



# Gaia

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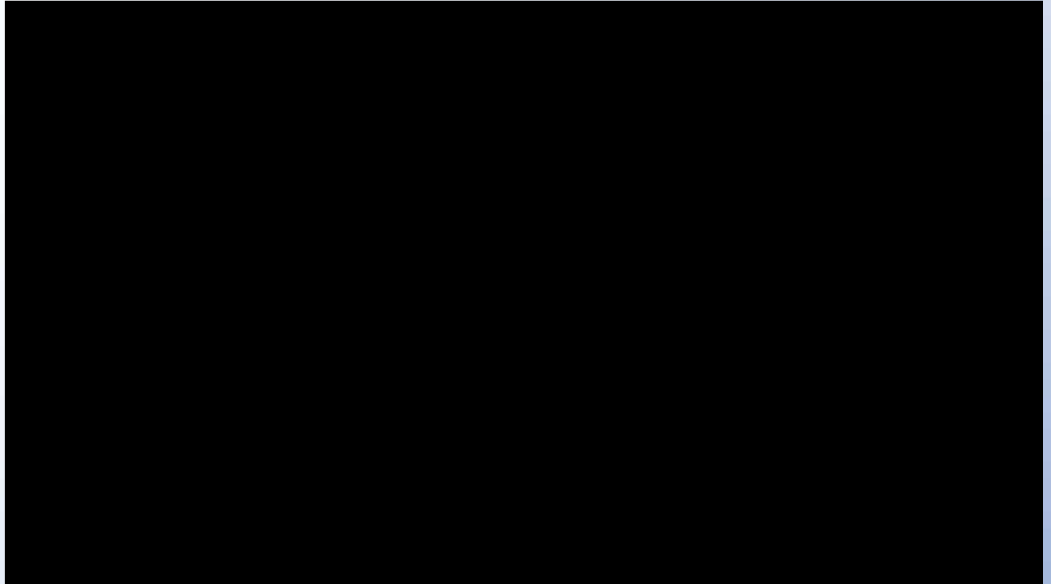
Science with 1 billion objects in three dimensions

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Gaia Project Scientist

# Gaia Summary

## Science topics

- Gaia: science with 1 billion objects in three dimensions
- Structure and dynamics of the Galaxy
- ESA cornerstone mission building on the Hipparcos heritage
- The story of the formation history of the Galaxy
- Spectroscopy
- Stellar astrophysics
- Satellite including the payload, by industry, management and operations
- Binaries and multiple stars
- by ESA and data processing by scientists (DPAC)
- Brown dwarfs and planetary systems
- Launched 19 December 2013 with Soyuz from Kourou
- Solar system
- Commissioning formally completed 18 July 2014
- Galaxies, Quasars and the Reference Frame
- 5 years of operations in L2
- Fundamental physics: General relativity
- First intermediate data release summer 2016, but Science Alerts started

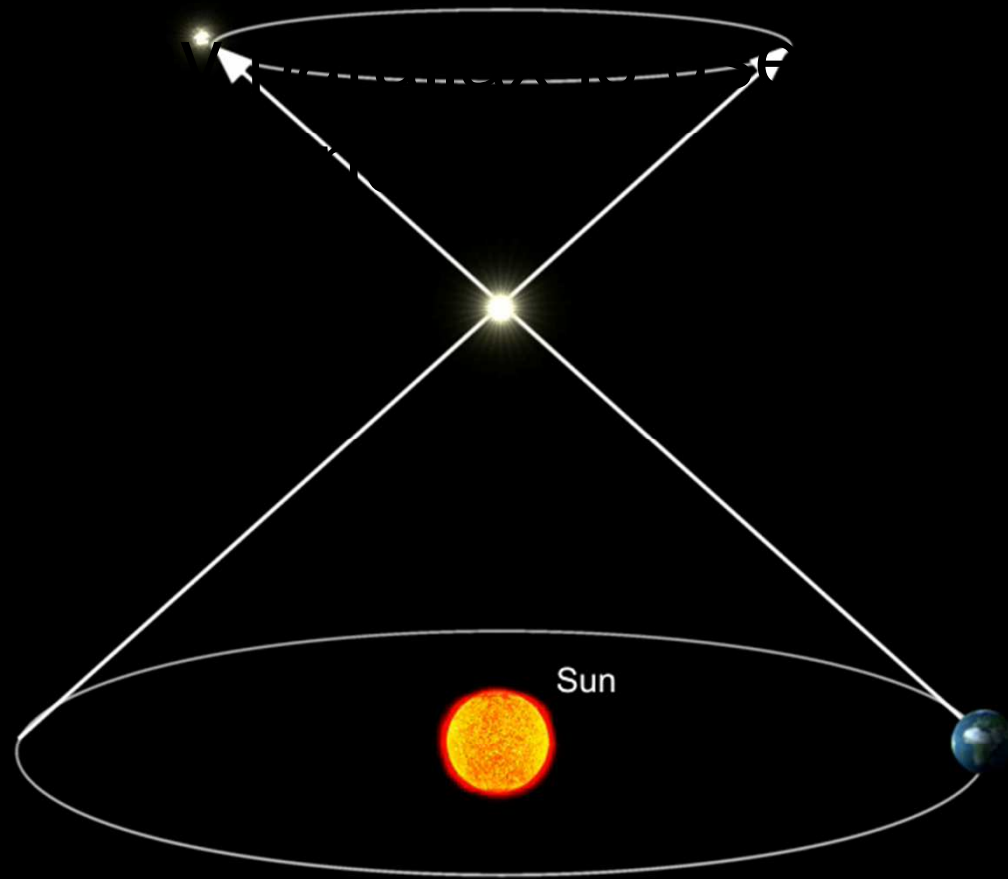


[cosmos.esa.int/gaia](https://cosmos.esa.int/gaia)



# Parallax

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# The first relative parallax

ASTRONOMISCHE NACHRICHTEN.

Nº. 365. 366.

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Bestimmung der Entfernung des 61<sup>sten</sup> Sterns des Schwans.  
Von Herrn Geheimen-Rath und Ritter *Bessel*.



Only in 1838, Friedrich Bessel managed to measure the relative parallax of 61 Cygni as  $\pi = 314 \pm 16$  milli-arcsec



# Closest Star

- Proxima Centauri
- 4.24 light years is a bit more than 40000000000000 km
- 1.30 pc i.e. parallax is  $1/1.30$  arcsec = 0.769 arcsec
- This parallax corresponds one part of 2340 of the full Moon
- Our Galactic Centre is at about 8500 pc away



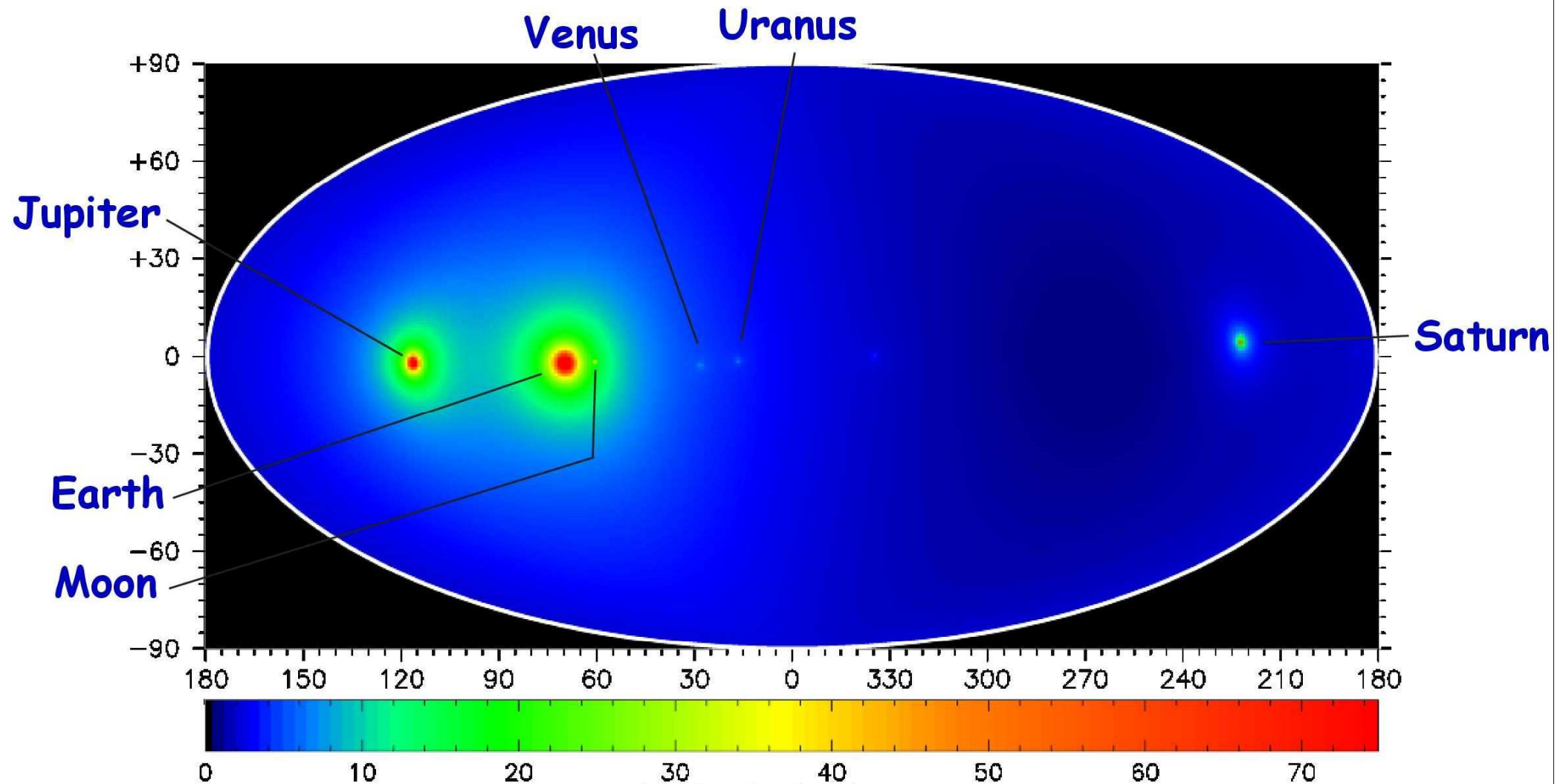
# Gaia accuracy

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- 7 microarcsec
- 257 millionth part of the full Moon



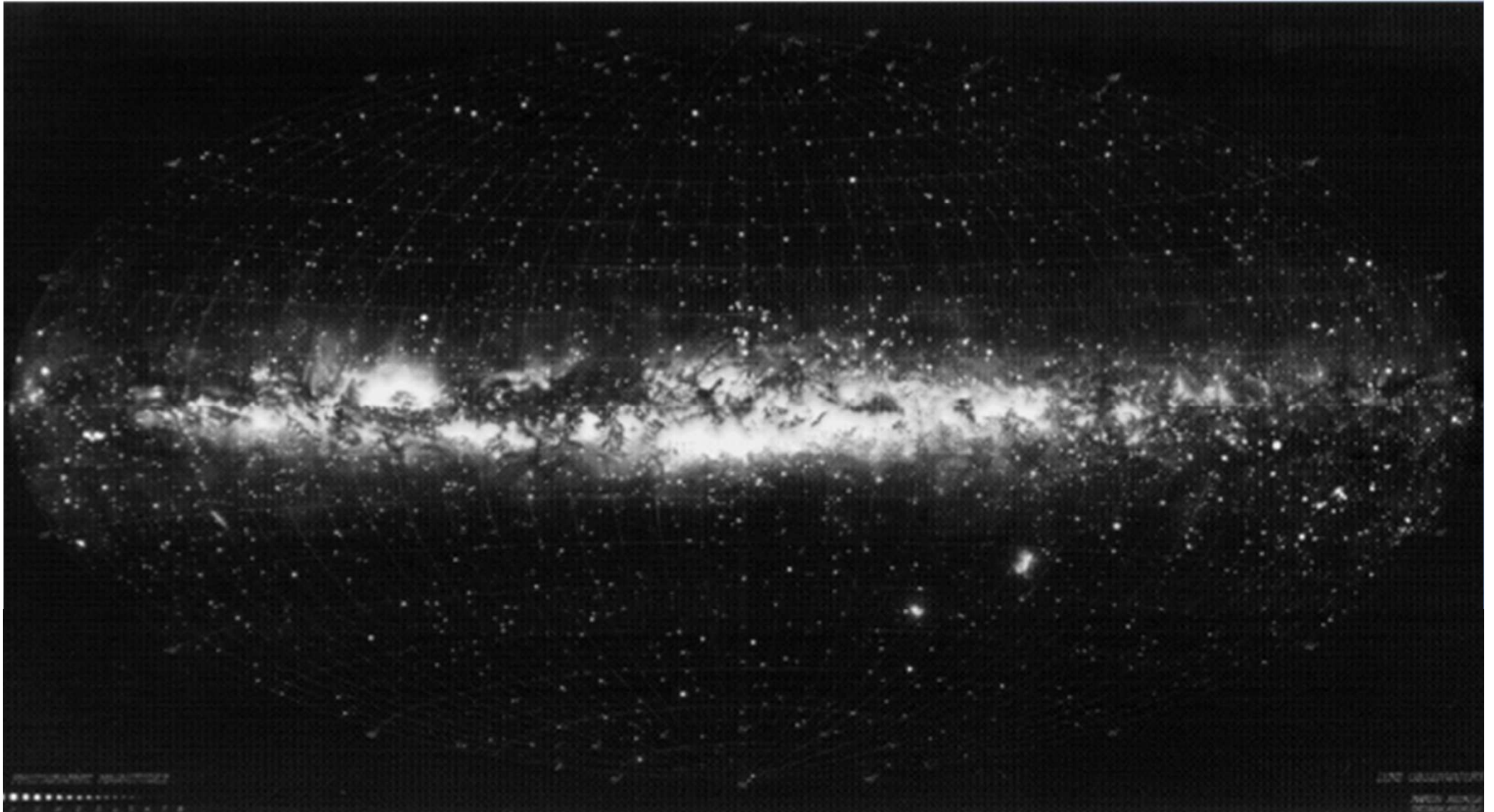
# Gaia: light bending in the solar system



Light bending in micro-arcsec, after subtraction of the much larger effect by the Sun

# Milky Way

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*NGC 6522 & NGC 6528 / 2 June 2008 / Don J. McCrady & Adam Block*



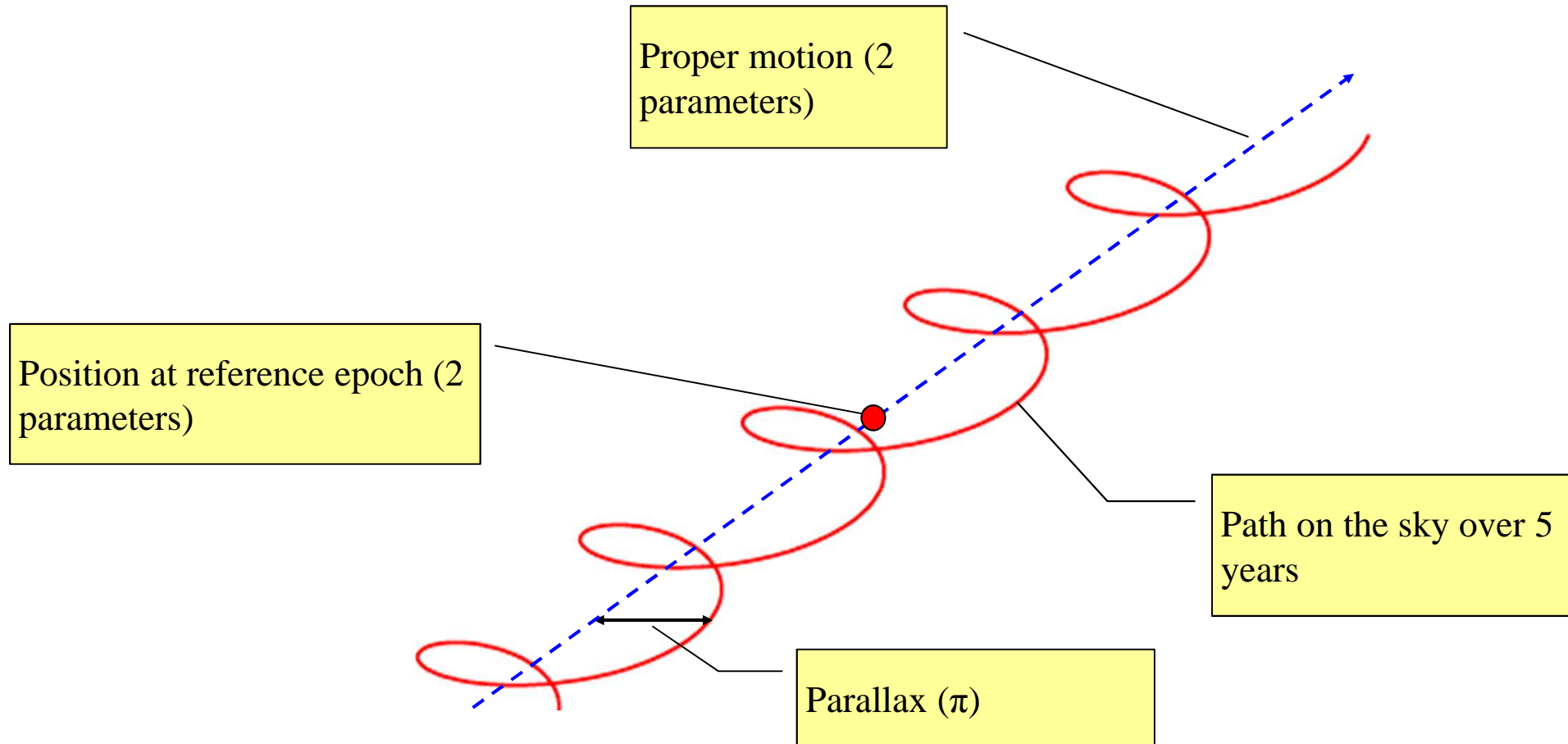
# Proper Motion

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- Stars are also moving
- By measuring positions over a long time interval the speed can be deduced



# Five-parameter source model

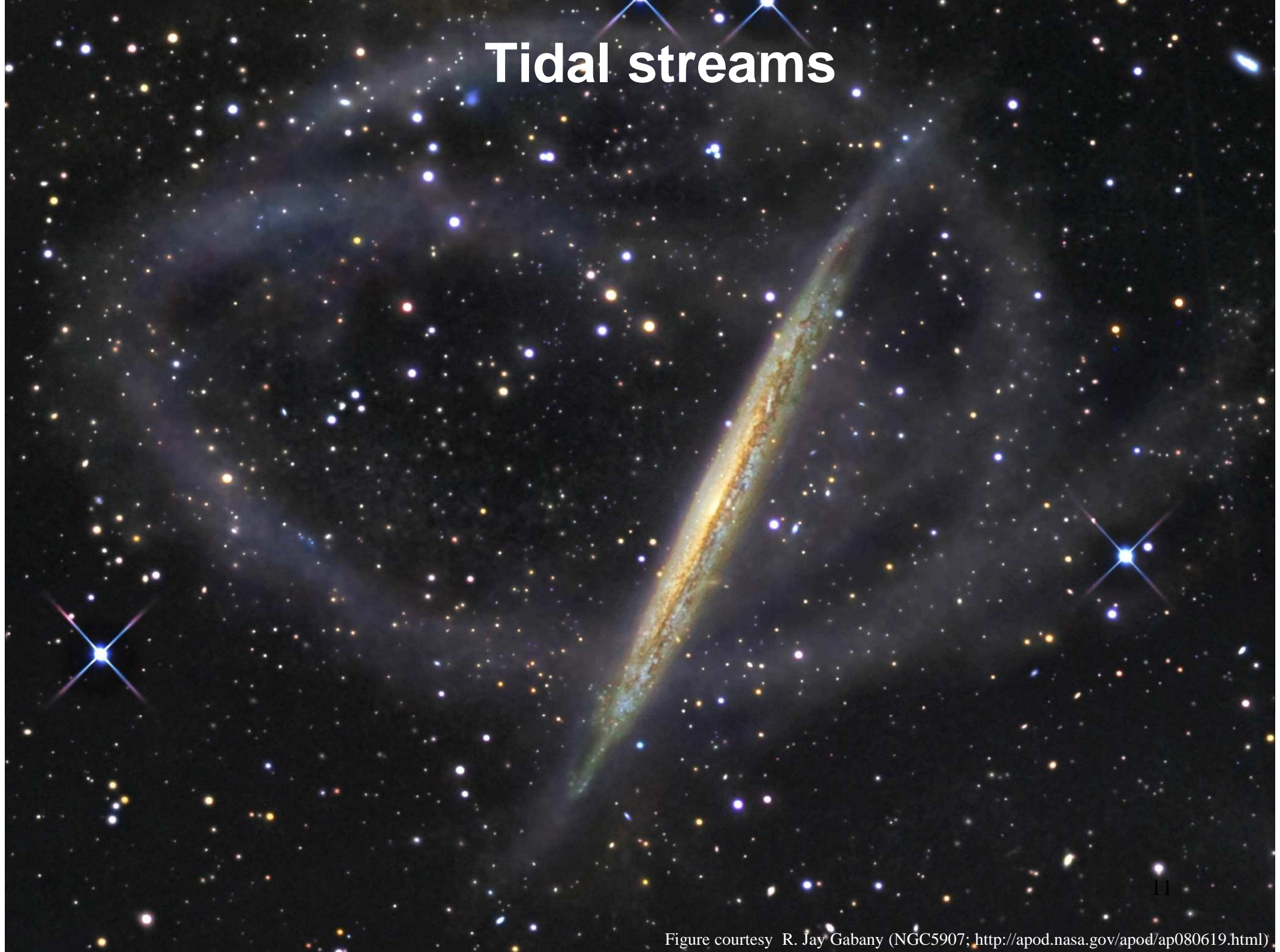


Gaia in a nutshell: monitor this path for 1,000 million stars during 5 years – resulting in 70 observations – and fit, for each star, a five-parameter model to retrieve reference position, proper motion, and parallax



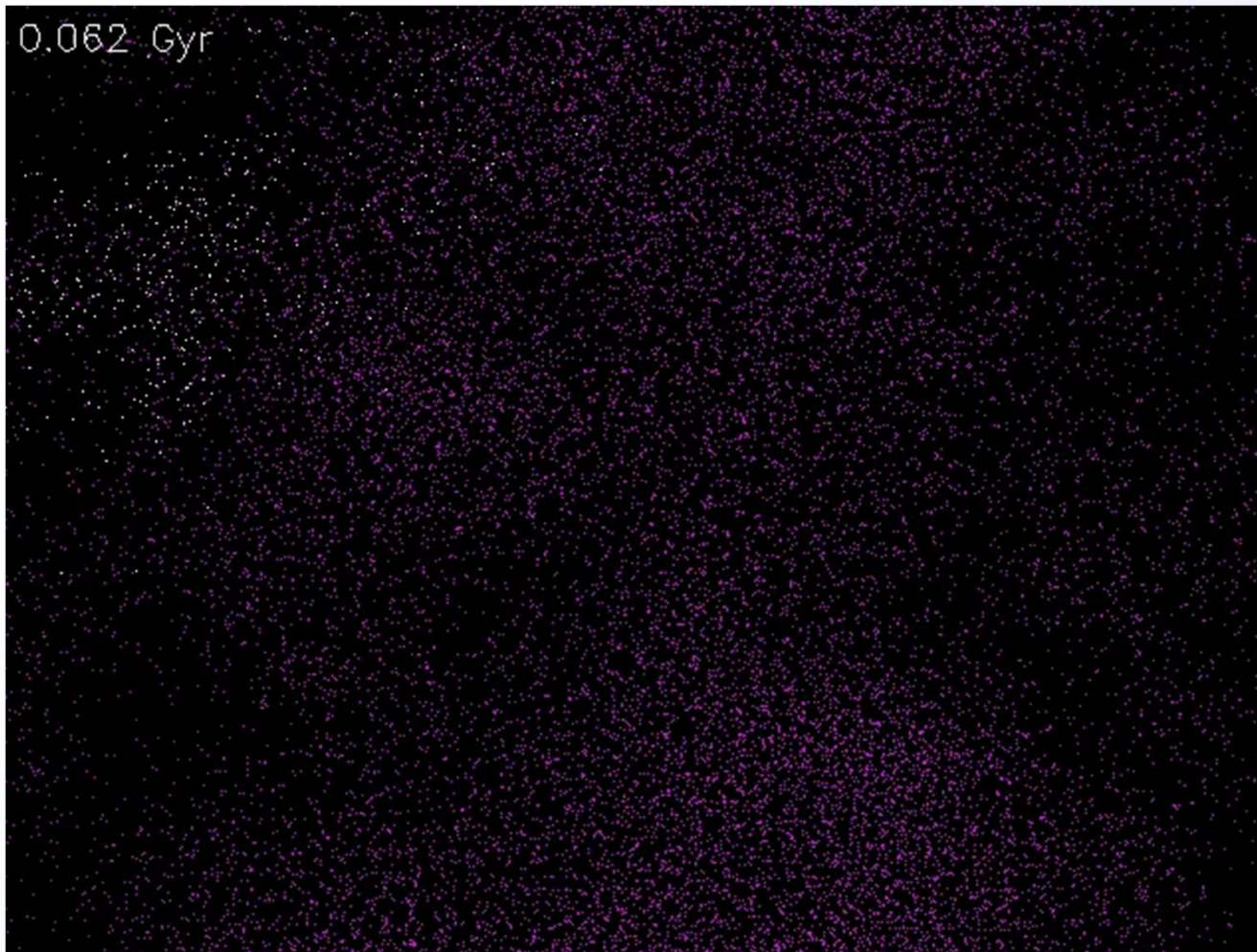


# Tidal streams









Courtesy of Amina Helmi





# Halo accretion mess

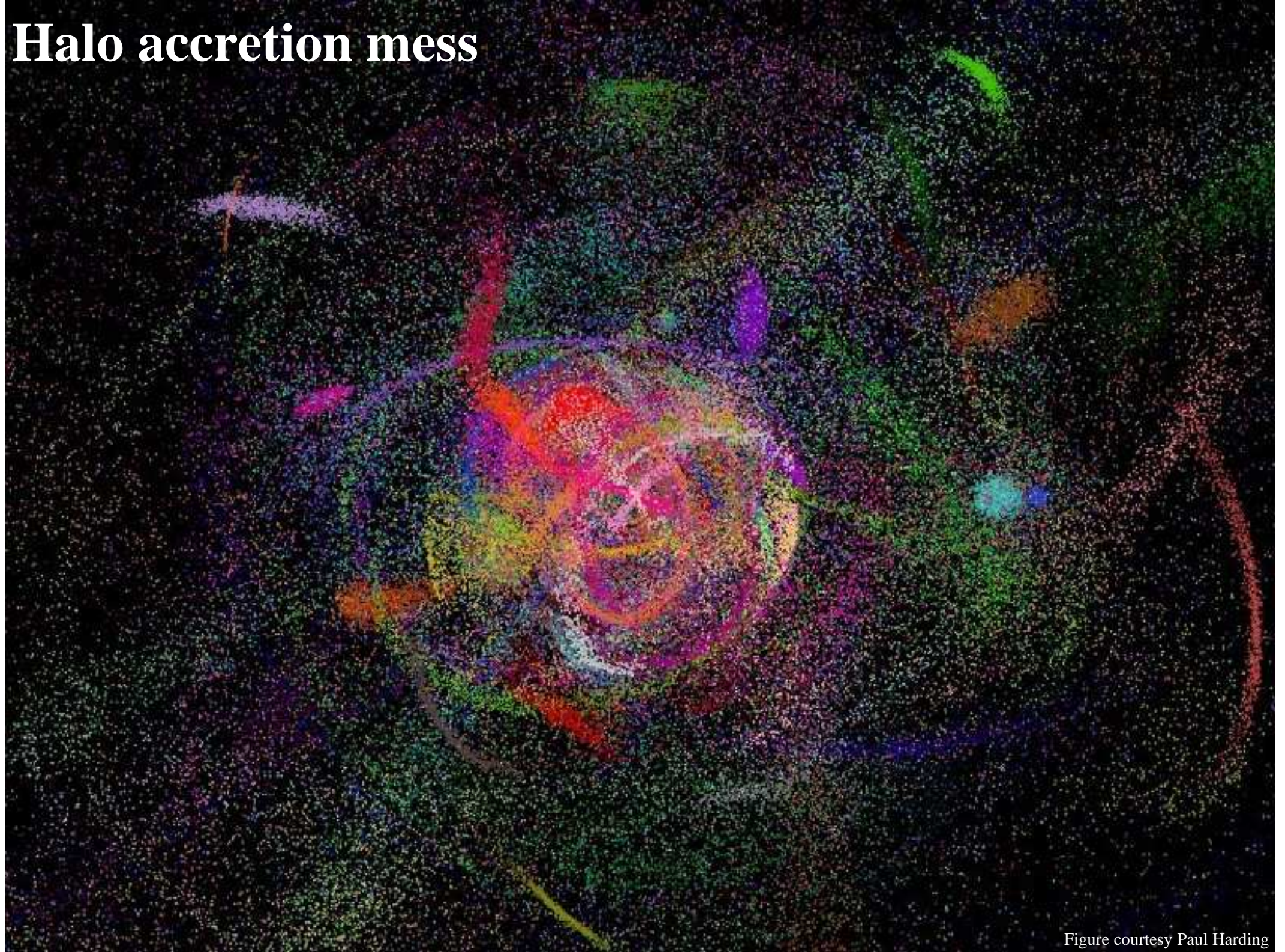


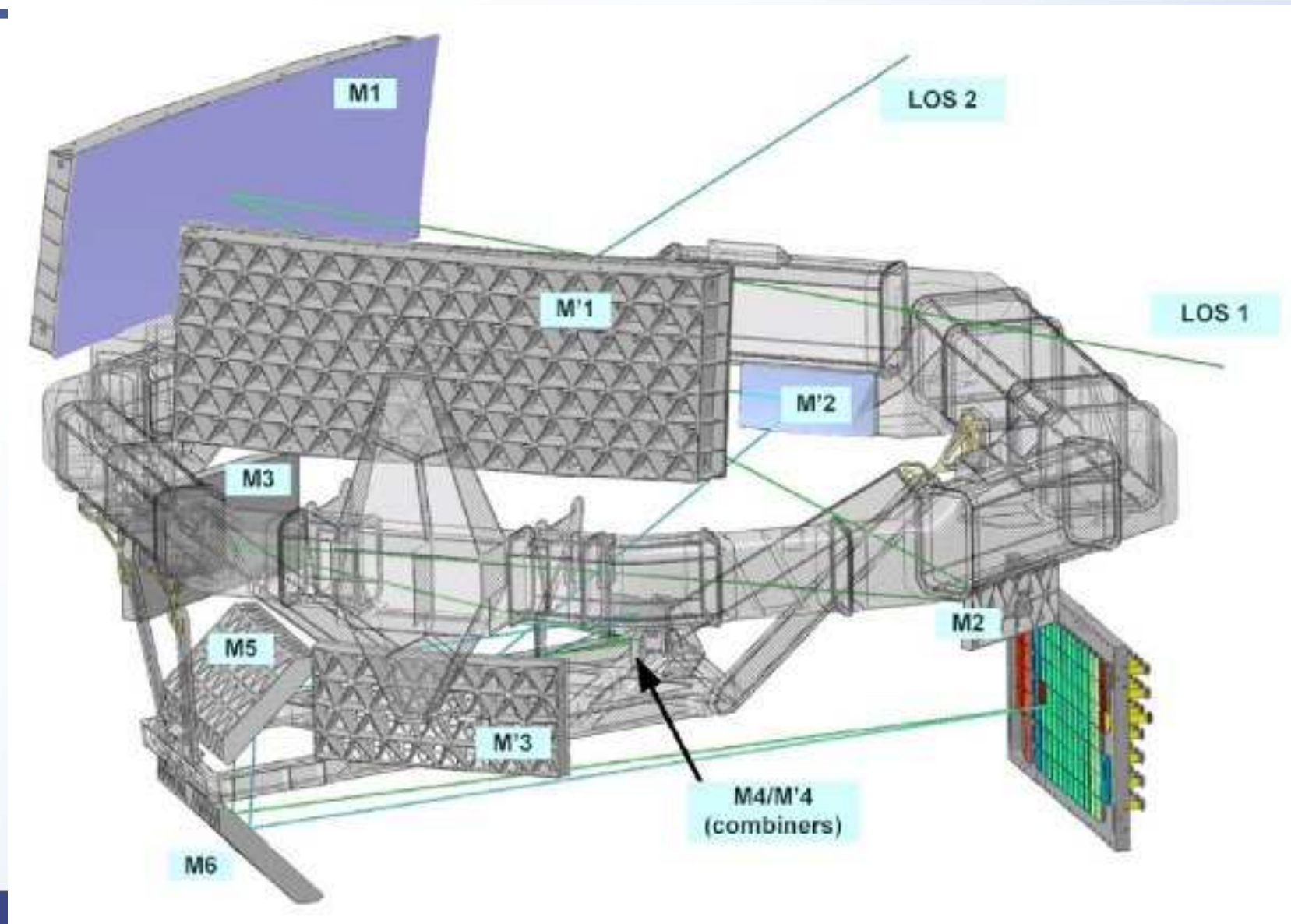
Figure courtesy Paul Harding



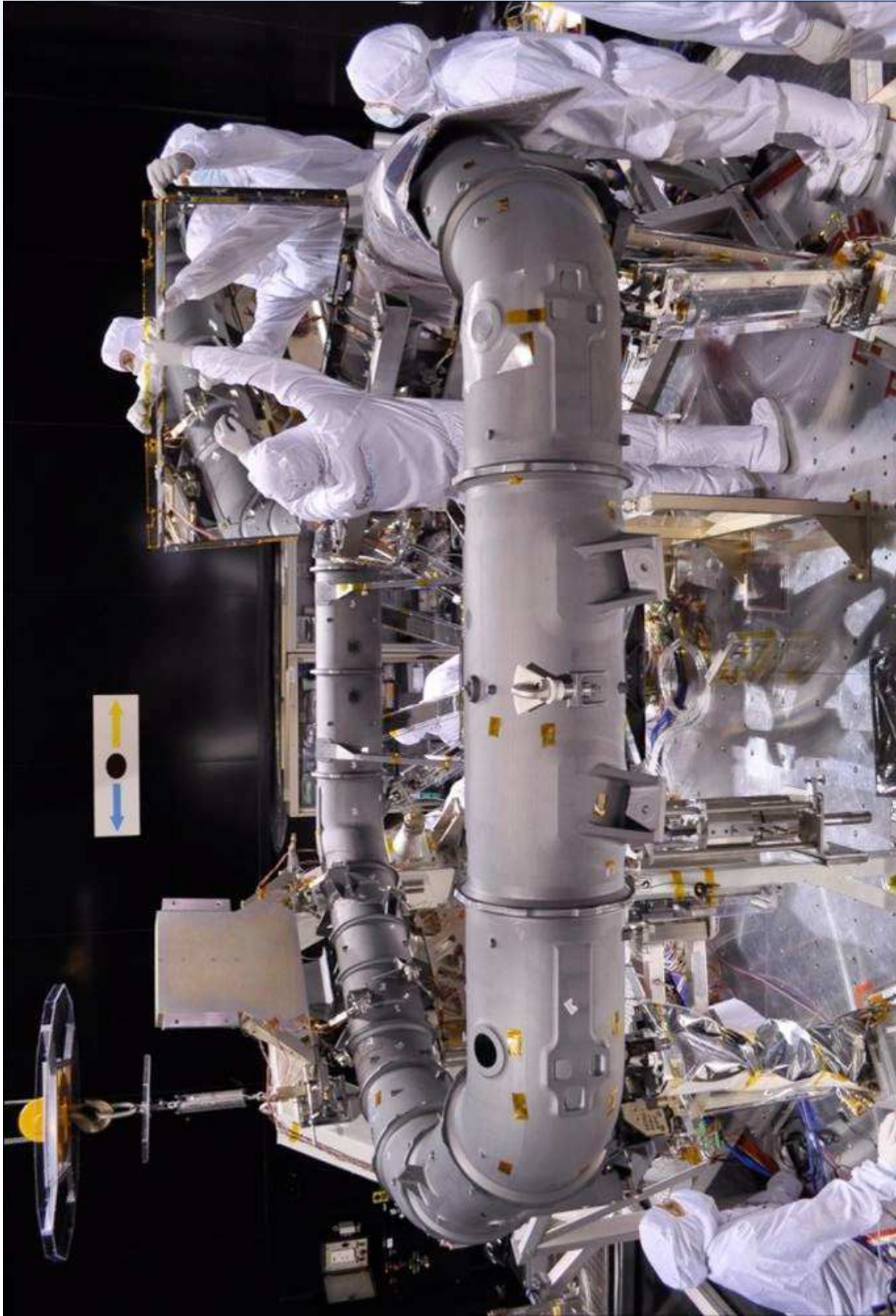


Composite photo by Tom Buckley-Houston; Photo by Stephen Rahn; Andromeda Photo by NASA/JPL-Caltech

# Payload and Telescope



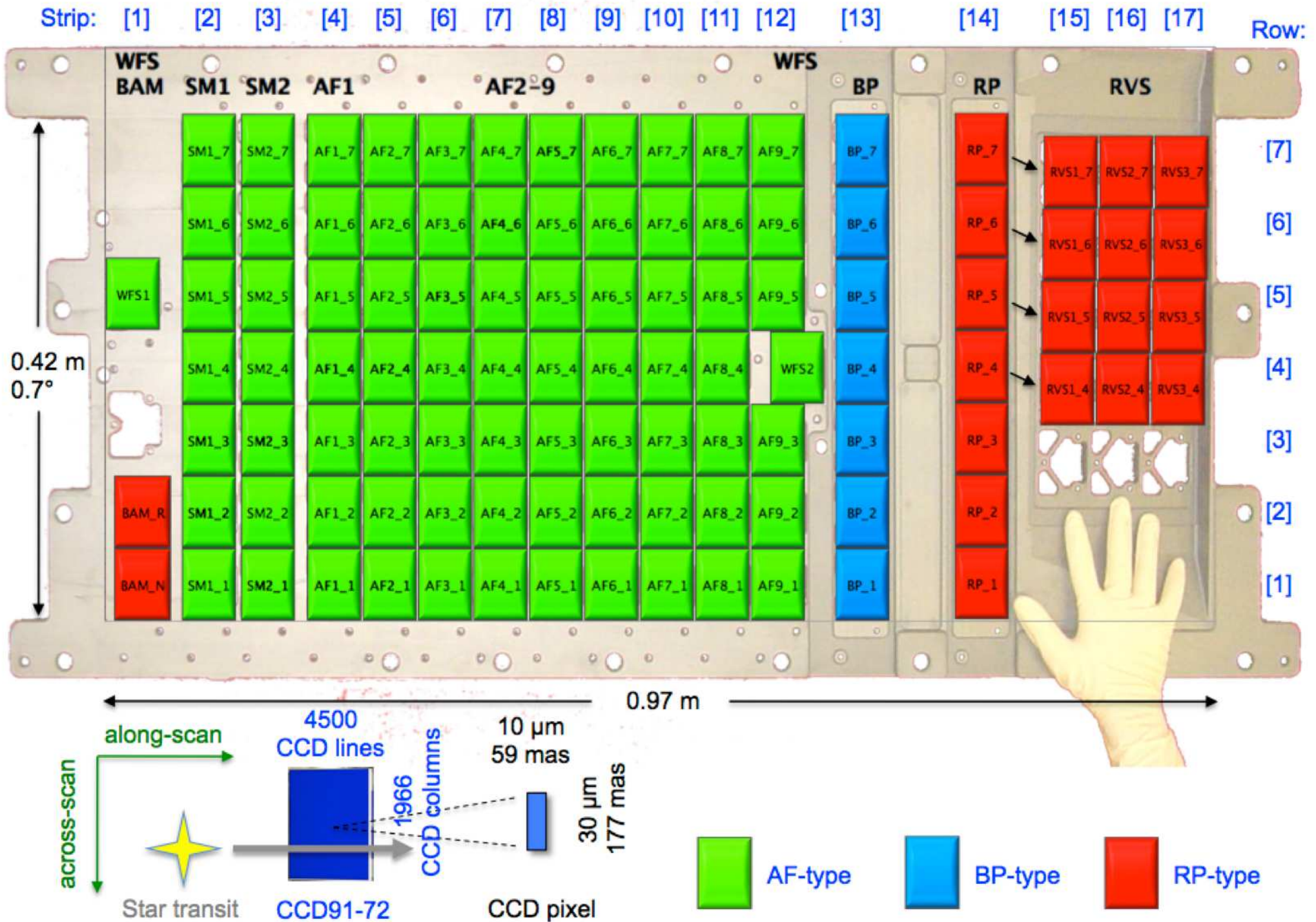




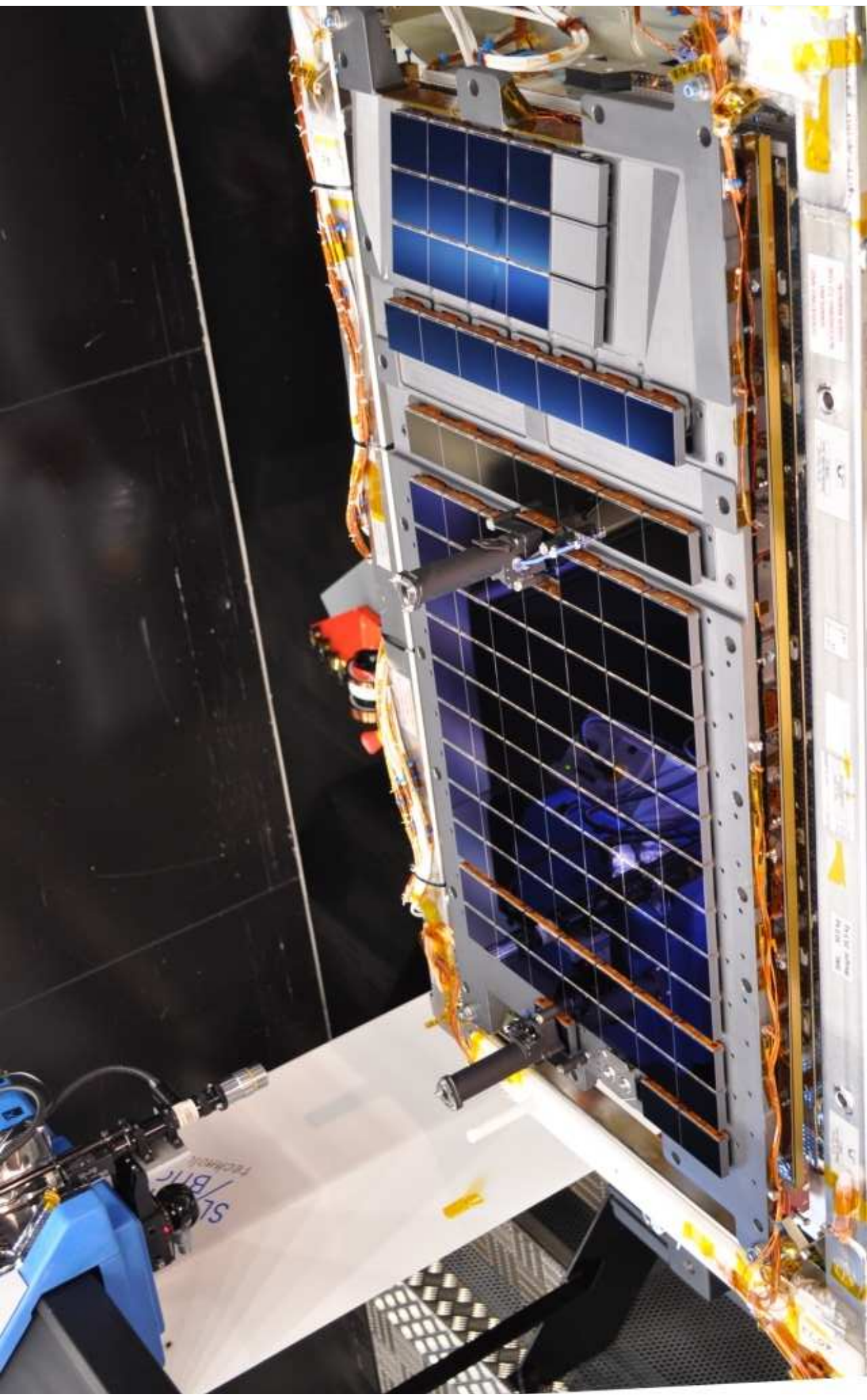


# Focal Plane

Figure courtesy Ralf Kohley













# Gaia integration on Fregat





# Gaia inside the fairing









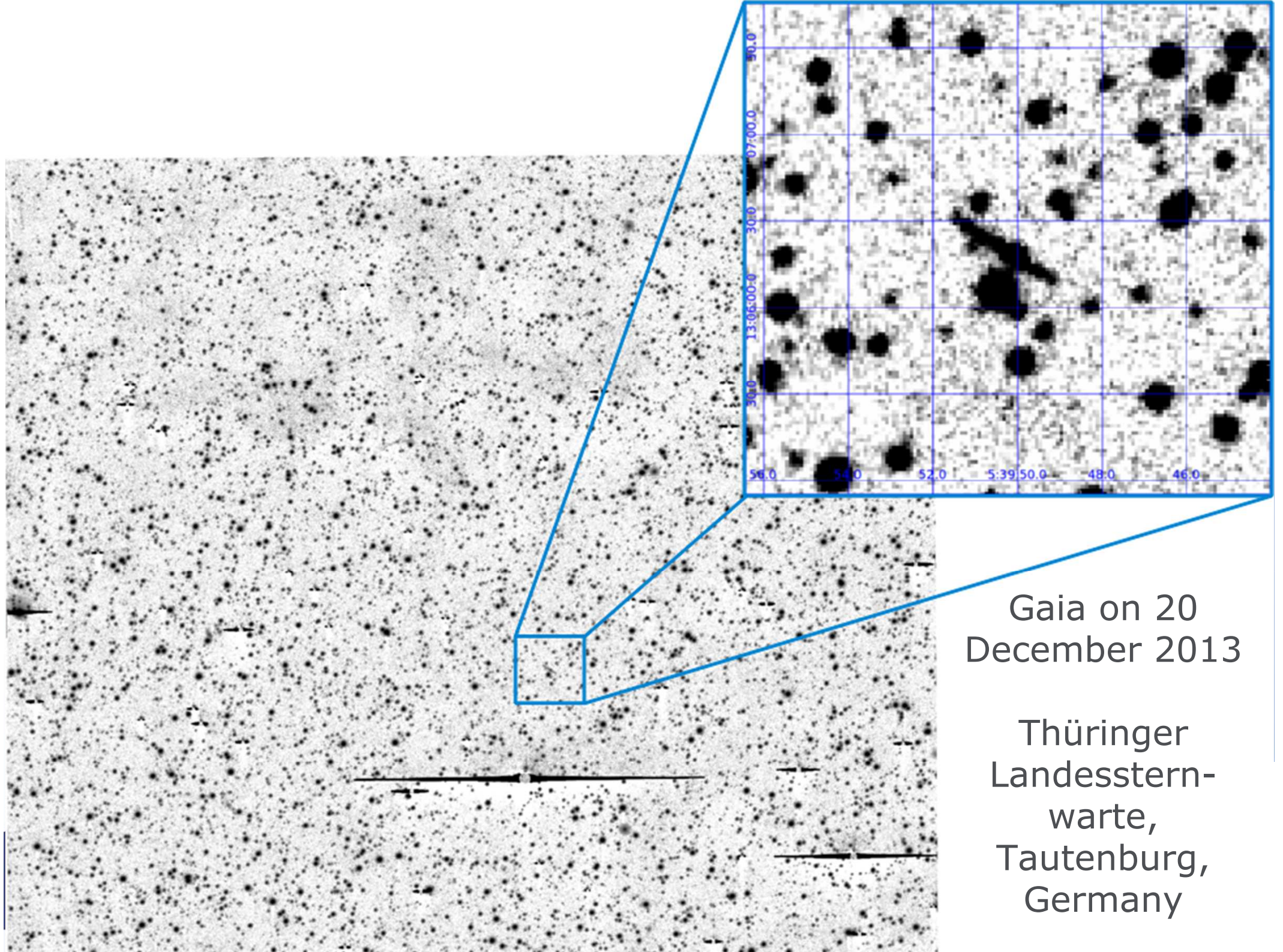
**VS06 • gaia** - December, 19<sup>th</sup> 2013











Gaia on 20  
December 2013

Thüringer  
Landesstern-  
warte,  
Tautenburg,  
Germany

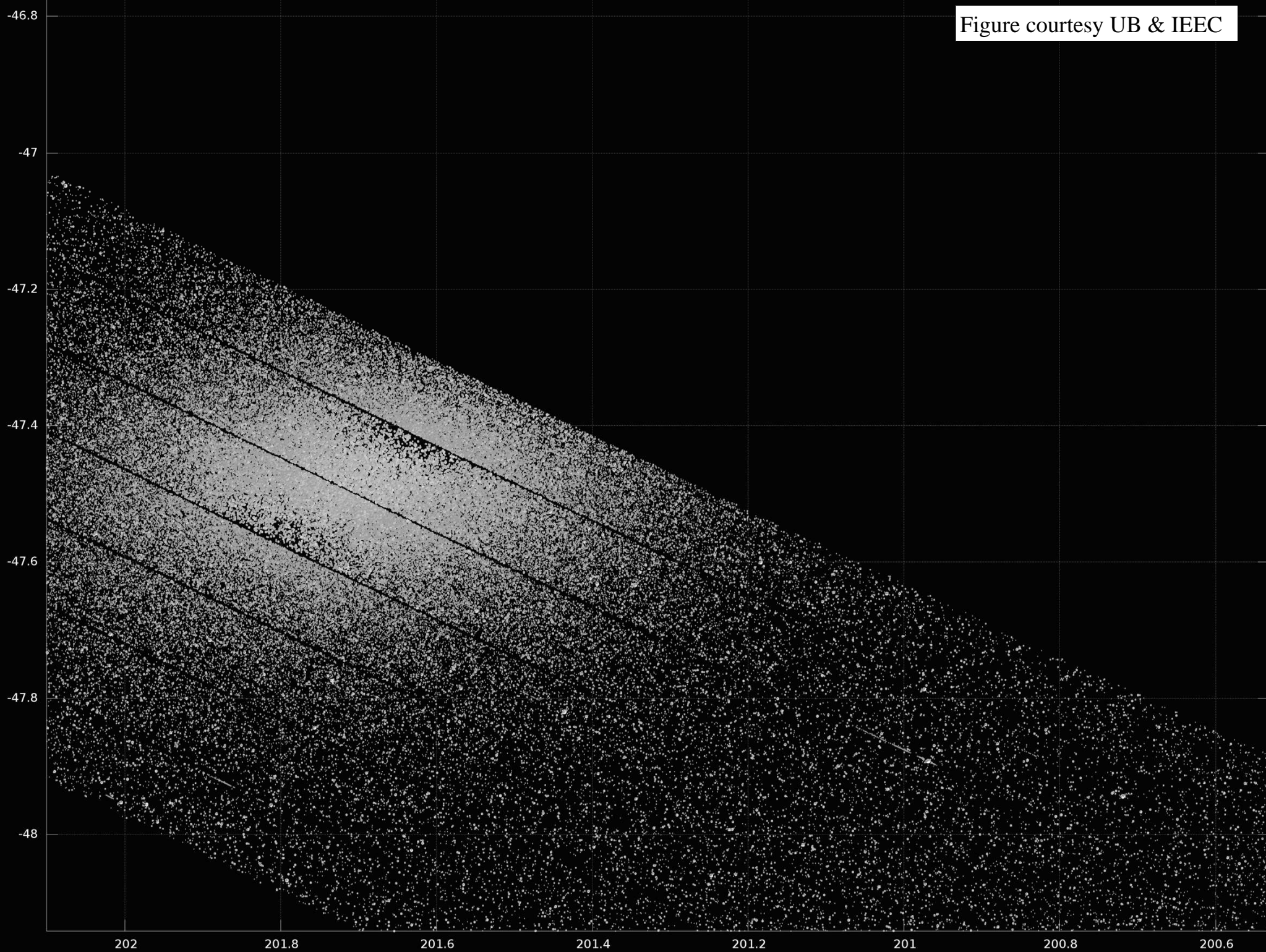






Delta [deg] - range: 1.57 deg

Alpha [deg] - range: 1.57 deg



Omega Cen 2014: FoV2, VPU2: 20140929

