catálogo



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