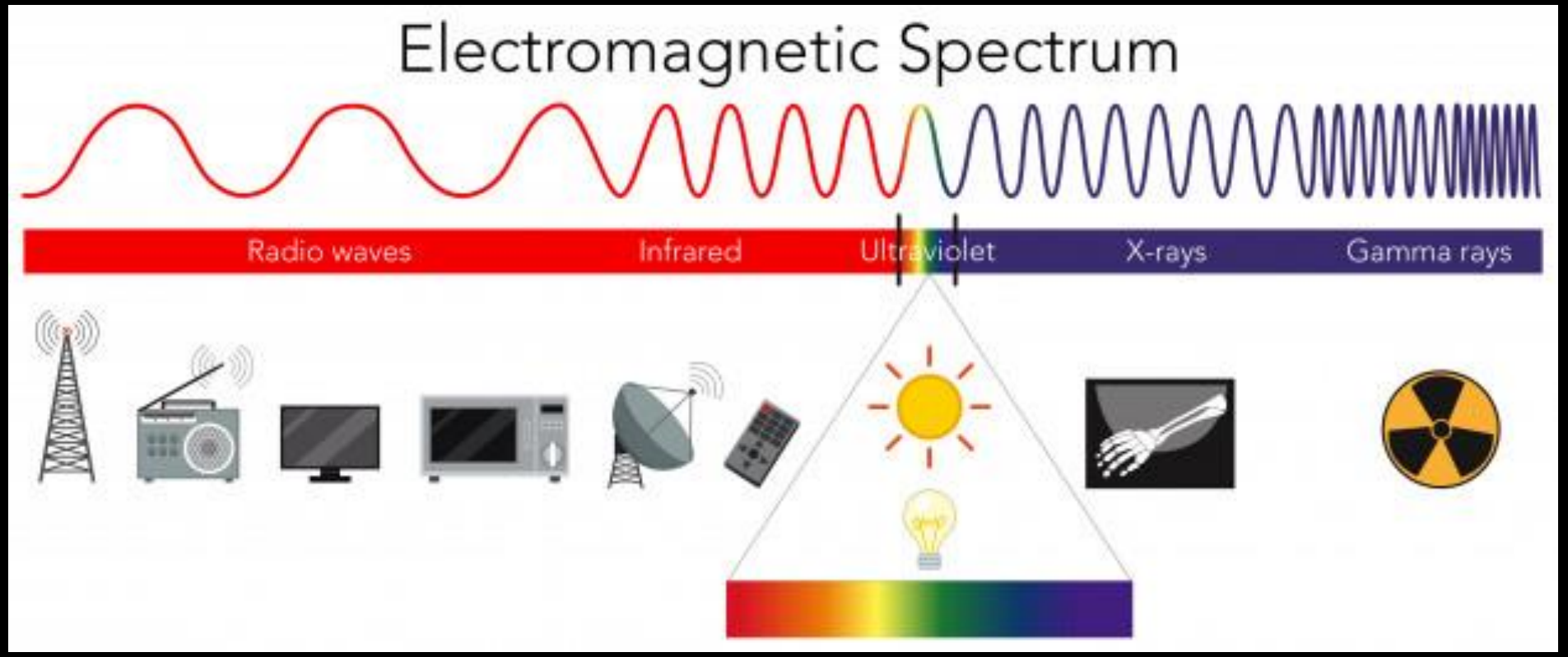
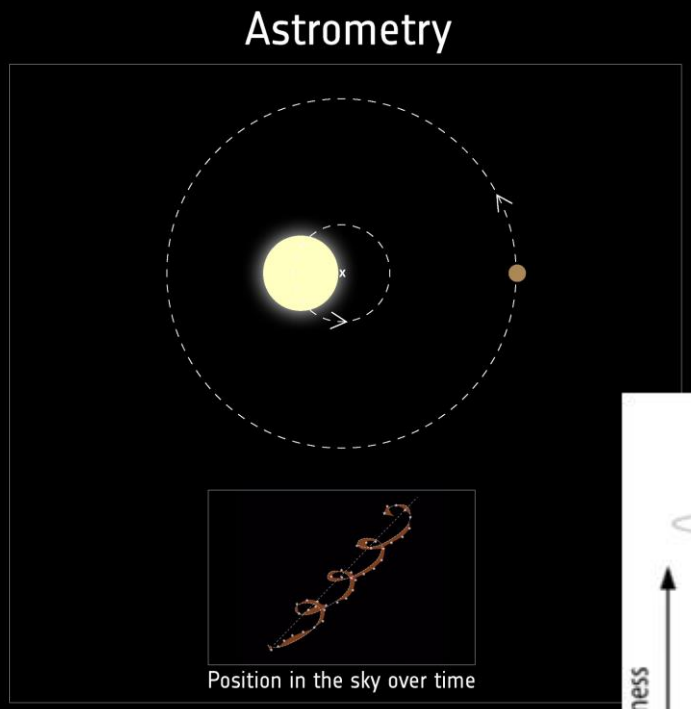
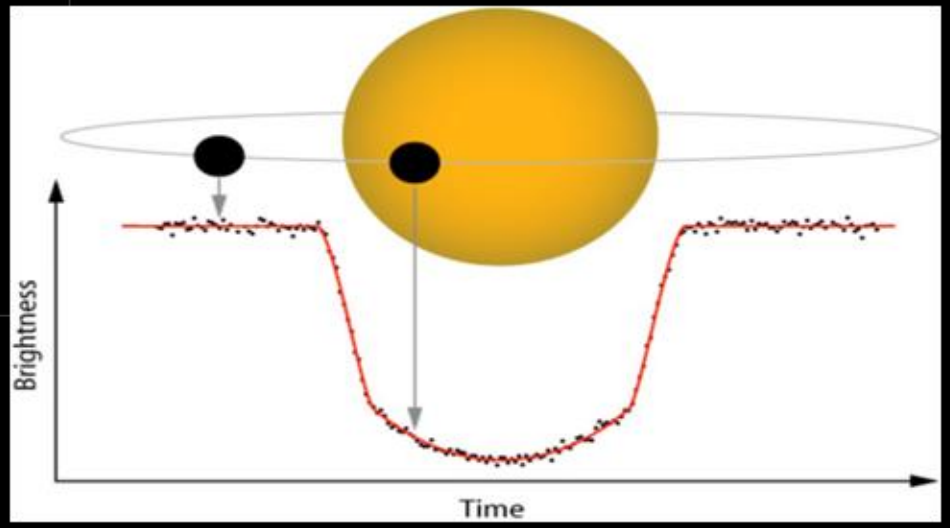

Electromagnetic Spectrum
Radio waves
Infrared
Ultraviolet
X-rays
Gamma rays

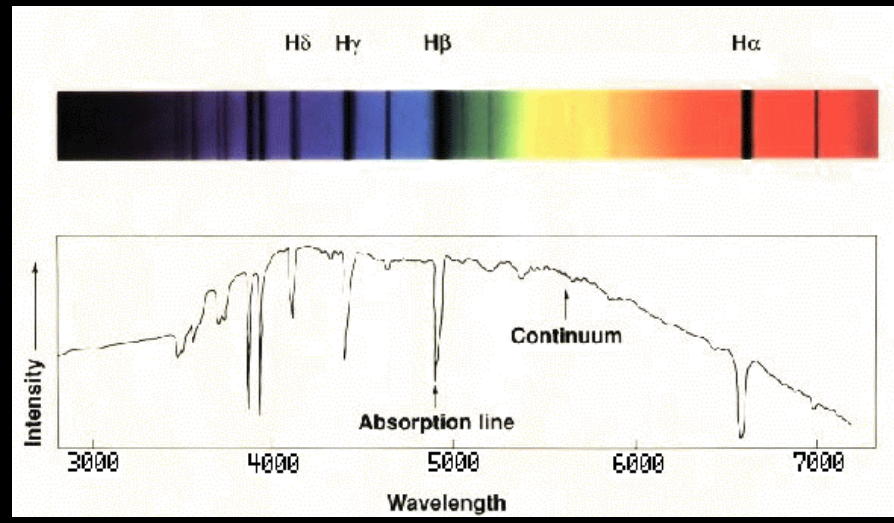
Bagaimana astronom melakukan pengukuran?

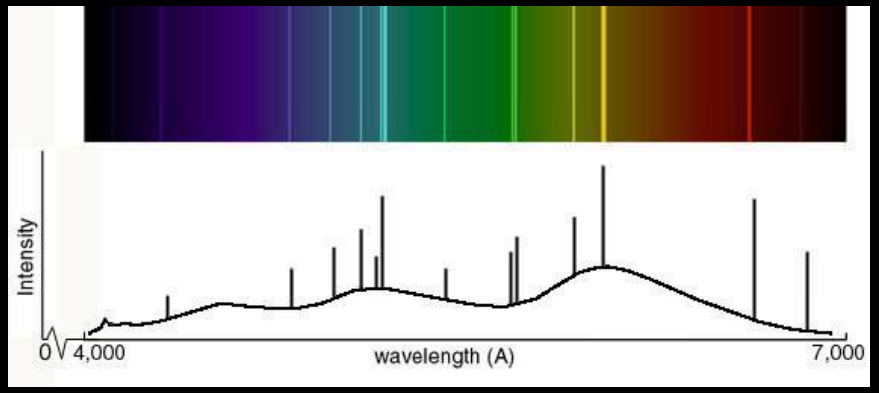


Astrometri

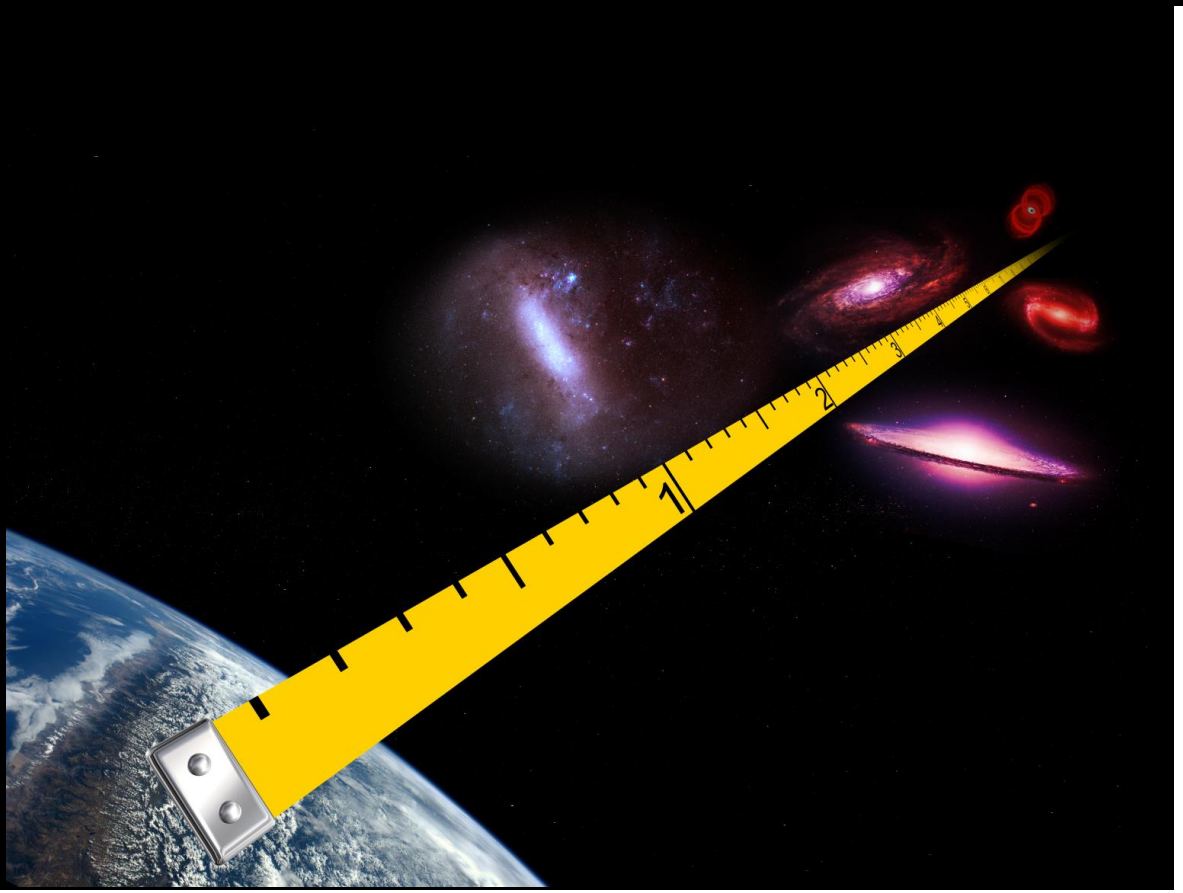


Fotometri

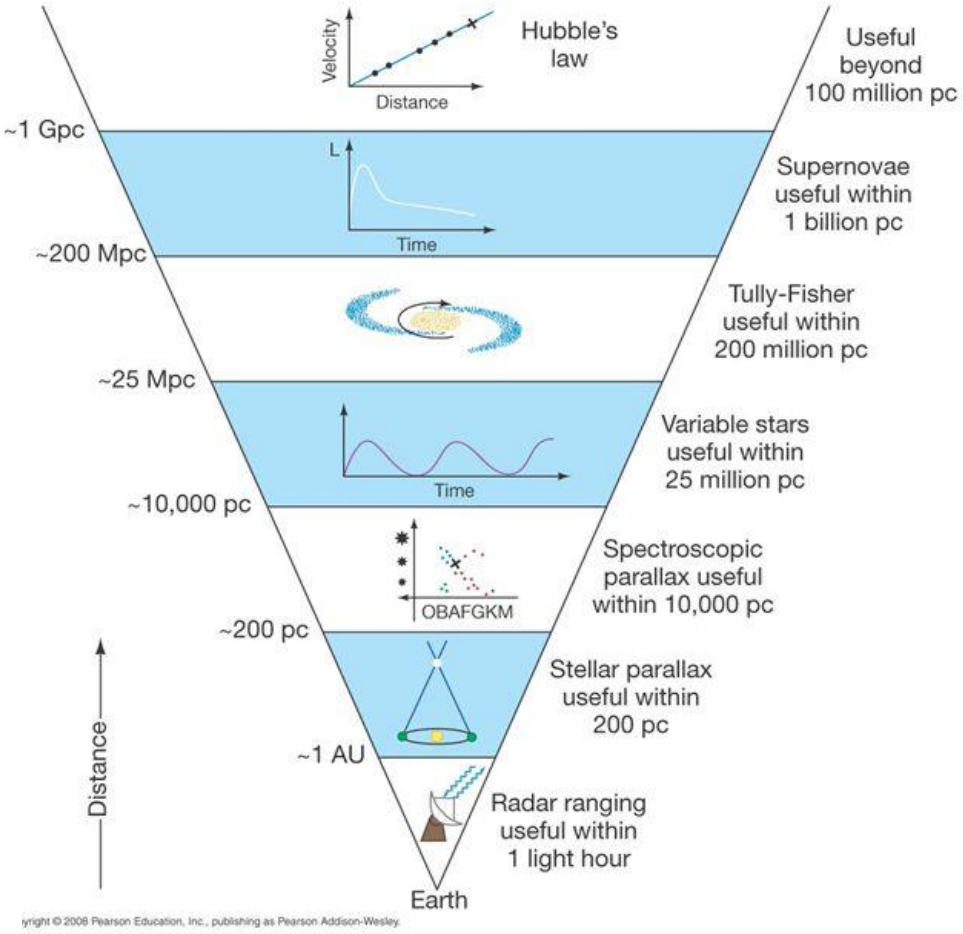


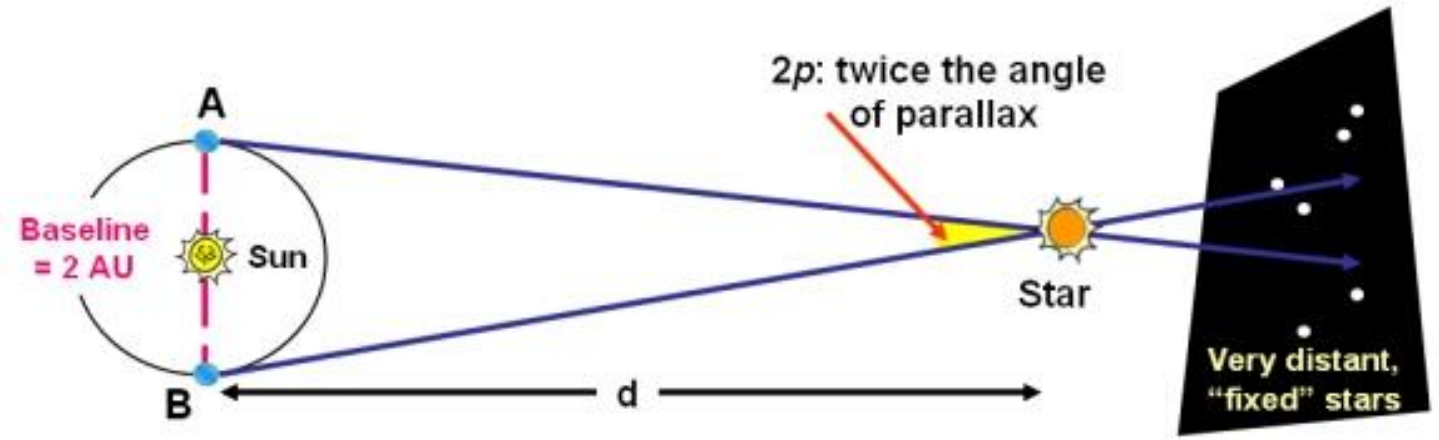


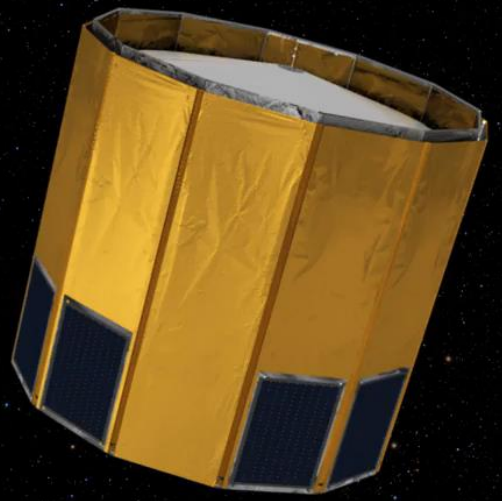
Spektroskopi



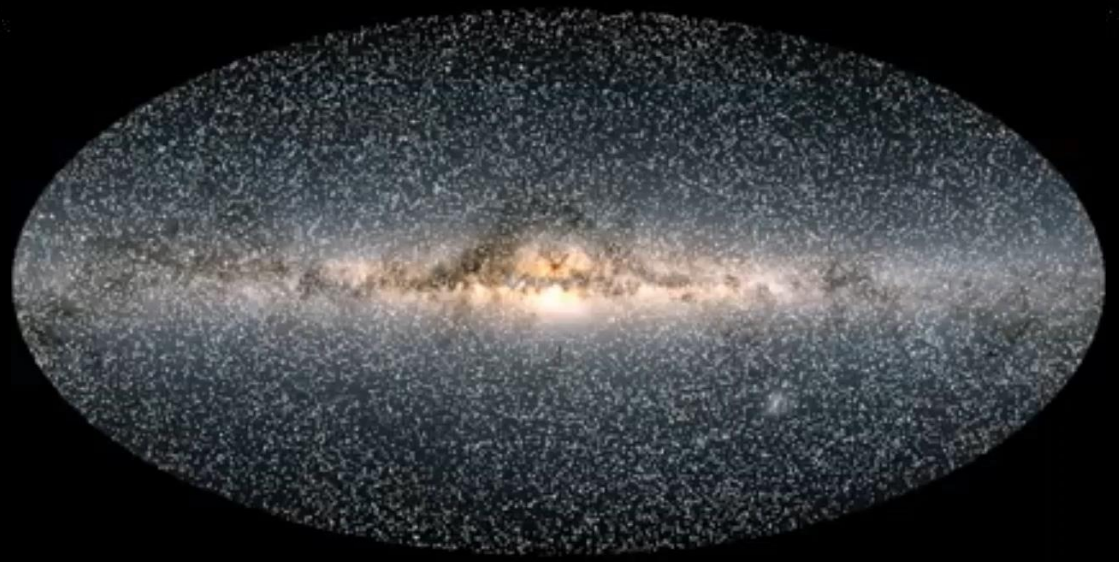
The "Cosmic Distance Ladder"







ESA / ATG medialab



GAIA'S GOLD

Gaia has measured with high precision the positions, distances and motions of more than 1 billion stars in the Milky Way. It covers about one-quarter of the disc of our Galaxy; its predecessor mission, Hipparcos, mapped about 100,000 stars in a much smaller region around our Sun.

Gaia will eventually measure proper motions accurate up to 1 kilometre per second for stars up to 20,000 parsecs away

Gaia's limit for measuring distances with an accuracy of 10% is 10,000 parsecs

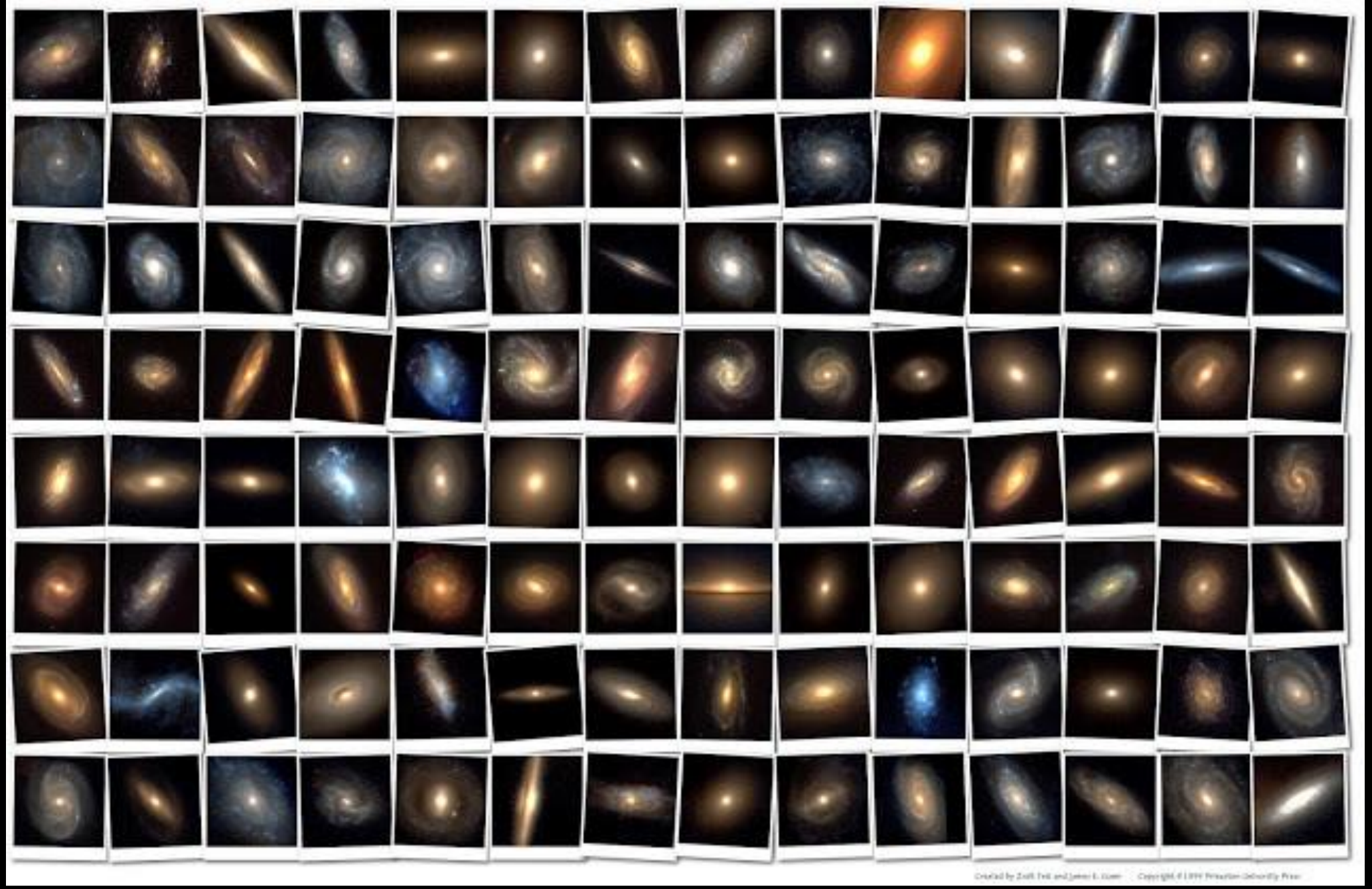
Galactic Centre

Sun

Hipparcos could measure stellar distances with an accuracy of 10% only up to 100 parsecs*

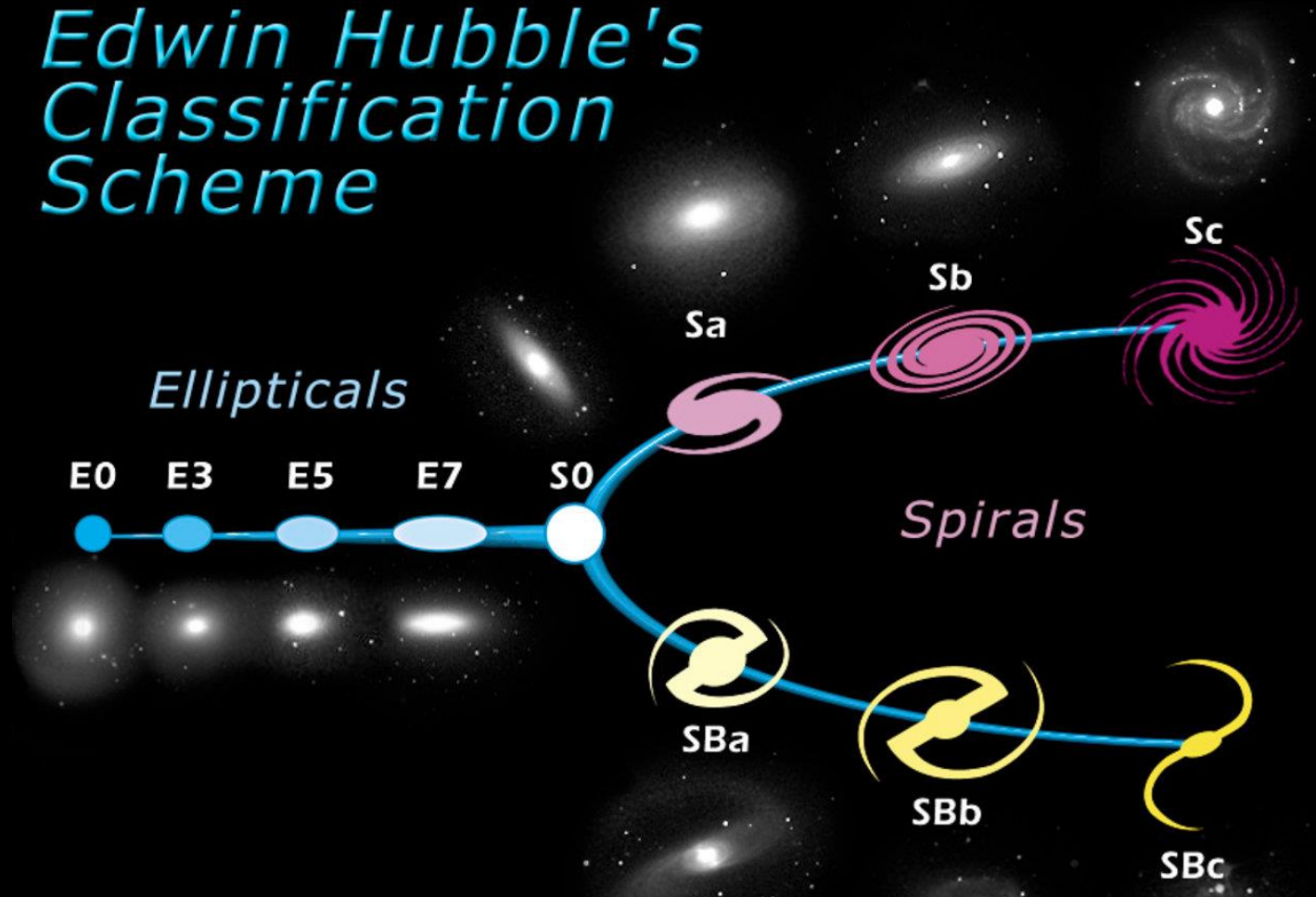
©nature

*1 parsec = 3.26 light years



Credit: Zsolt Frei, Institute of Physics, Eötvös University, Budapest

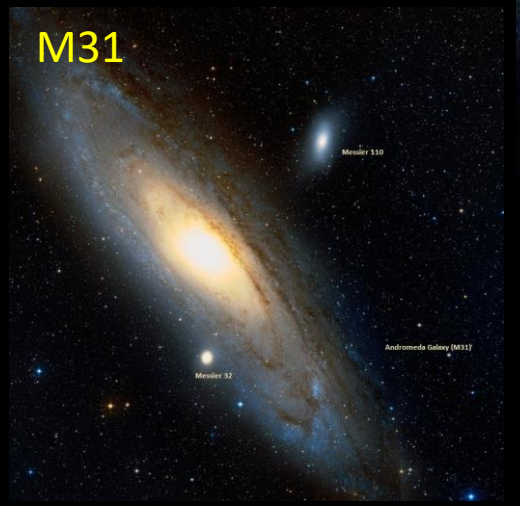
Edwin Hubble's Classification Scheme



NGC 4565

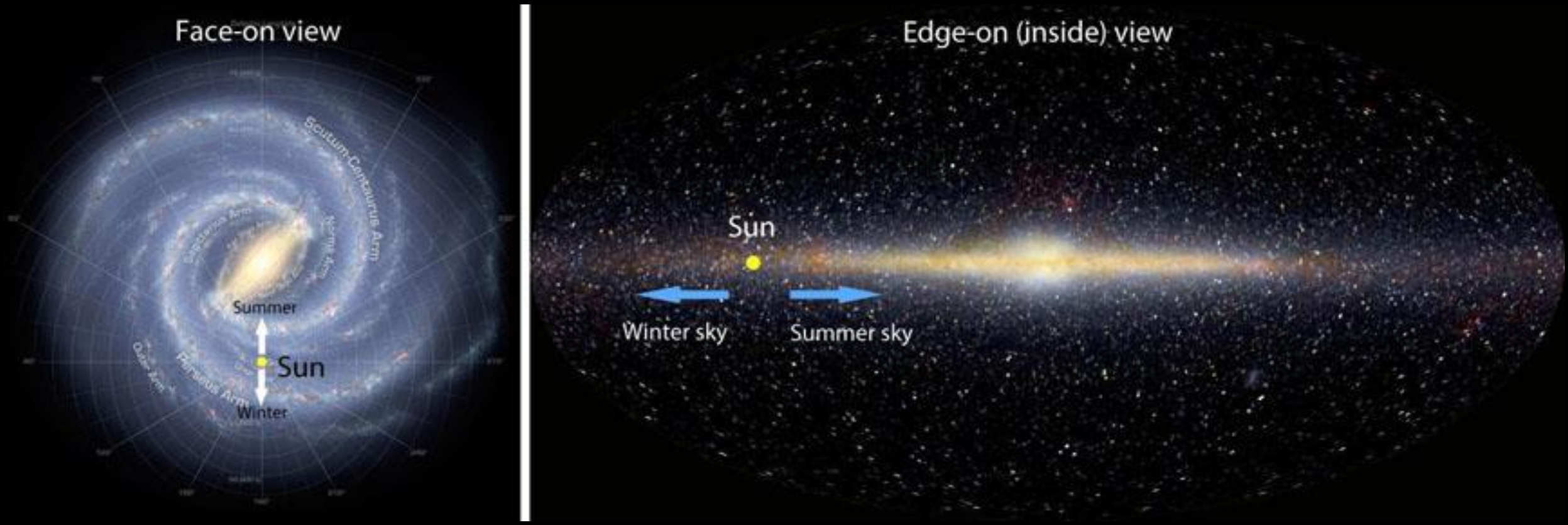
NGC 1232

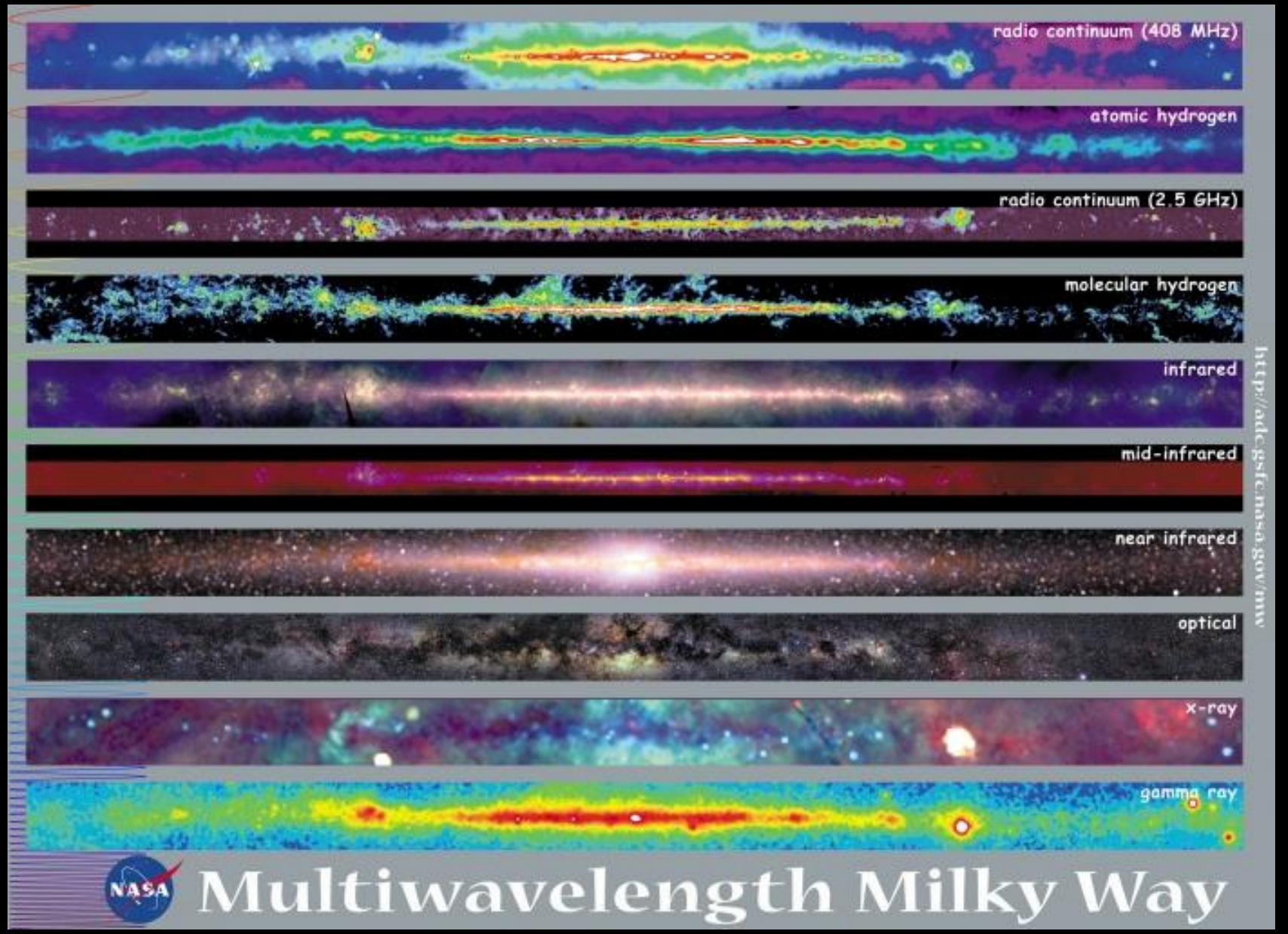
M31



https://esahubble.org/images/heic9902o/

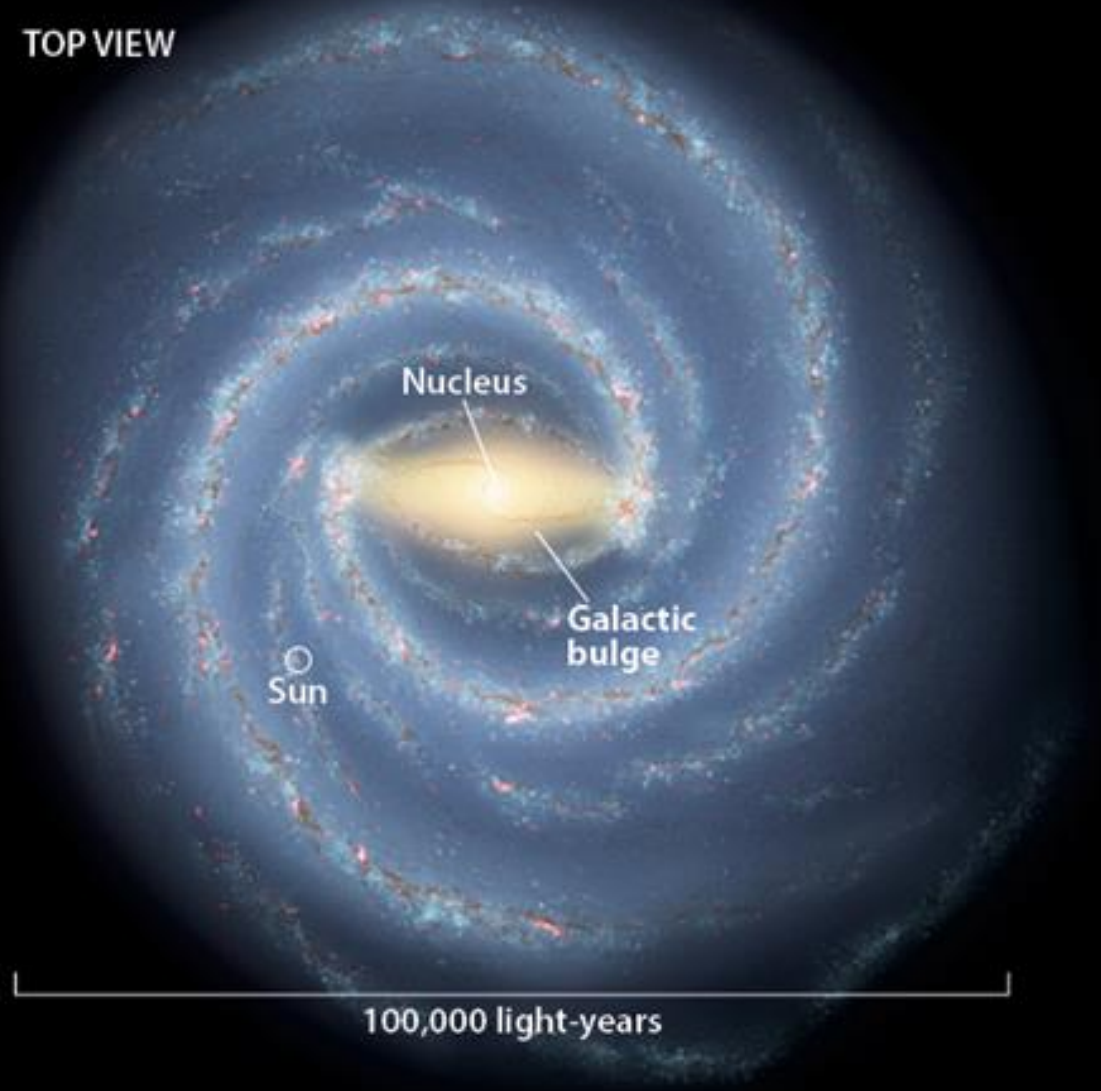
Galaksi kita: spiral berbatang SBbc

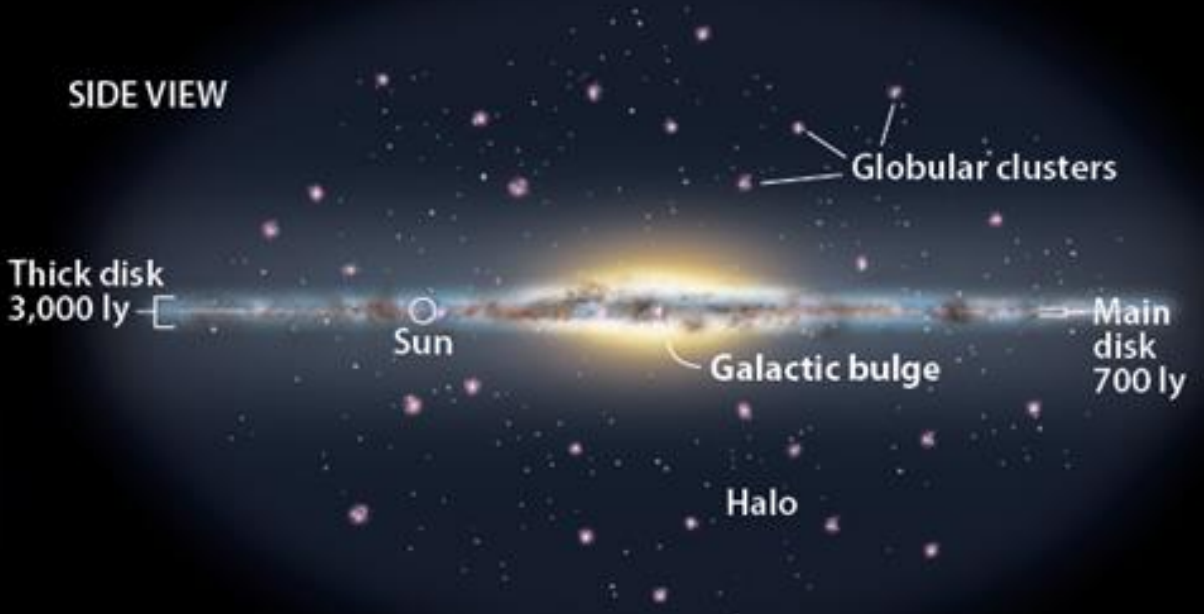




Credit: NASA Goddard Space Flight Center.

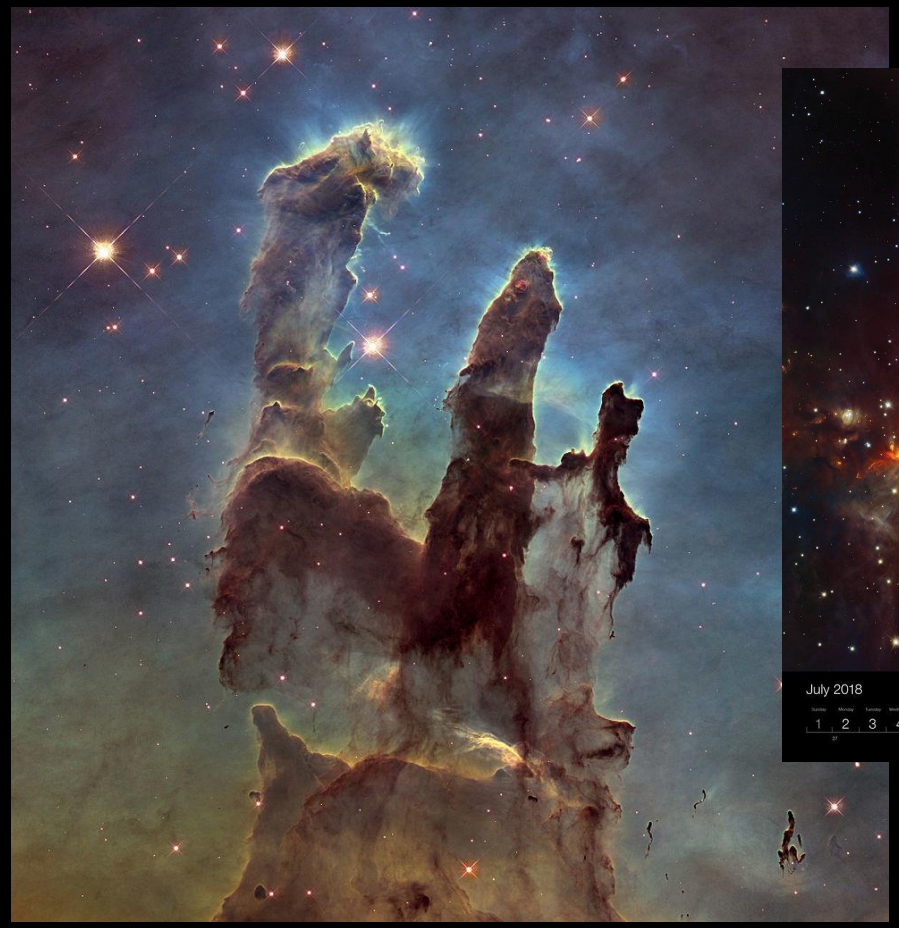
Anatomy of the Milky Way





Mapping the galaxy is hard. That's why Gaia has such a gigantic mission to undertake. But it's not just the stars in the disk Gaia is mapping — it's also globular clusters and other objects nearby. The Milky Way itself is 100,000 light-years across and 700 light-years high in the main disk, with some areas stretching as high as 3,000 light-years, thanks to the presence of diffuse older stars. LEFT: NASA/JPL-CALTECH; RIGHT: ESA; LAYOUT: ESA/ATG MEDIALAB

Nebula dan daerah pembentukan bintang

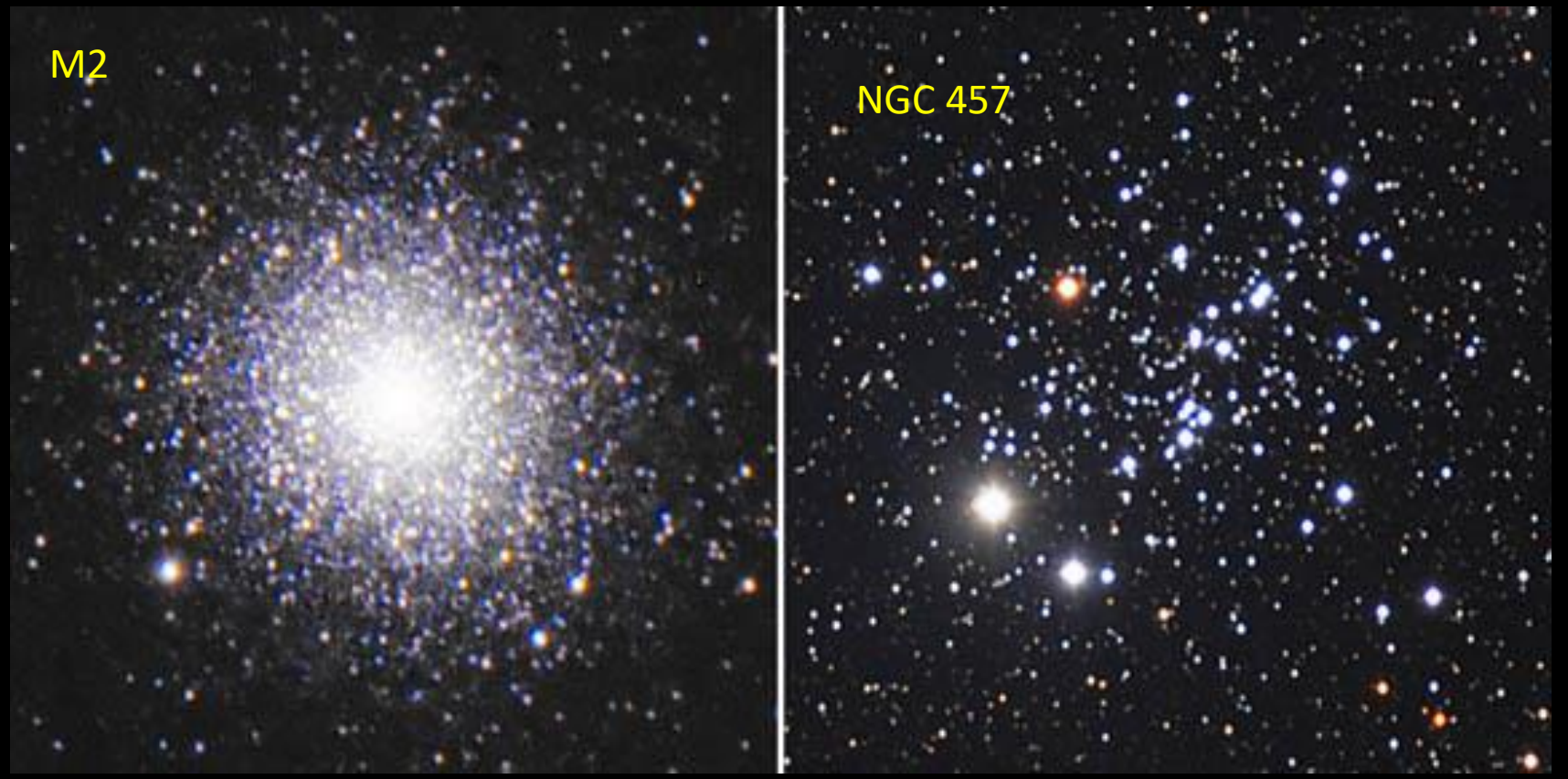


Star-Forming Region 30 Doradus
Hubble Space Telescope • WFC3/UVIS

NASA, ESA, F. Paresce (INAF–IASF, Italy), and the WFC3 Science Oversight Committee STScI-PRC09-32a

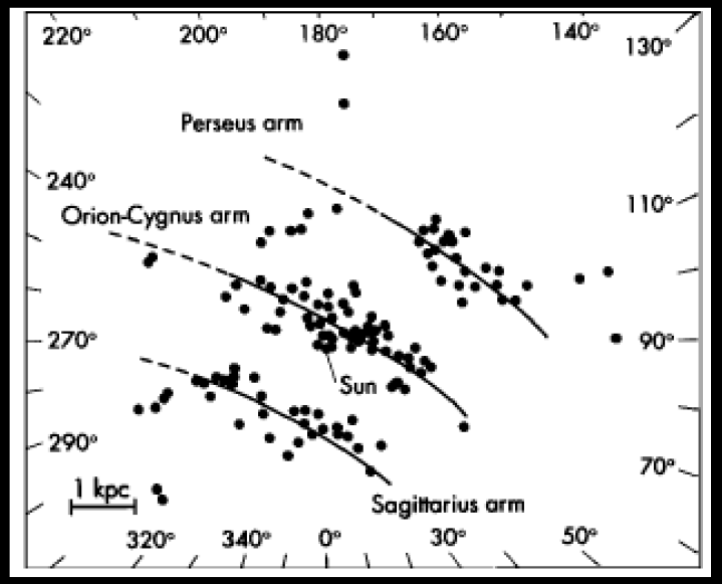
Gugus bola

Gugus terbuka



Hunter Wilson Astrophotography

Lengan Spiral



Vogt & Moffat 1975

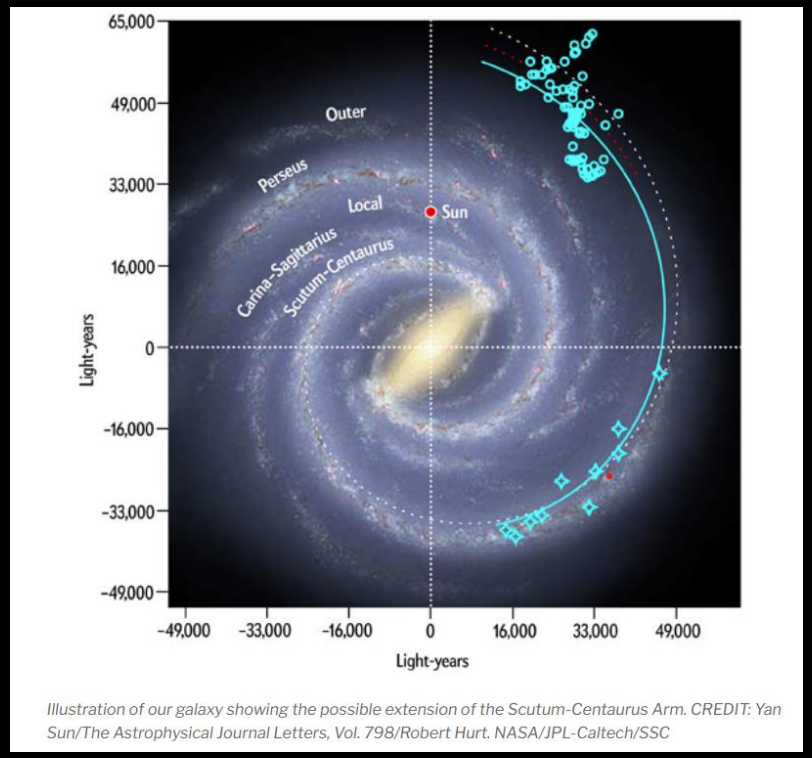
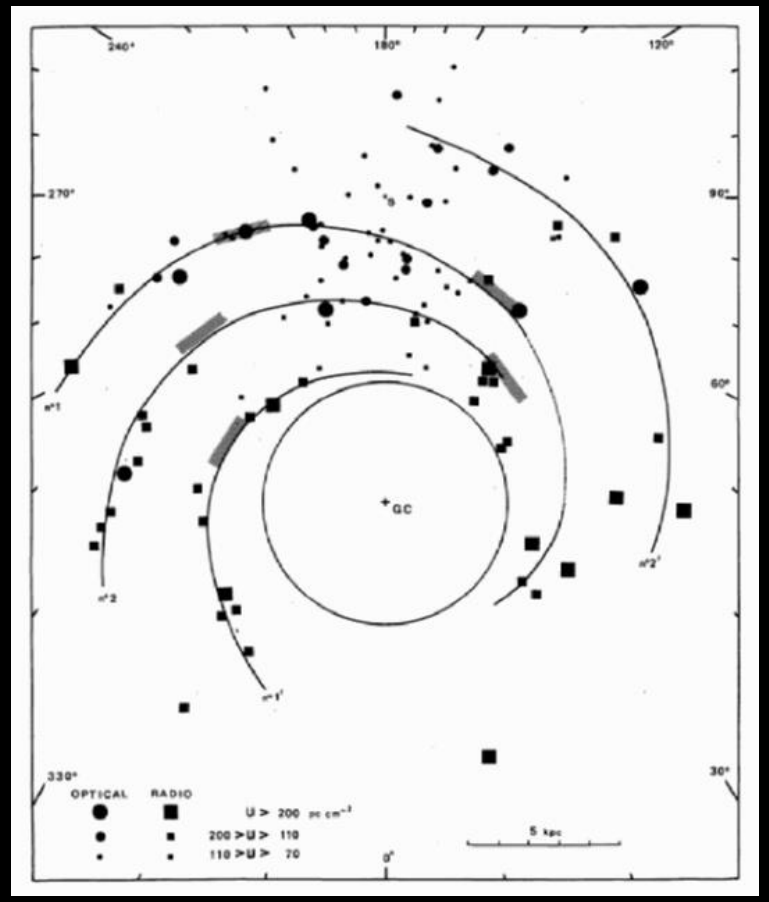


Illustration of our galaxy showing the possible extension of the Scutum-Centaurus Arm. CREDIT: Yan Sun/The Astrophysical Journal Letters, Vol. 798/Robert Hurt. NASA/JPL-Caltech/SSC



Credit: Georgelin & Georgelin 1976

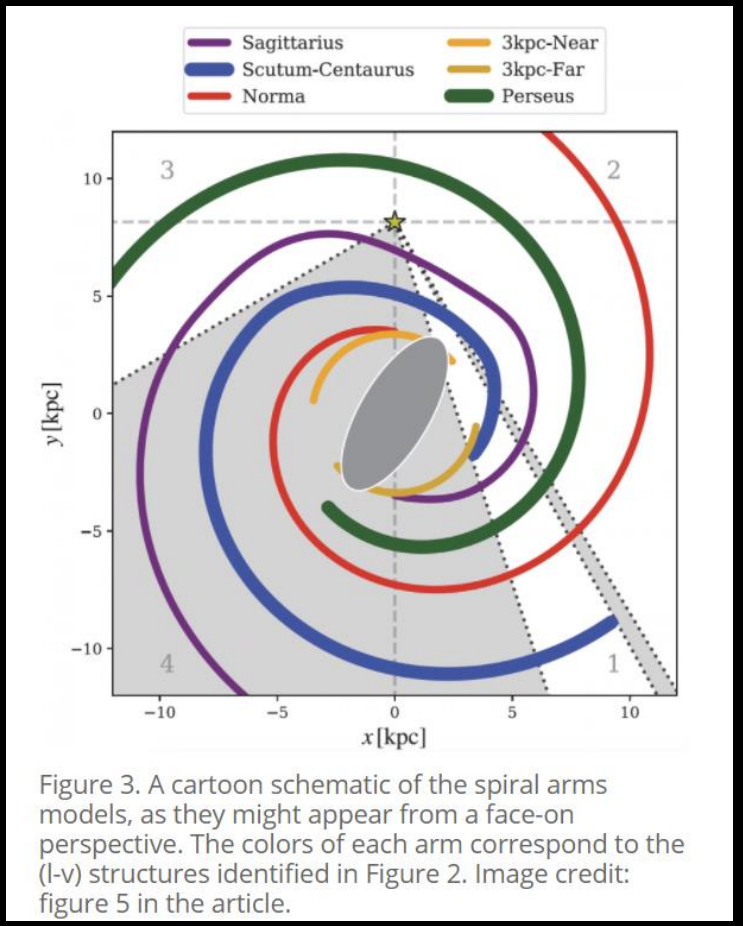
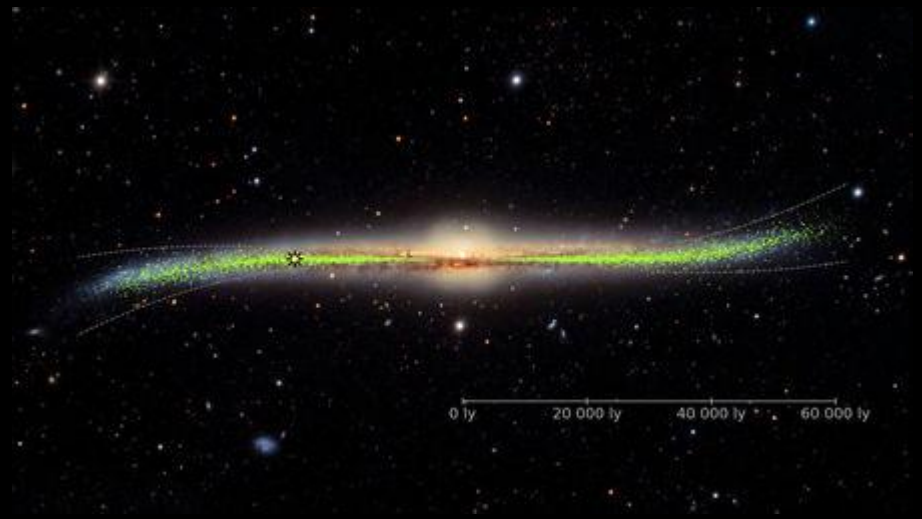
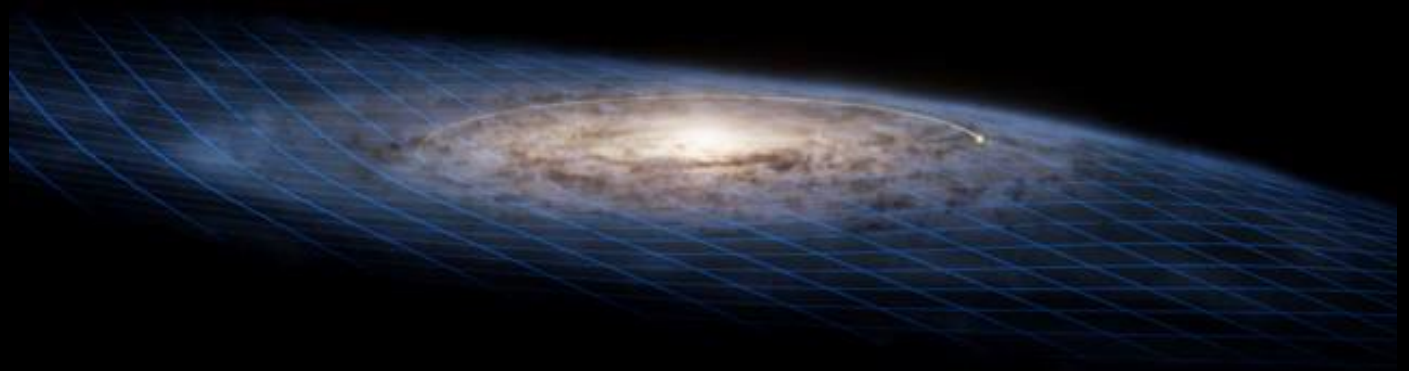


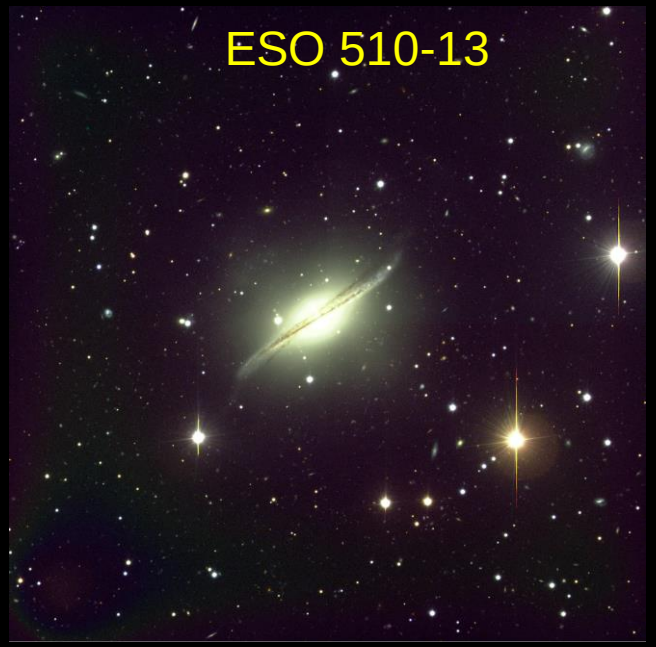
Figure 3. A cartoon schematic of the spiral arms models, as they might appear from a face-on perspective. The colors of each arm correspond to the (l-v) structures identified in Figure 2. Image credit: figure 5 in the article.

L. G. Hou et al. (2009)

Pelengkungan piringan



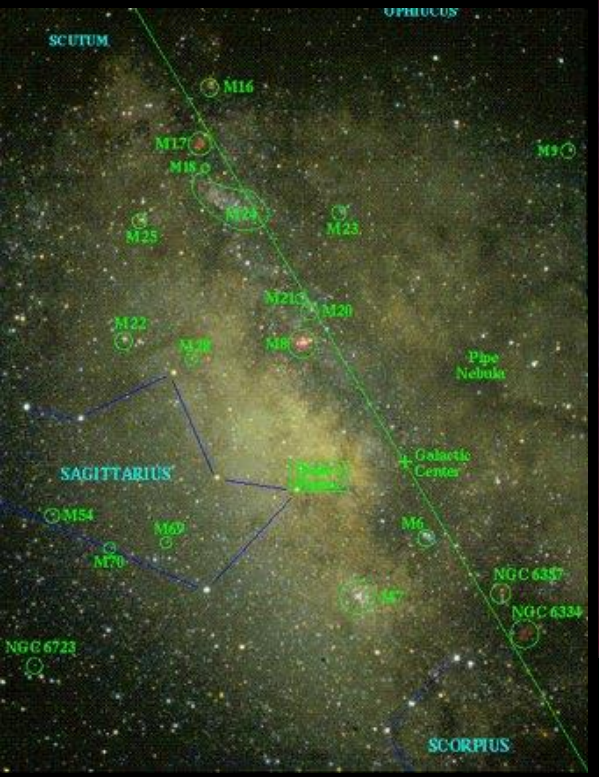




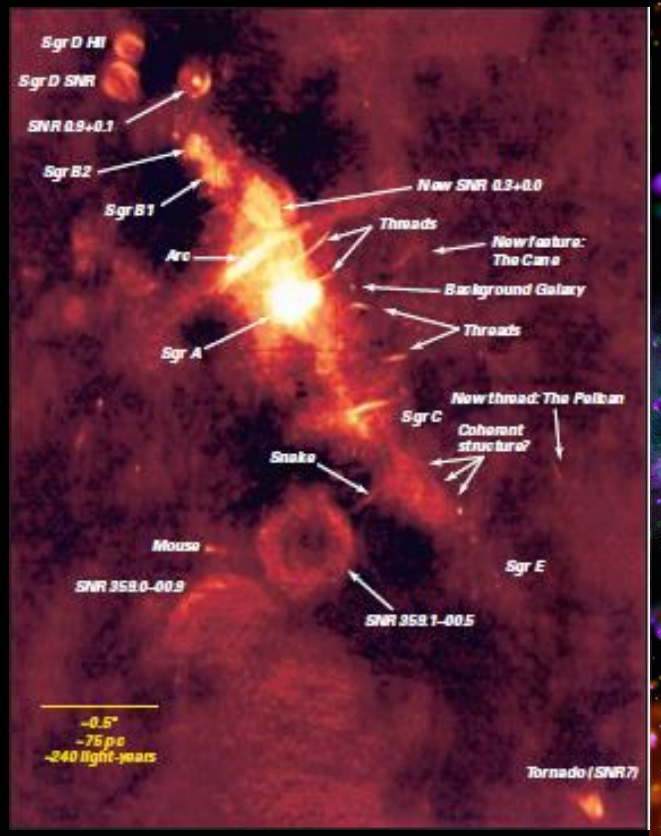
UGC 3697

Image credit: Stefan Payne-Wardenaar / NASA / JPL-Caltech / ESA.

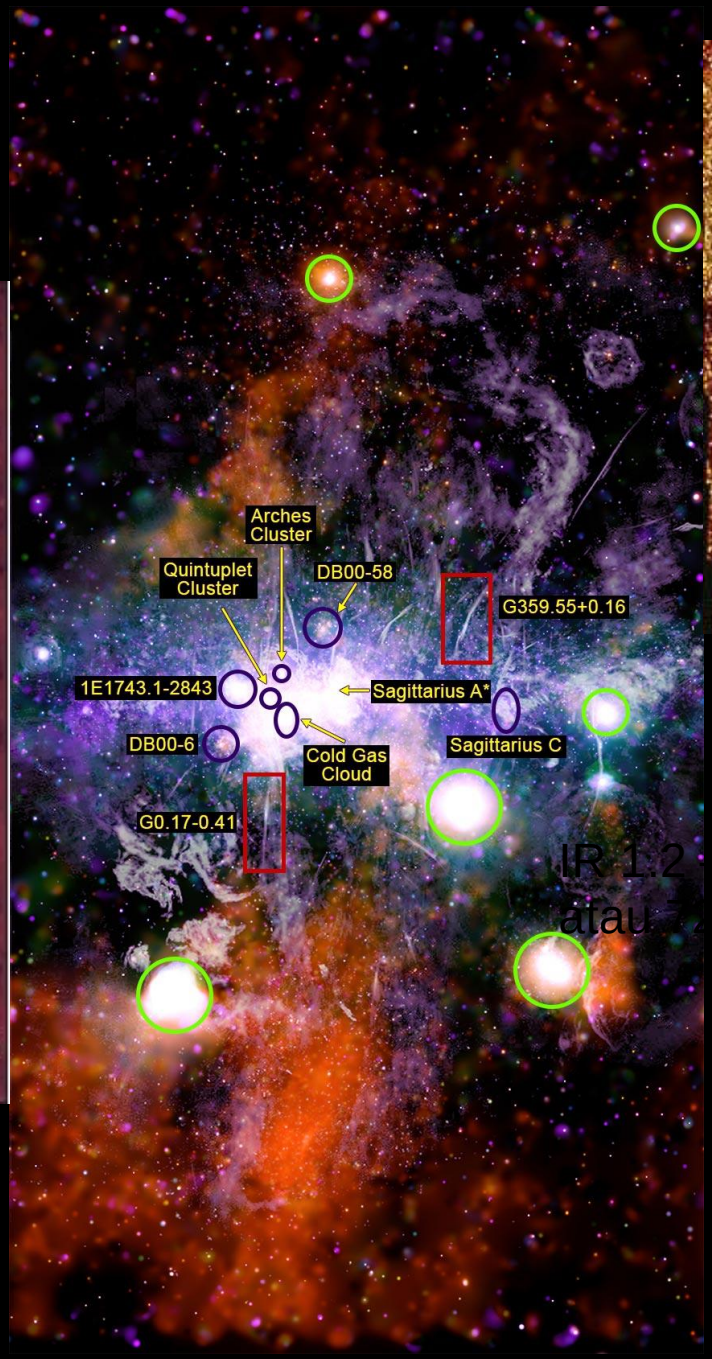
Pusat Galaksi



Optik, (10° × 15°)



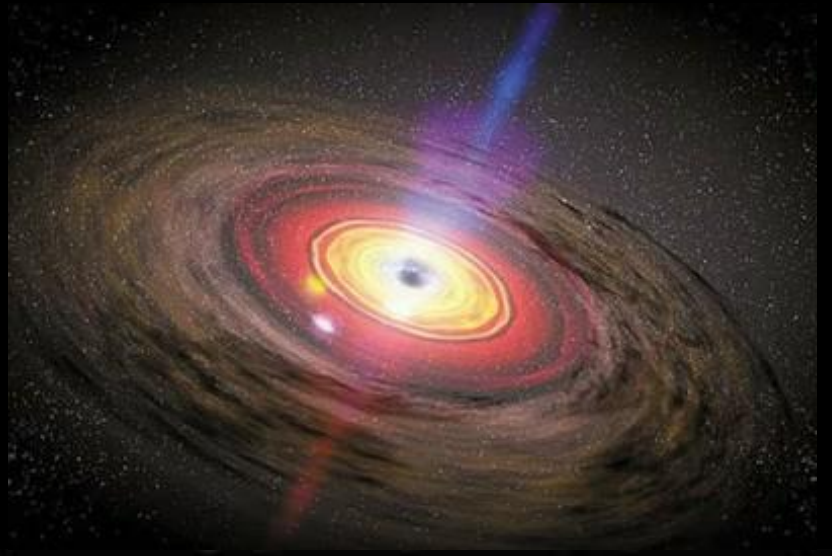
Radio 90cm (330 MHz)

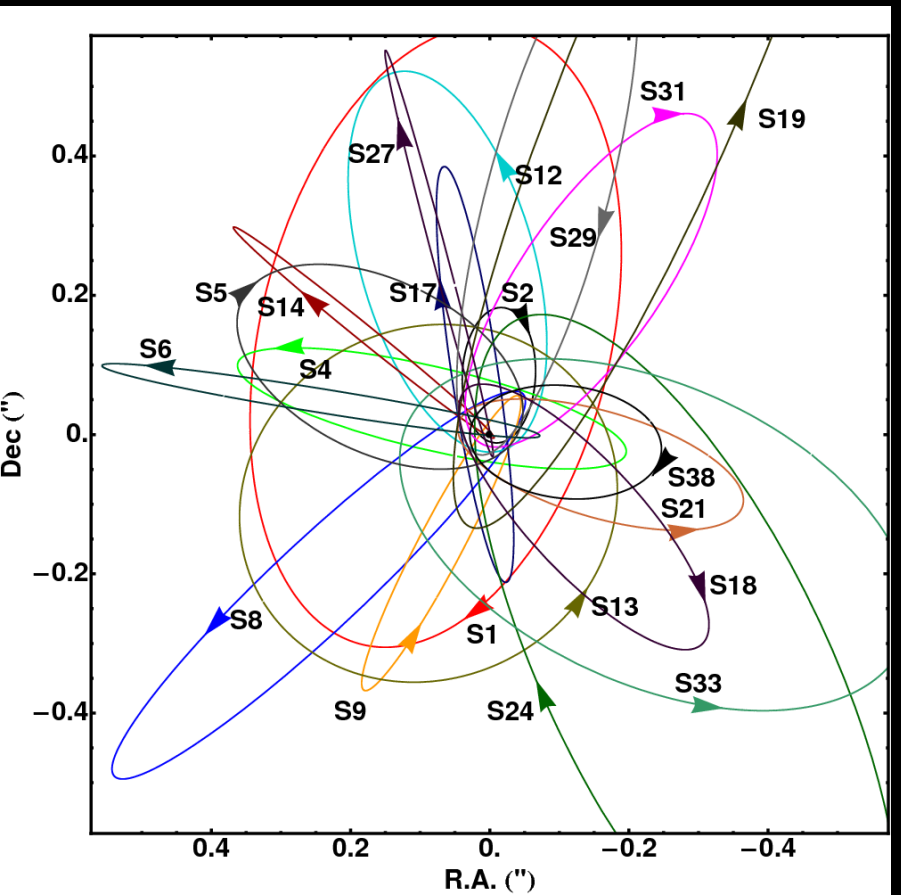


Radio dan X-ray

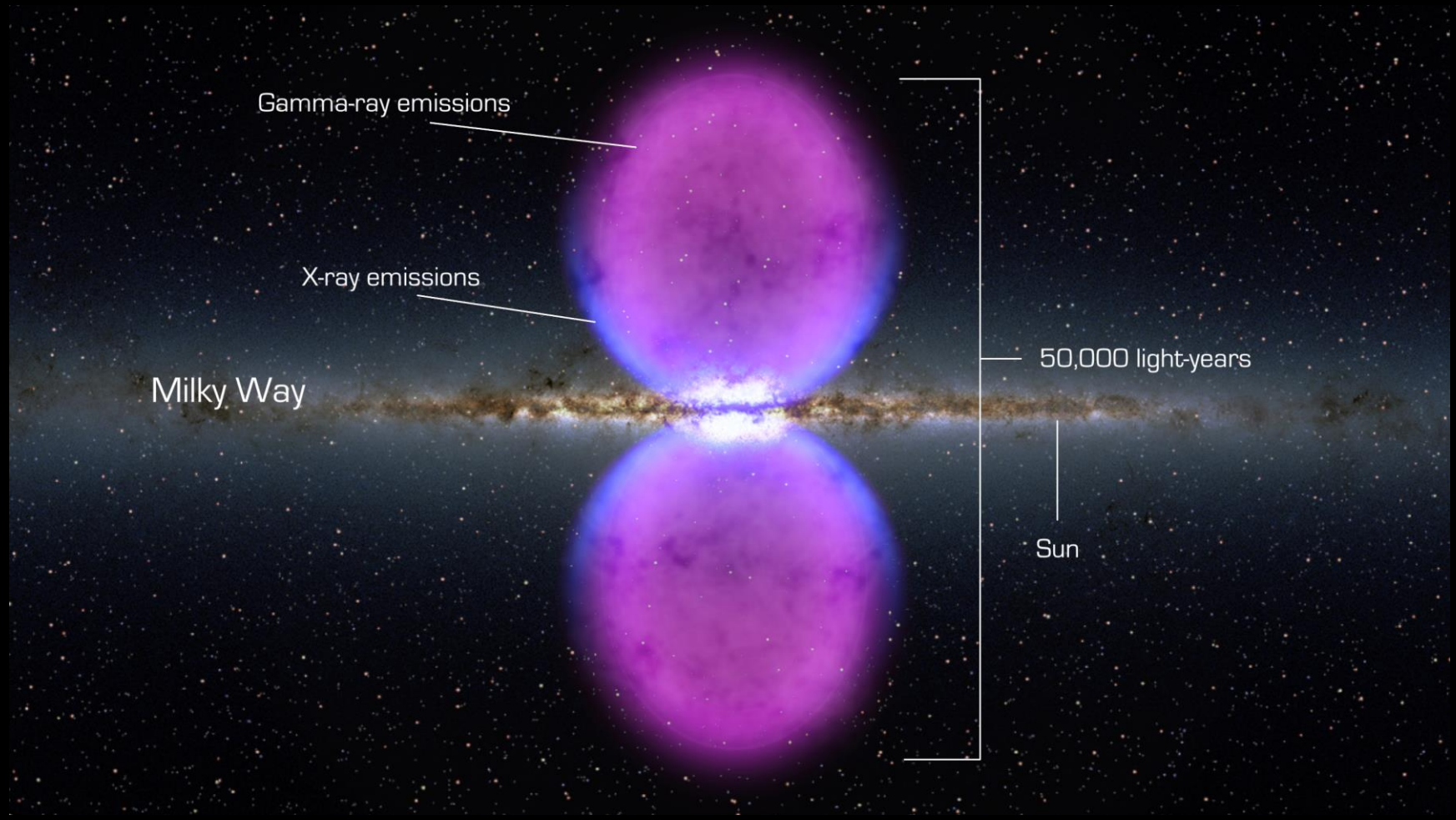
IR 1.2 – 2.2 micron
(0.5° × 0.5°)

Supermassive Black hole

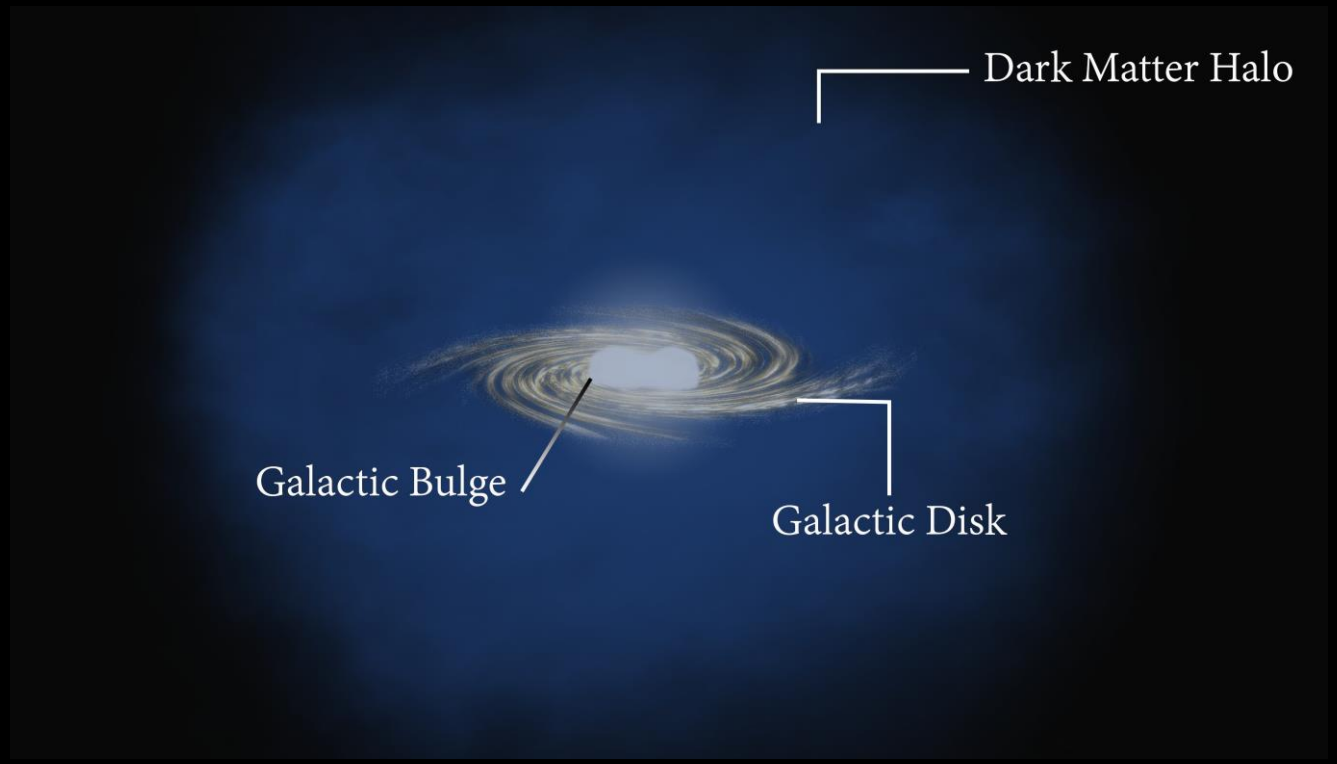


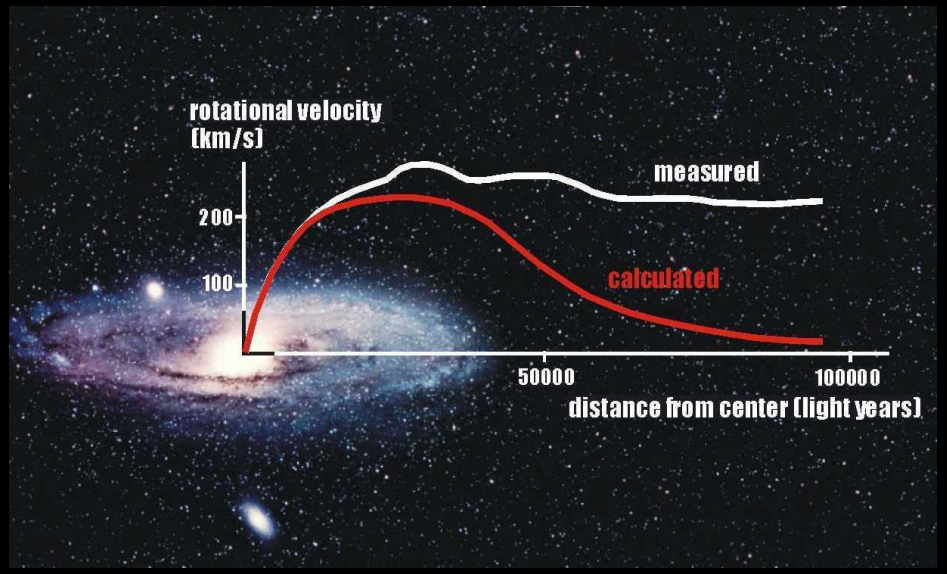


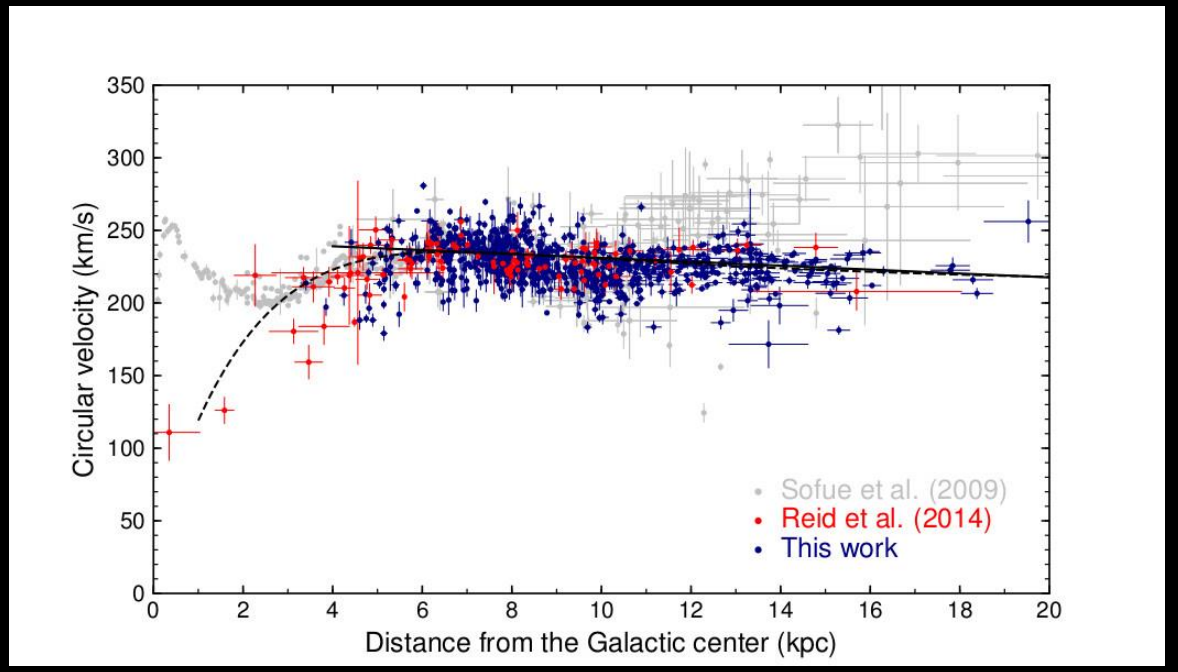
Fermi Bubble



Dark matter

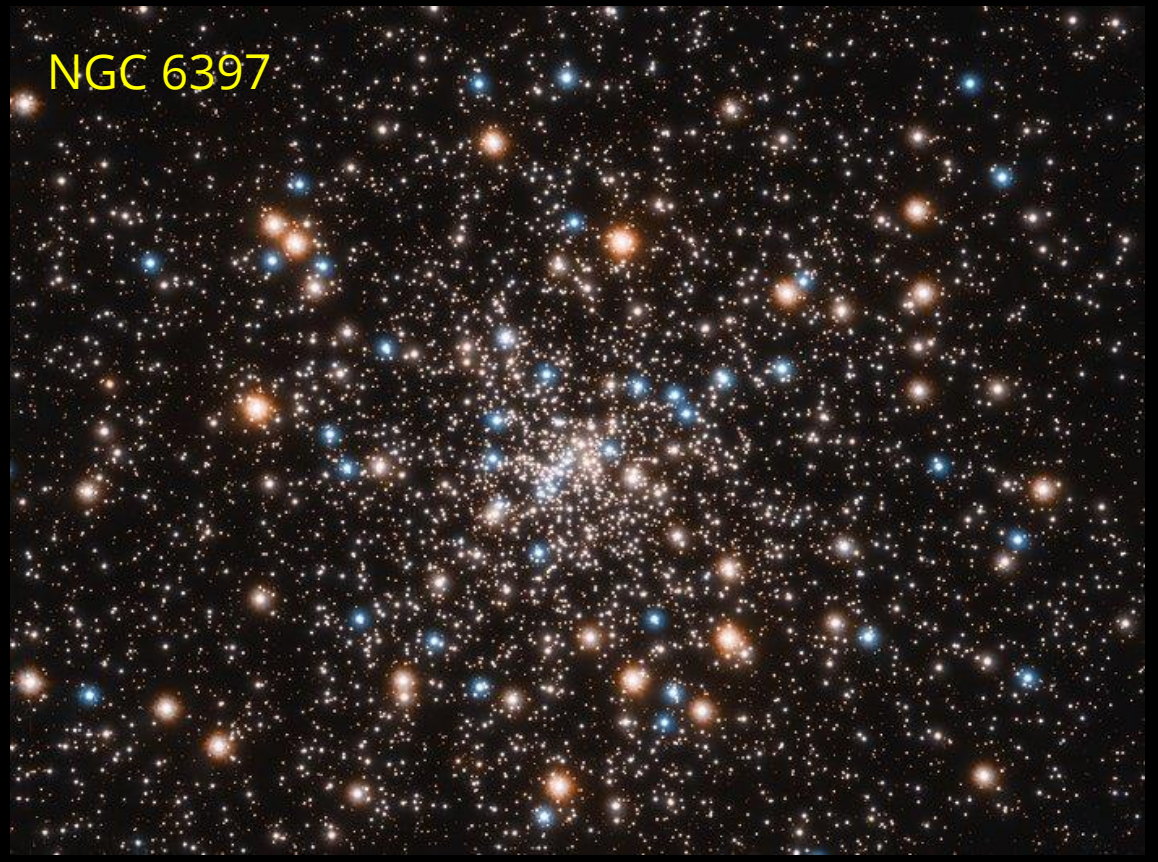

Dark Matter Halo
Galactic Bulge
Galactic Disk


rotational velocity
(km/s)
200
100
measured
calculated
50000
100000
distance from center (light years)

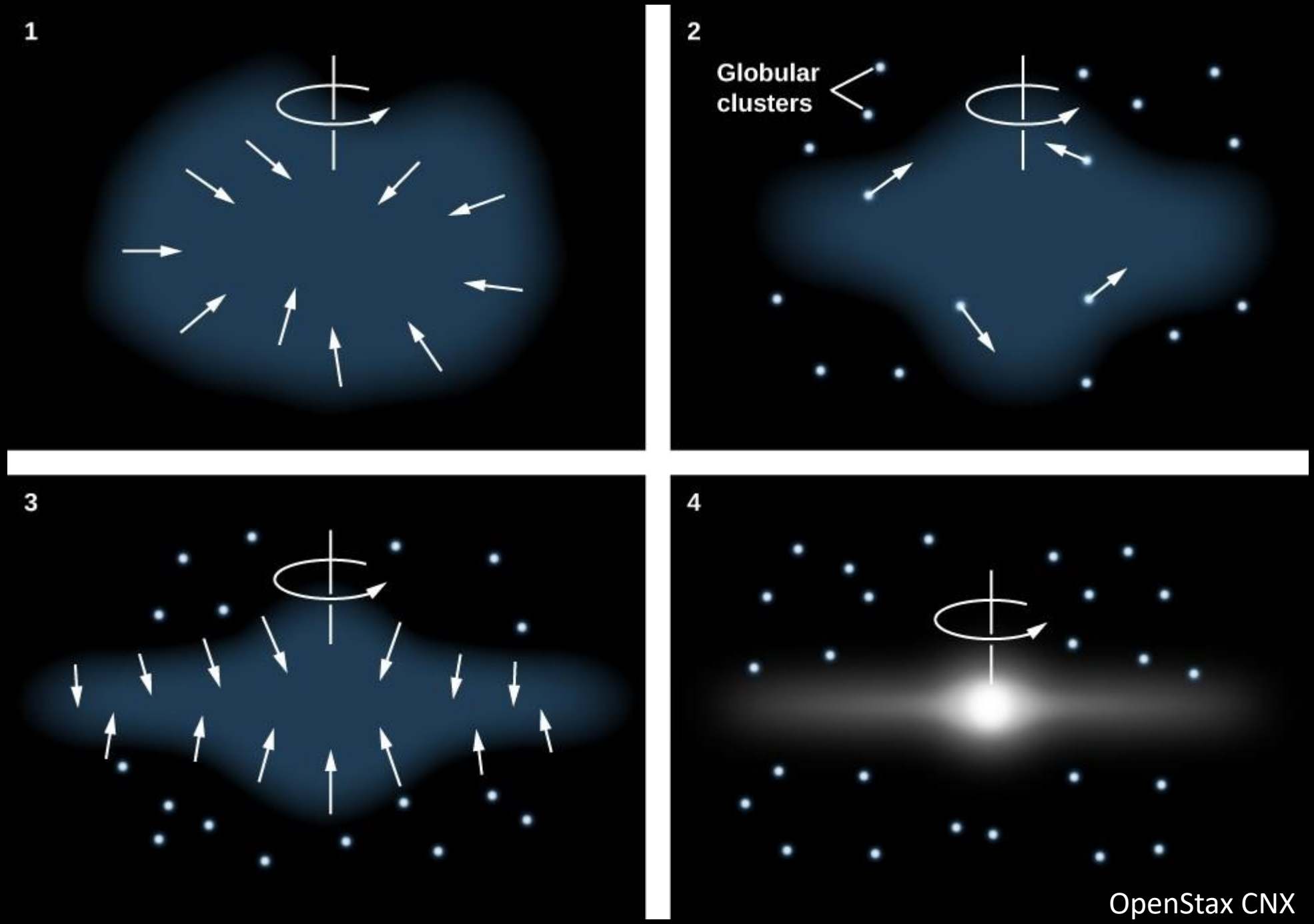

Circular velocity (km/s)
Distance from the Galactic center (kpc)
Sofue et al. (2009)
Reid et al. (2014)
This work

Formasi dan Evolusi

- Umur 13,4 milyar tahun



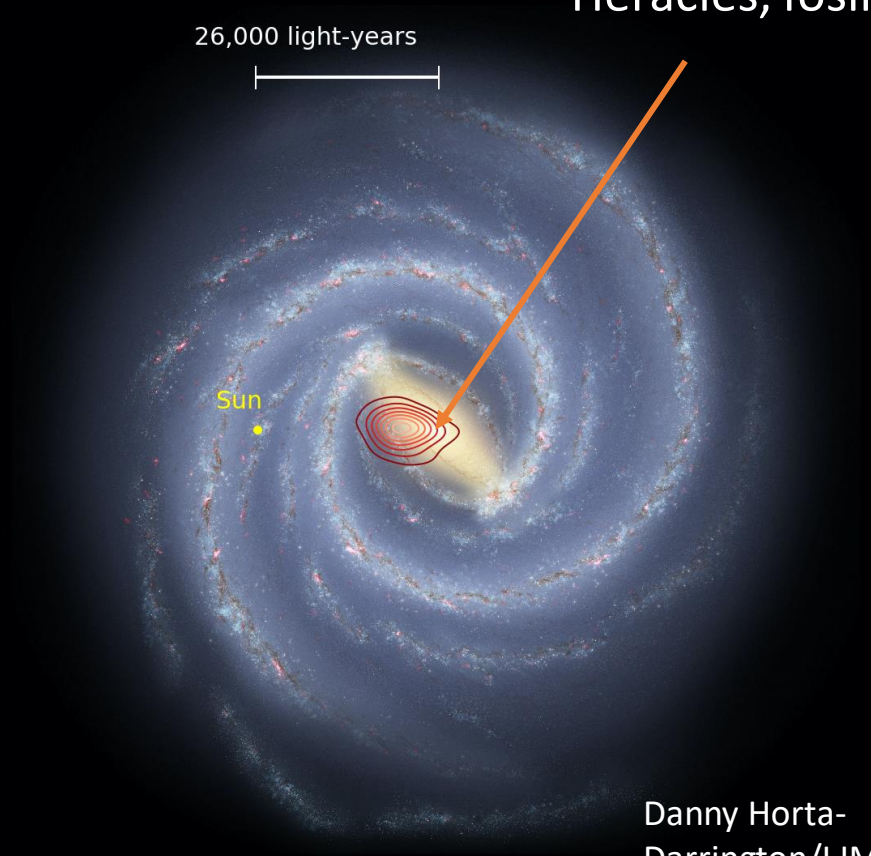
Credit: NASA, ESA, and T. Brown and S. Casertano (STScI)



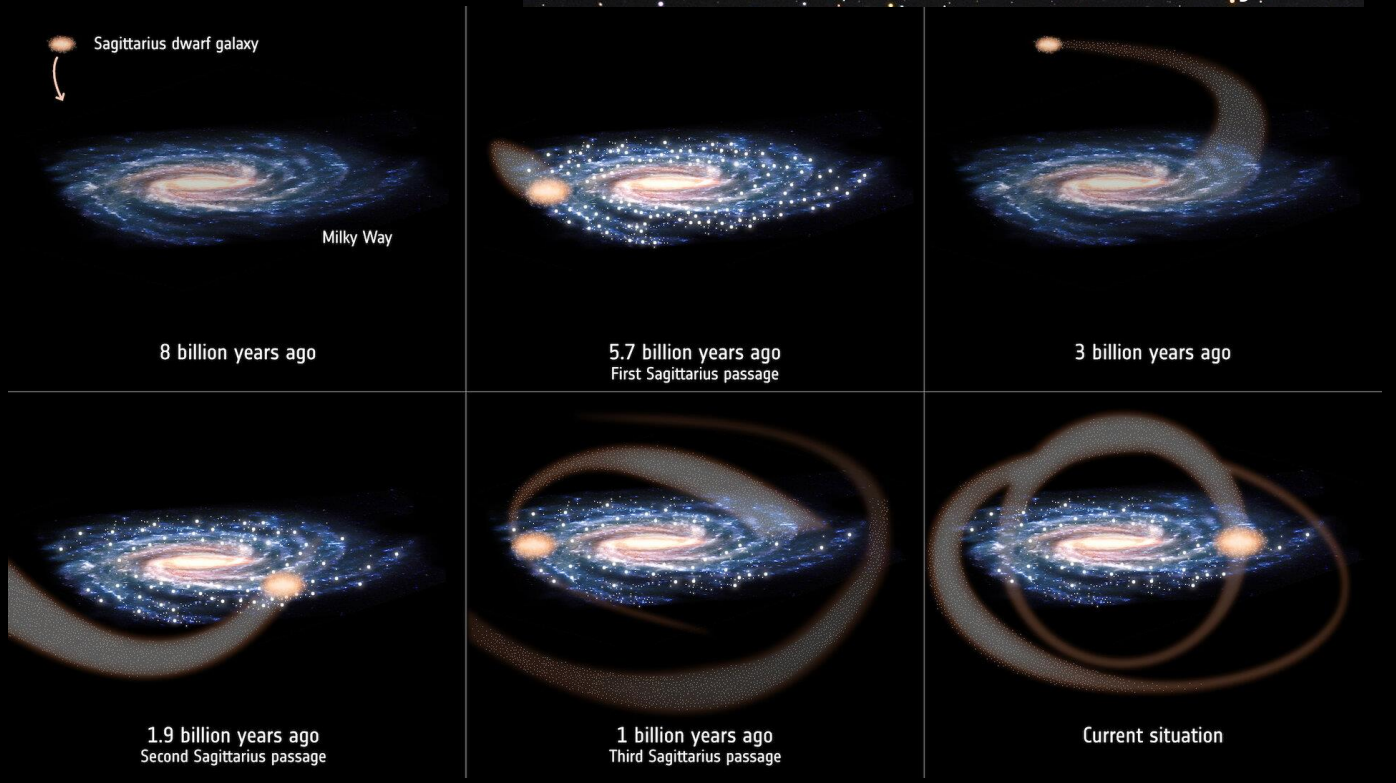
OpenStax CNX

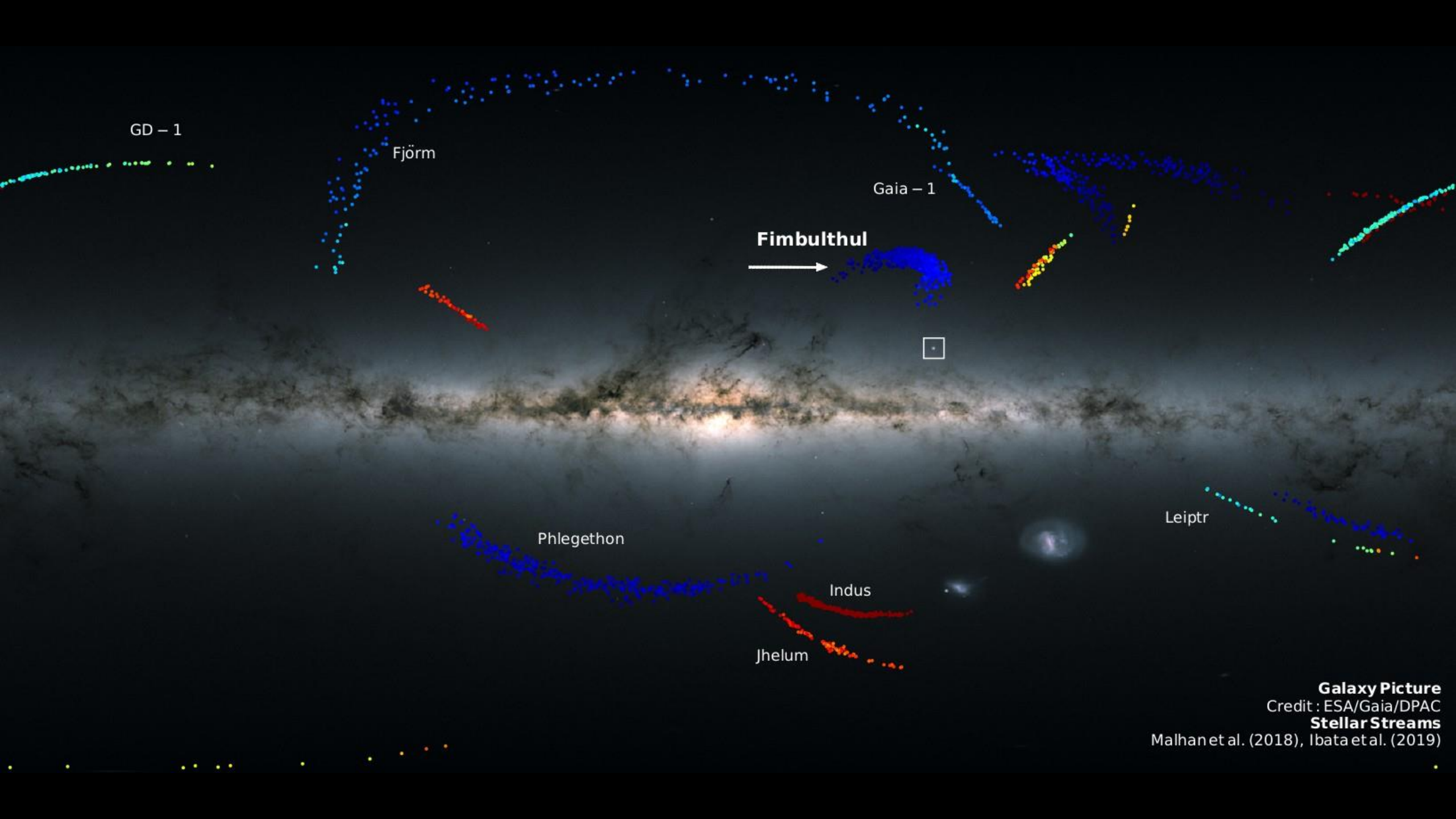
Formasi dan Evolusi

Heracles, fosil galaksi

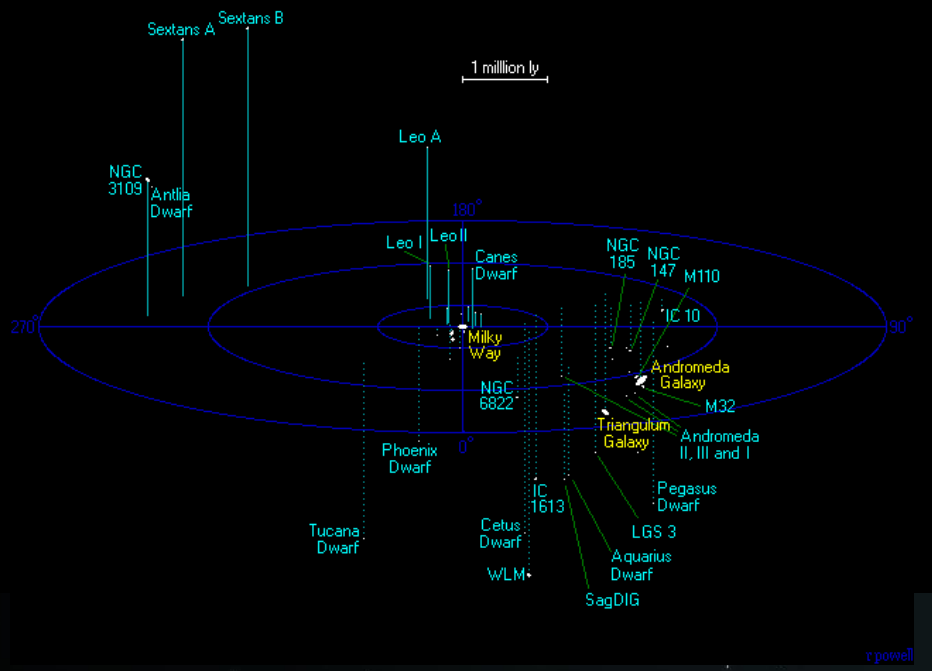


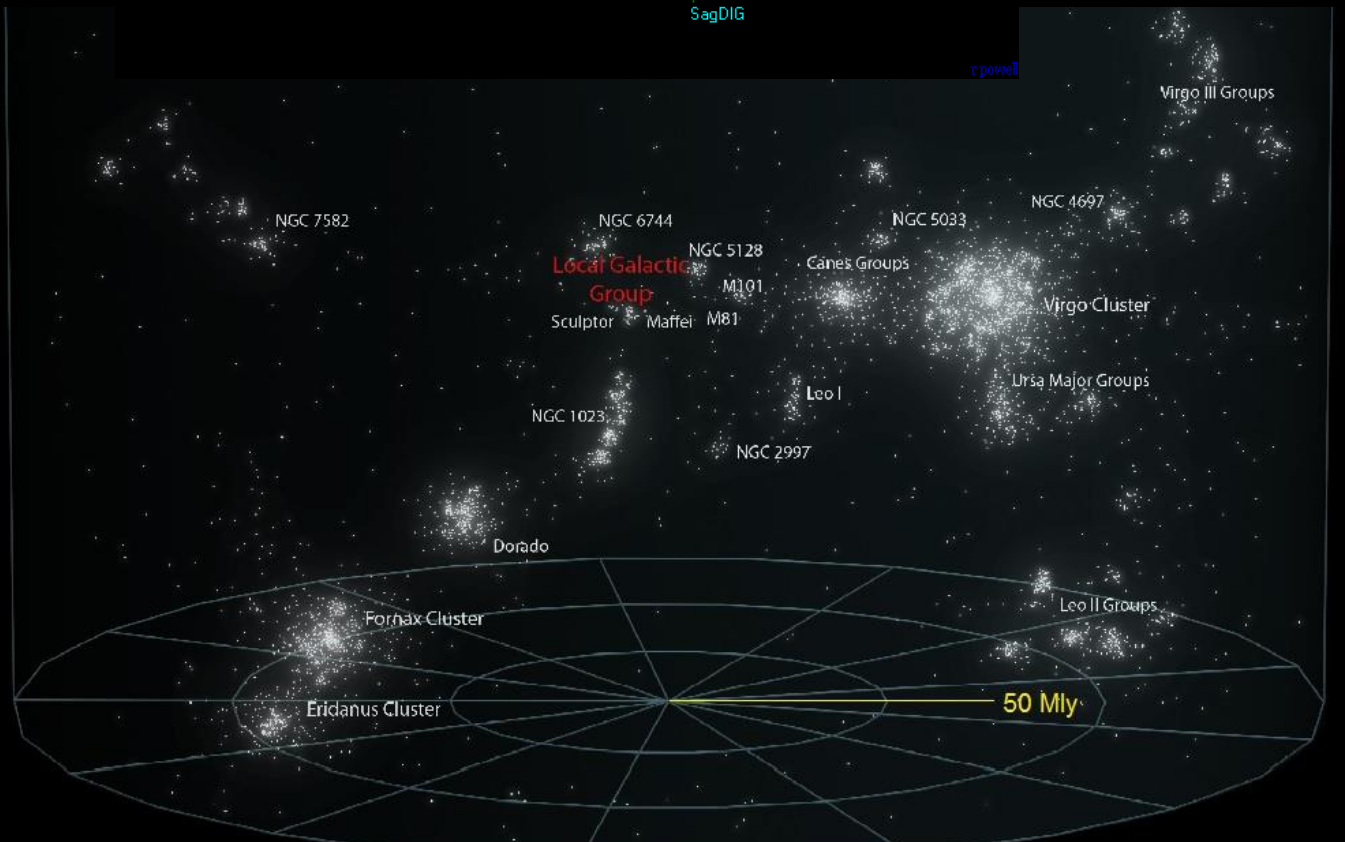
Danny Horta-Darrington/LJMU/Nasa/JPL-Caltech/SDSS/PA




GD – 1
Fjörm
Gaia – 1
Fimbulthul
Phlegethon
Indus
Jhelum
Leiptr
Galaxy Picture
Credit : ESA/Gaia/DPAC
Stellar Streams
Malhan et al. (2018), Ibata et al. (2019)

Local Group & Supercluster Virgo






0.000 billion years