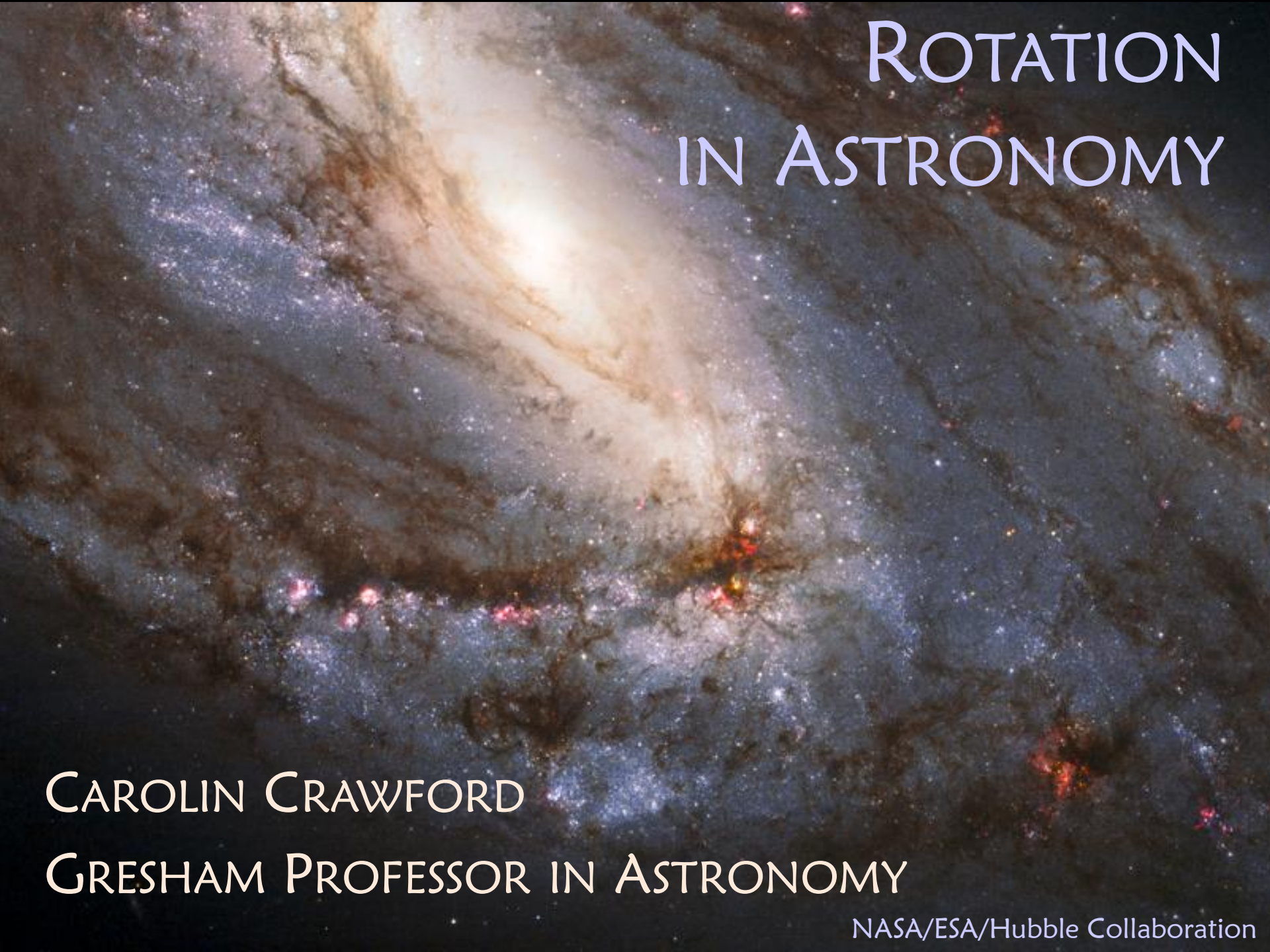
Rotation in Astronomy

Carolin Crawford
Gresham Professor in Astronomy



NASA/ESA/Hubble Collaboration

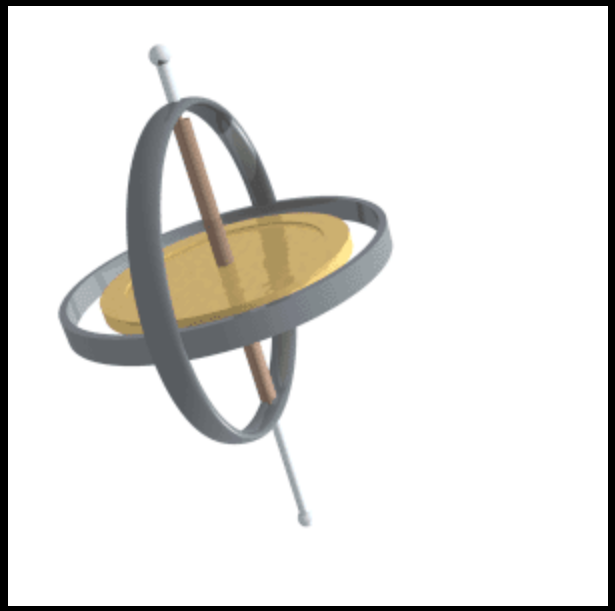

NASA Suomi NPP mission

NASA NEAR mission

Angular Momentum

NASA/Hubble Heritage Team

Angular Momentum



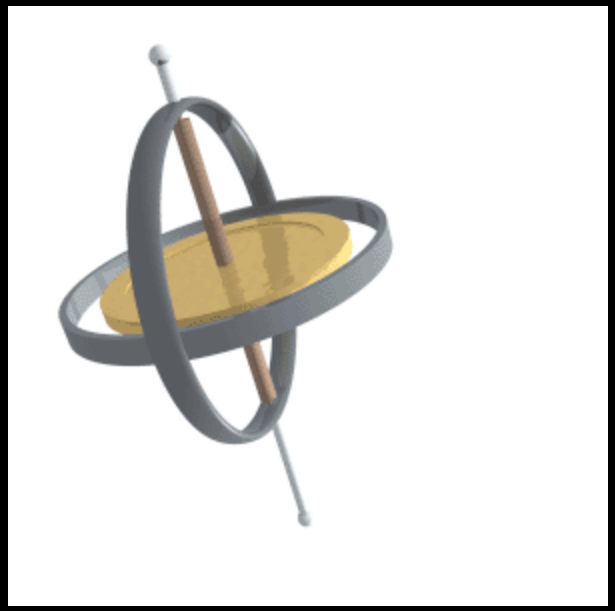
NASA/Hubble Heritage Team

Angular Momentum

for a rotating body, the quantity

mass x rotational rate x $(\text{radius})^2$

is conserved about an axis



NASA/Hubble Heritage Team

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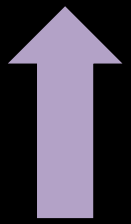
if radius 

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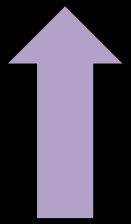
if radius  then rotational rate must 

Angular Momentum

for a rotating body, the quantity

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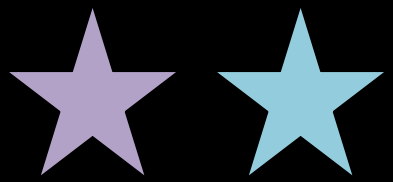
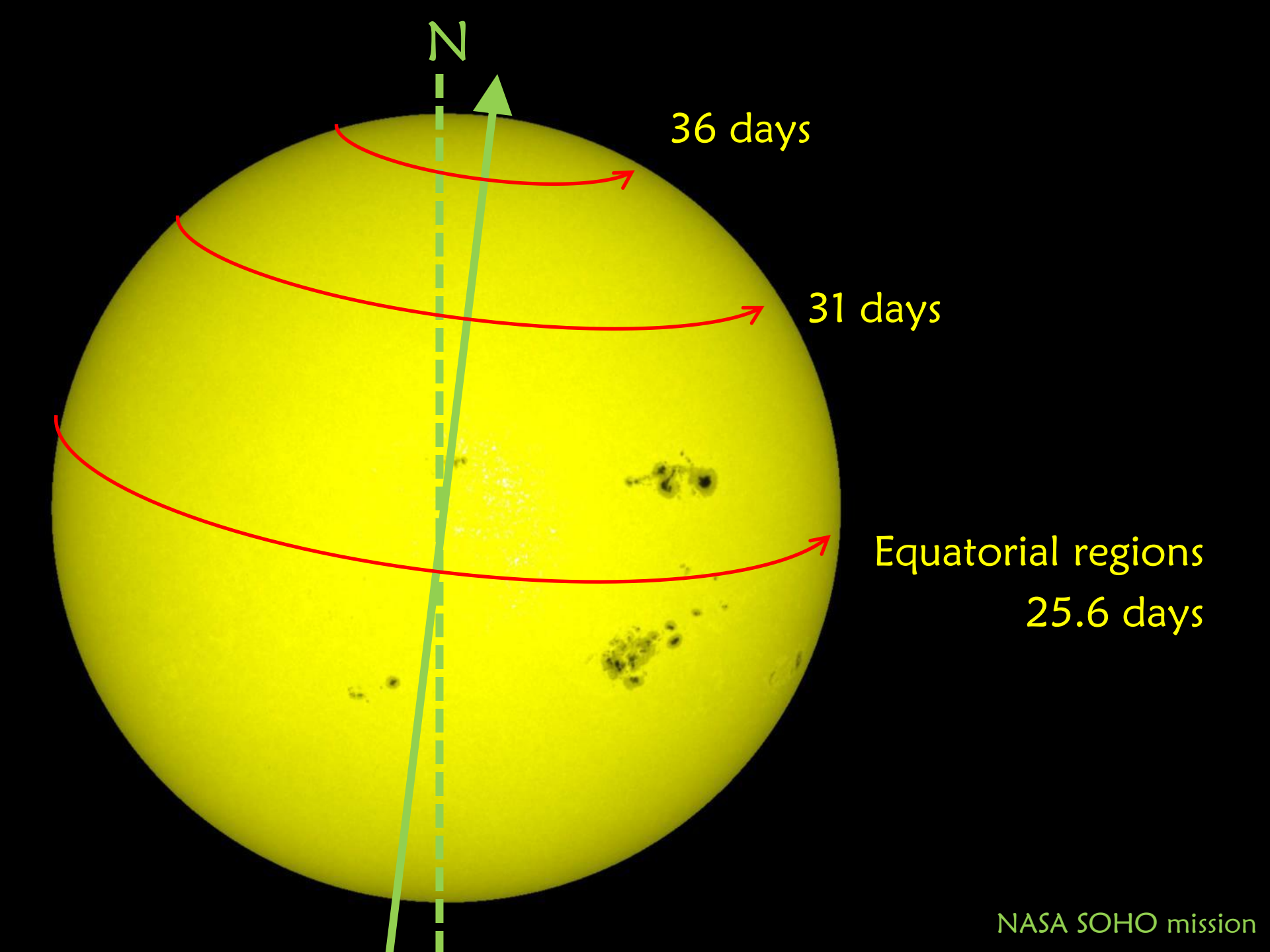
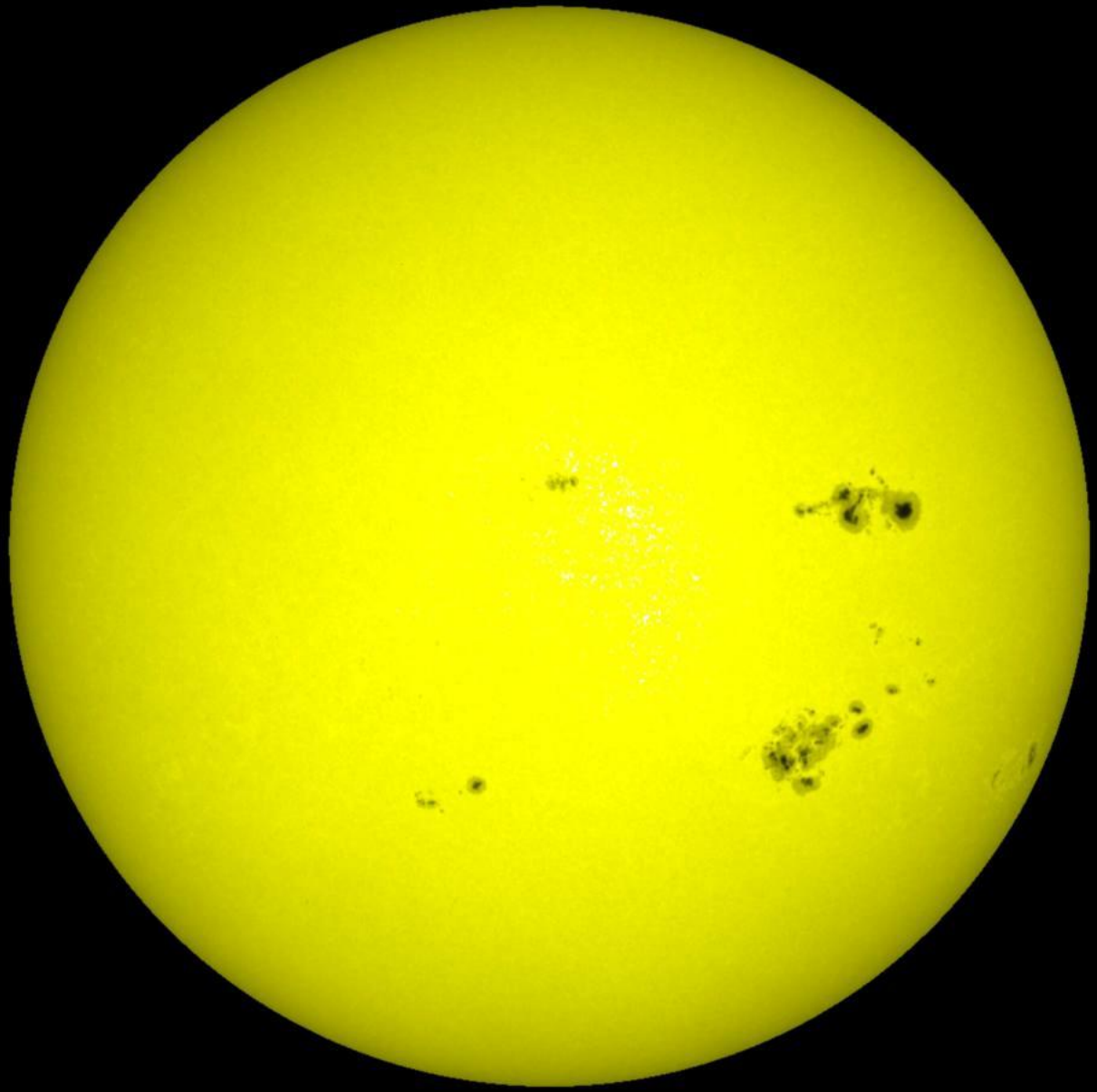
if radius ↑ then rotational rate must ↓

if radius ↓ then rotational rate must ↑

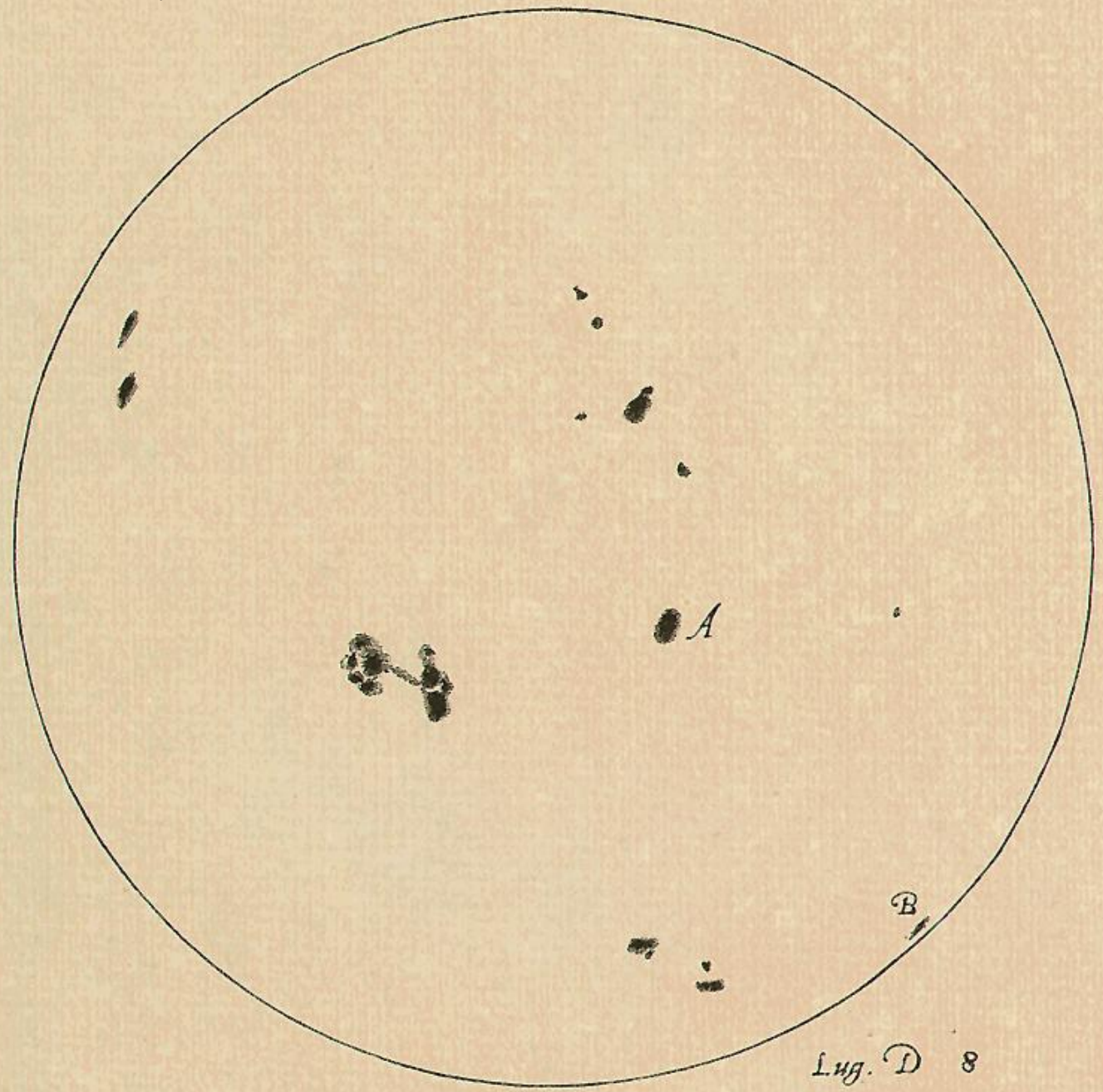


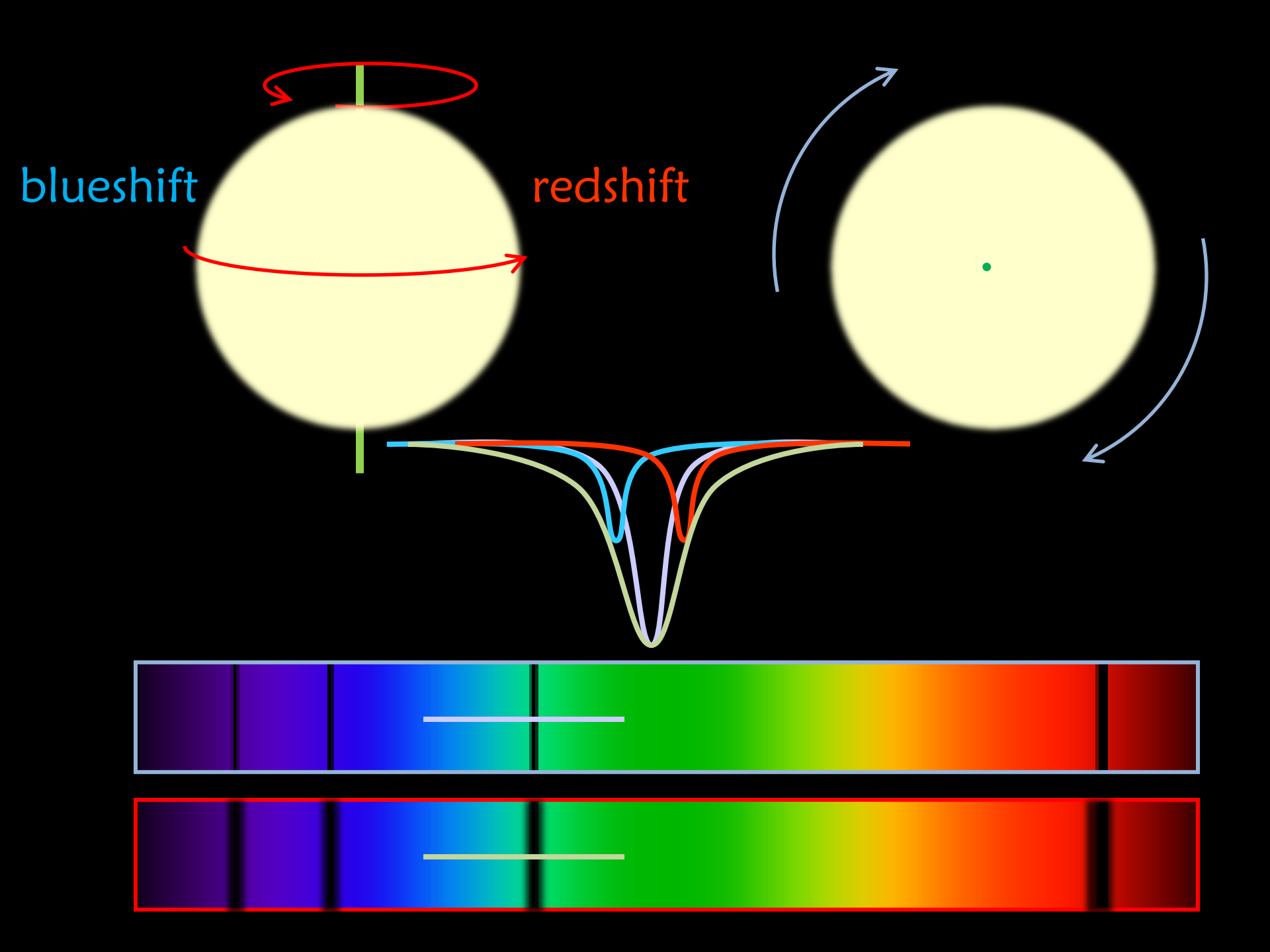

NASA/Hubble Heritage Team


N
36 days
31 days
Equatorial regions
25.6 days
NASA SOHO mission



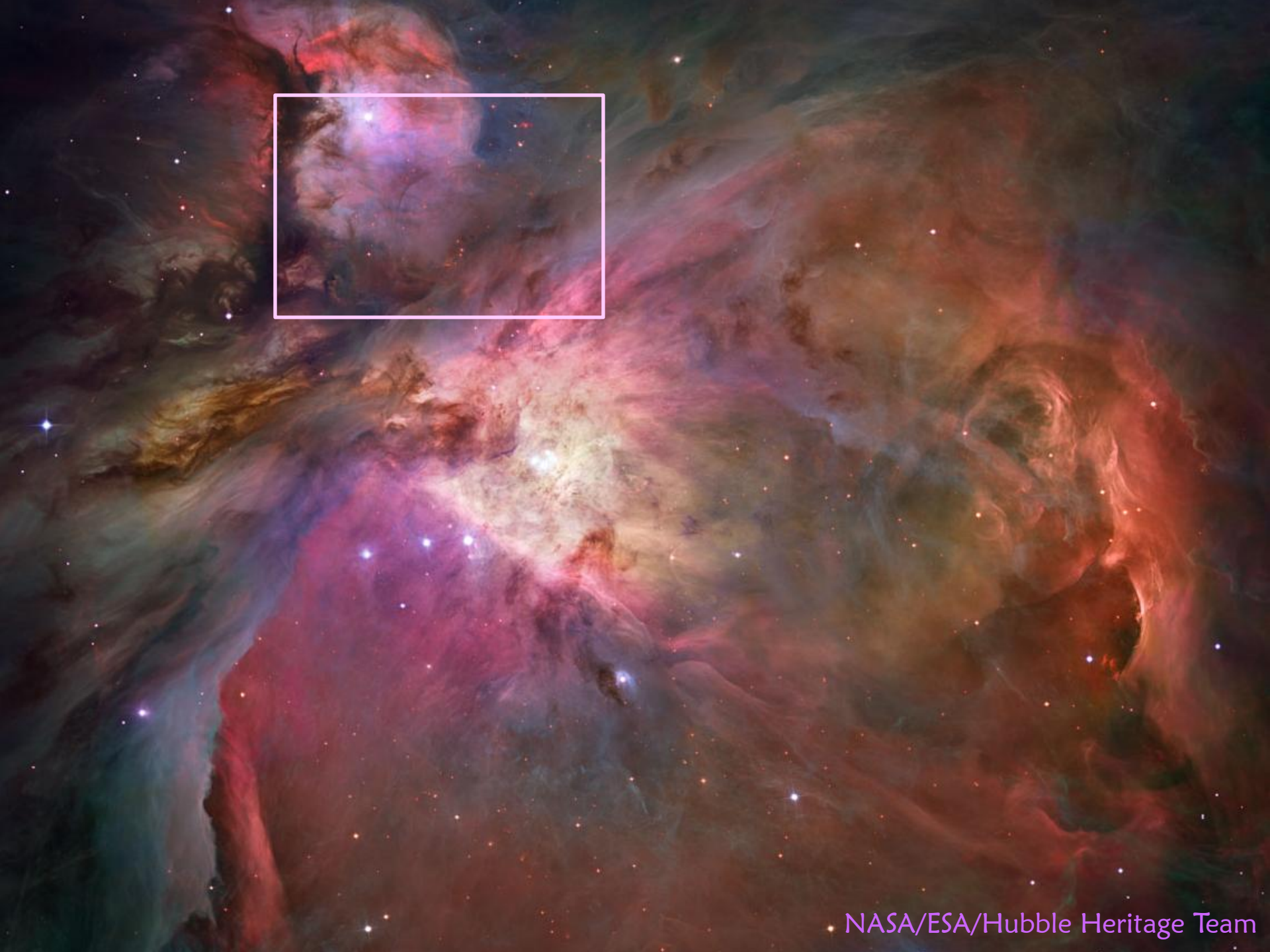
NASA SOHO mission

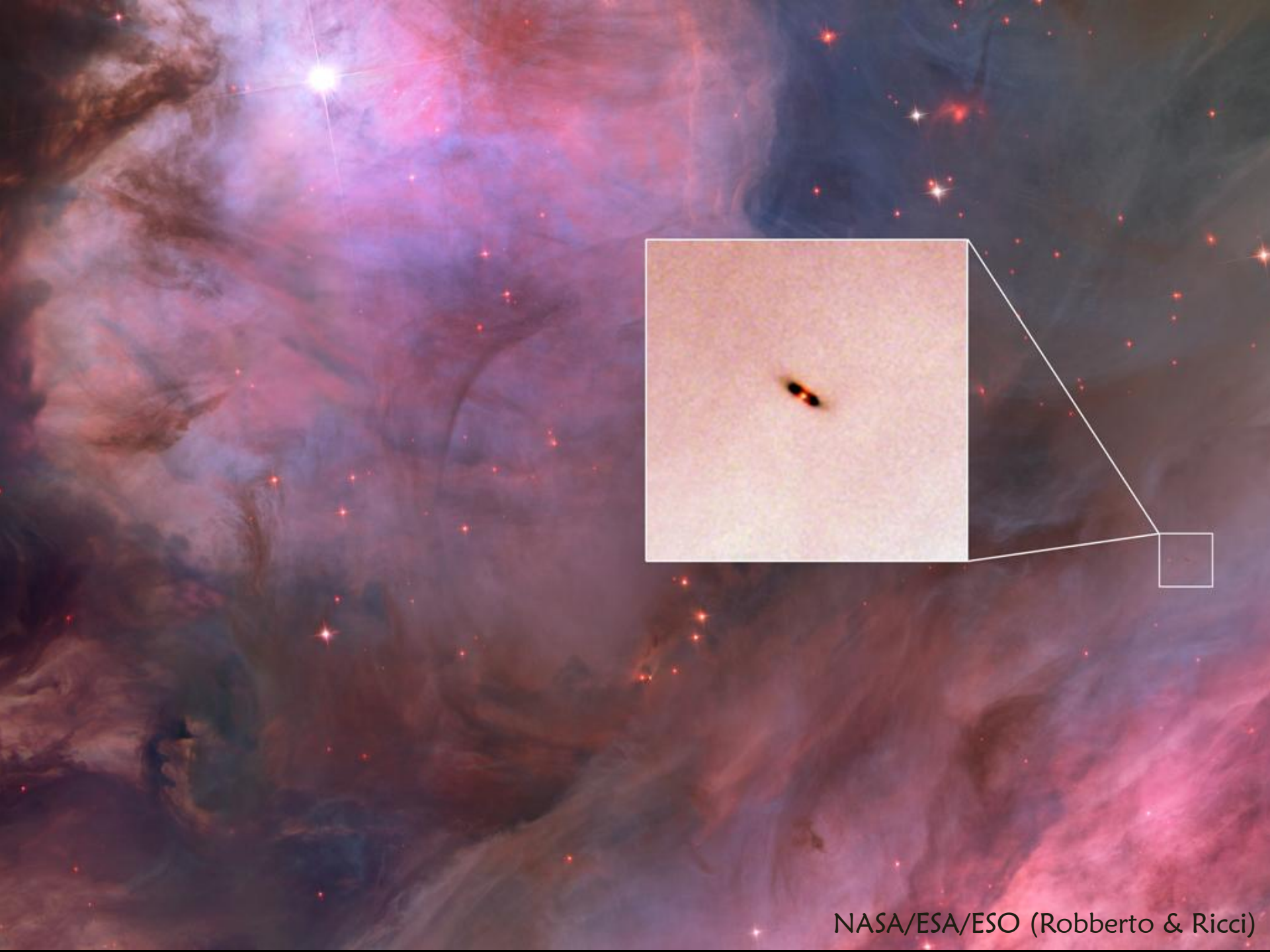

A
B
Lug. D 8


blueshift
redshift


Russell Cronan

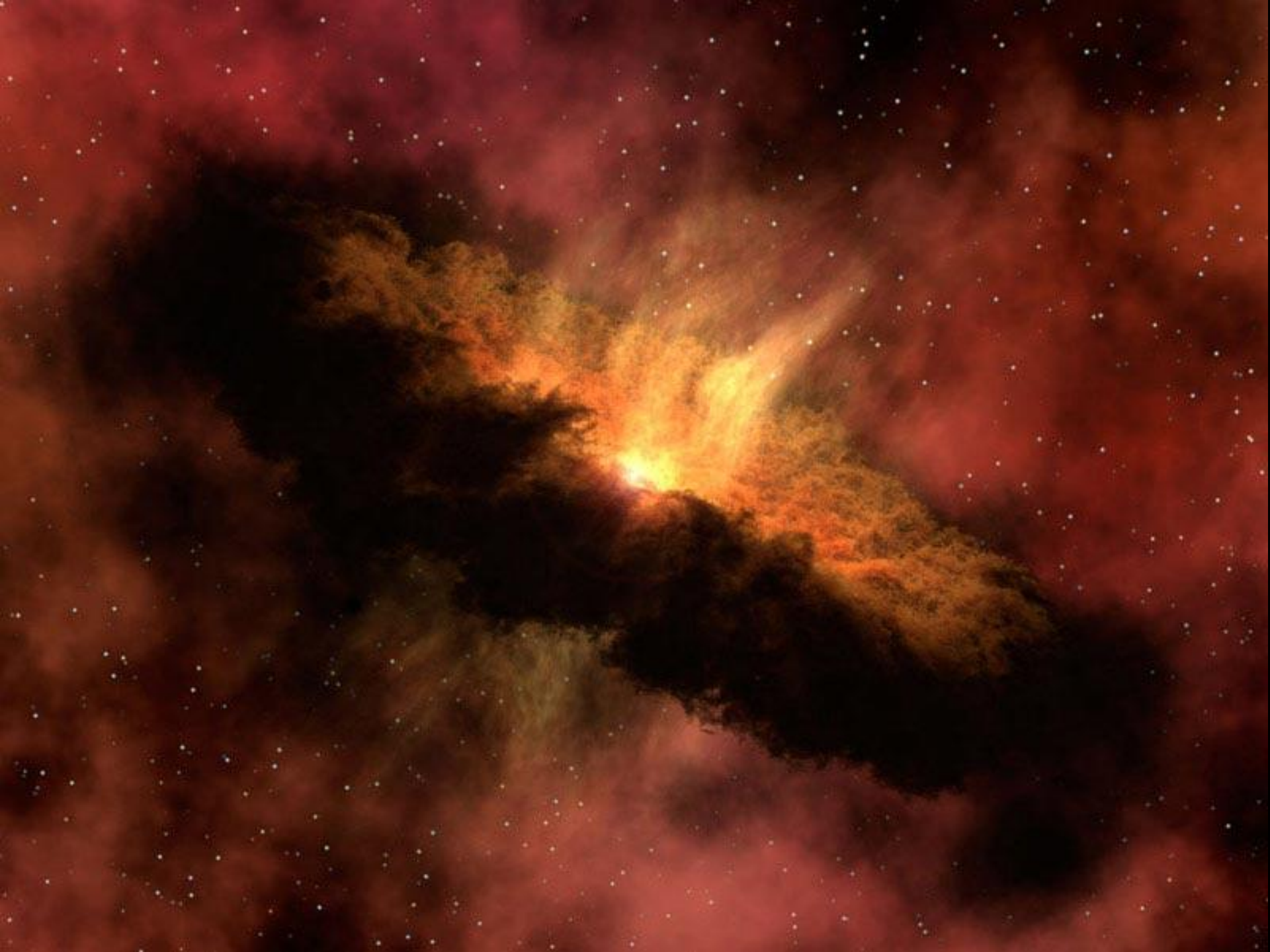
NASA/ESA/Hubble Heritage Team

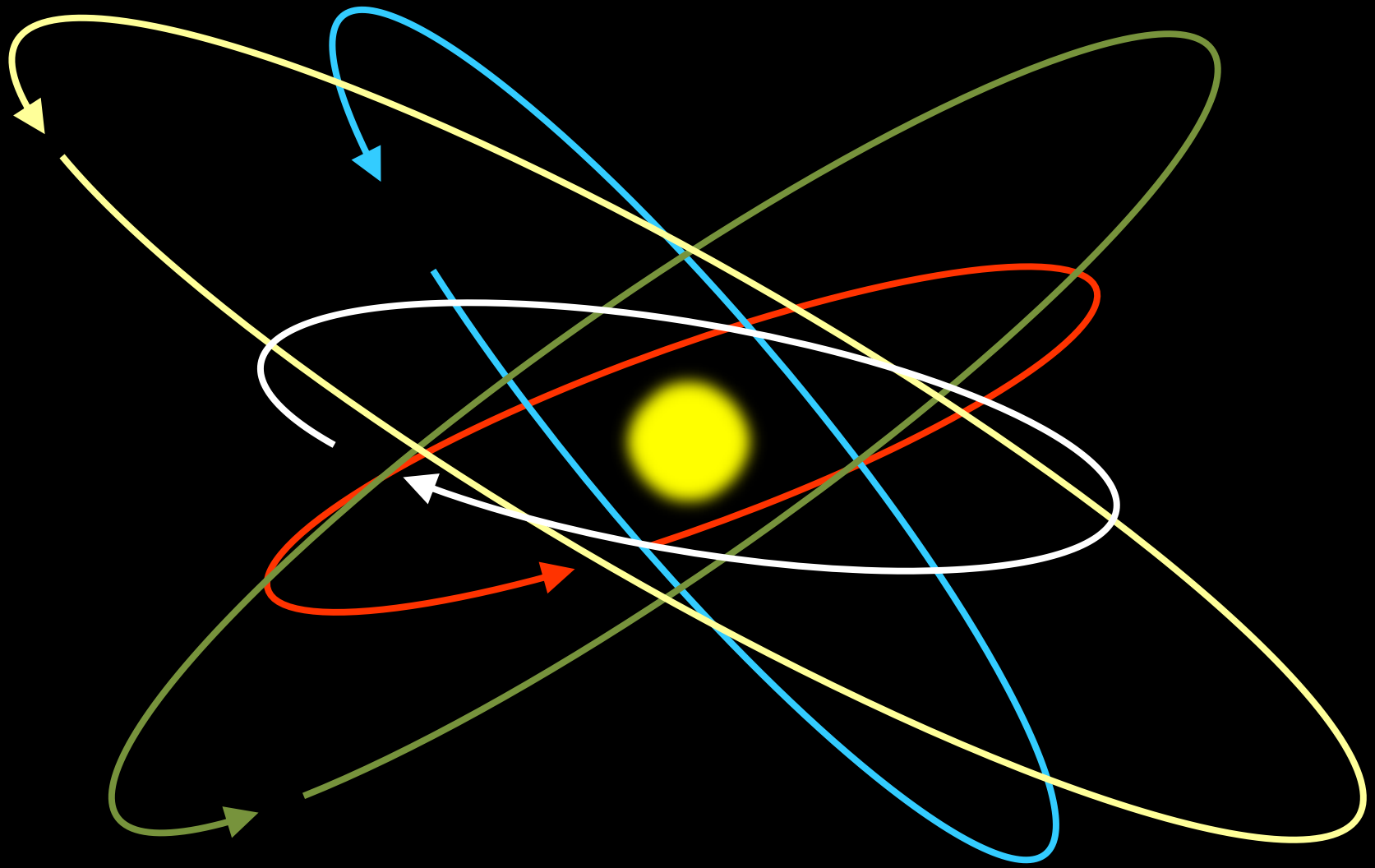

NASA/ESA/Hubble Heritage Team



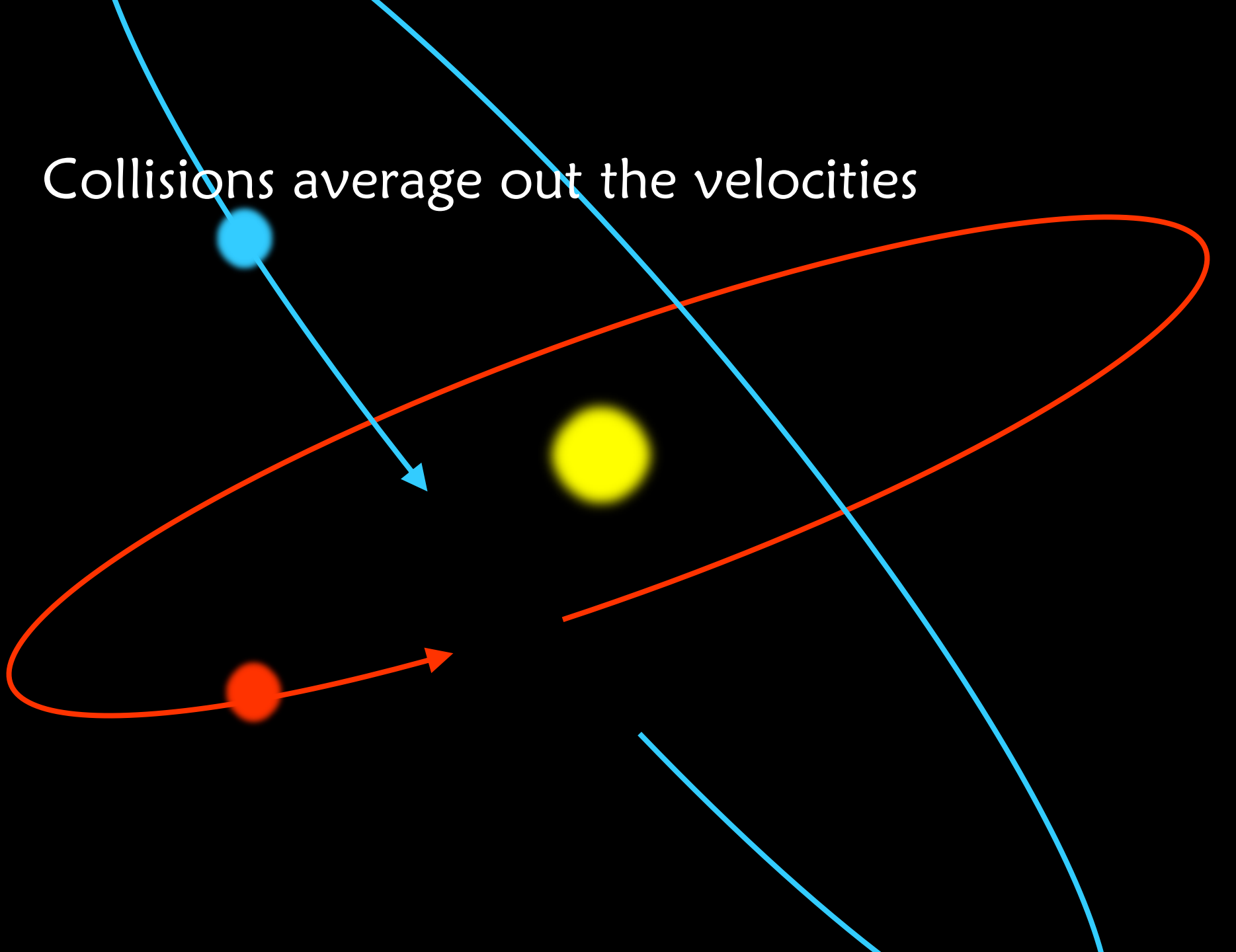
NASA/ESA/ESO (Robberto & Ricci)

NASA/ESA/ESO (Robberto & Ricci)

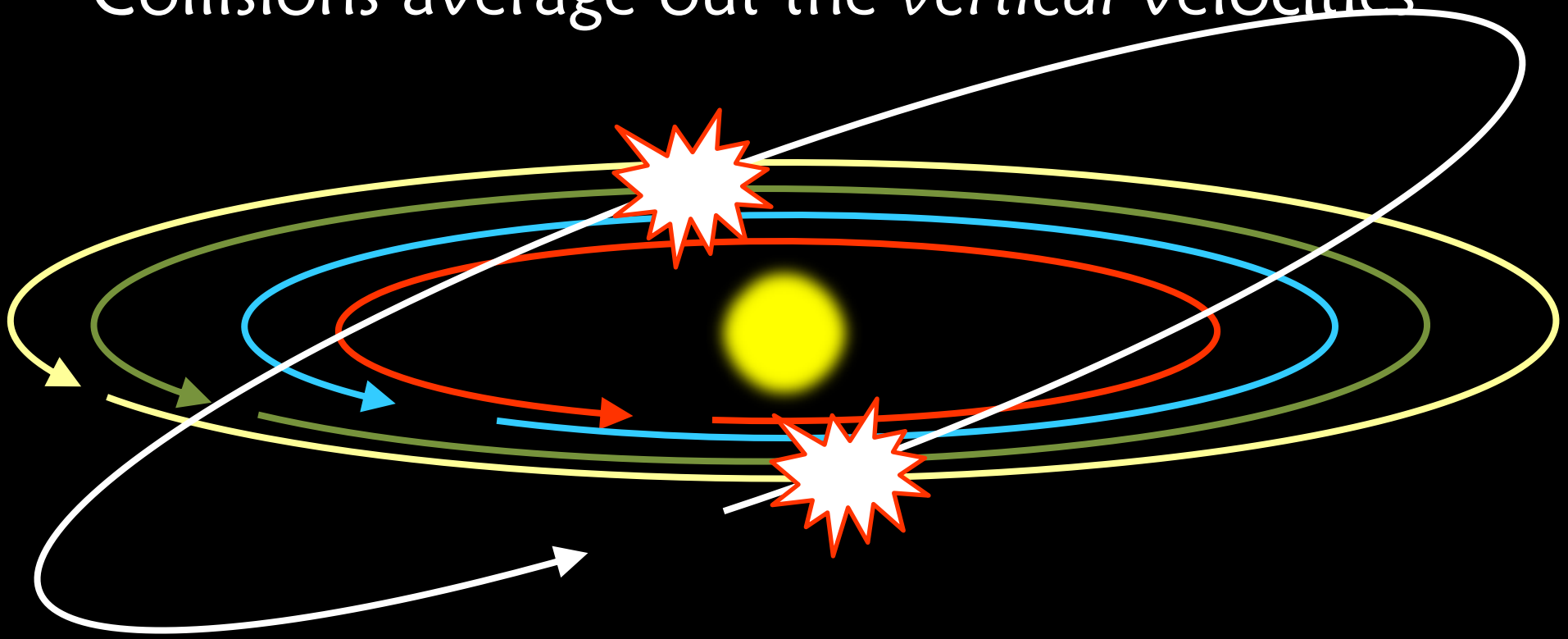


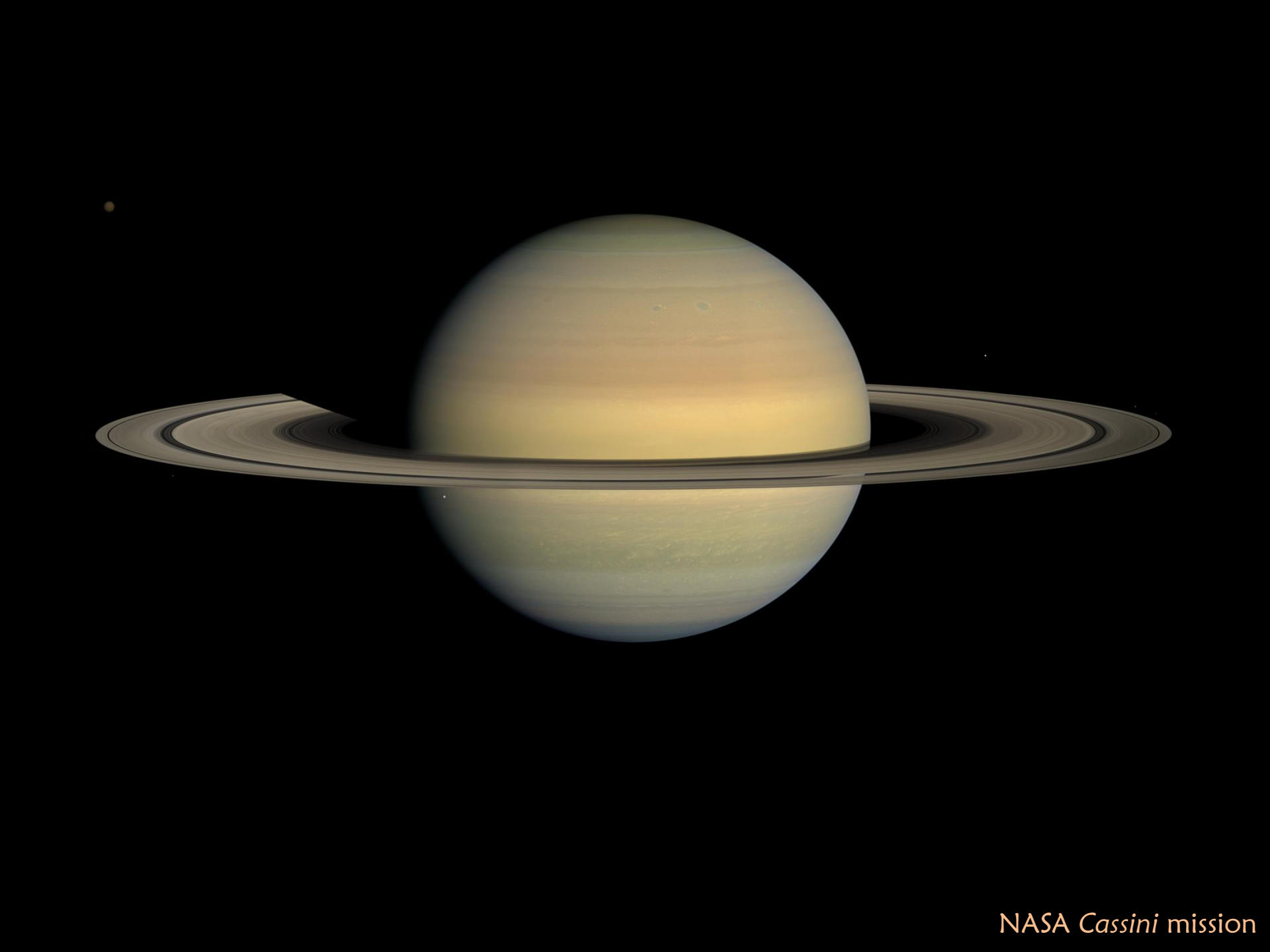


Collisions average out the velocities



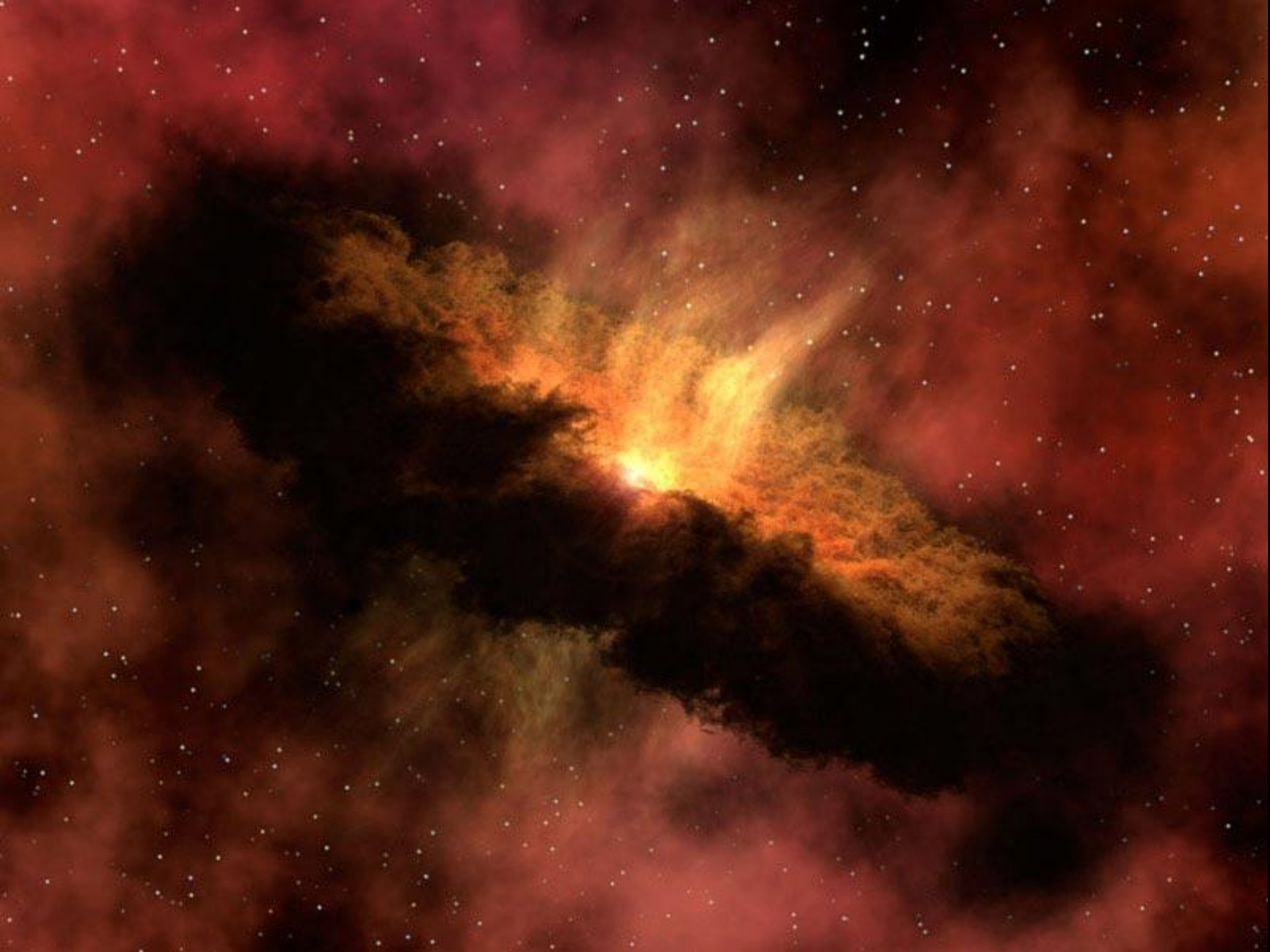
Collisions average out the *vertical* velocities

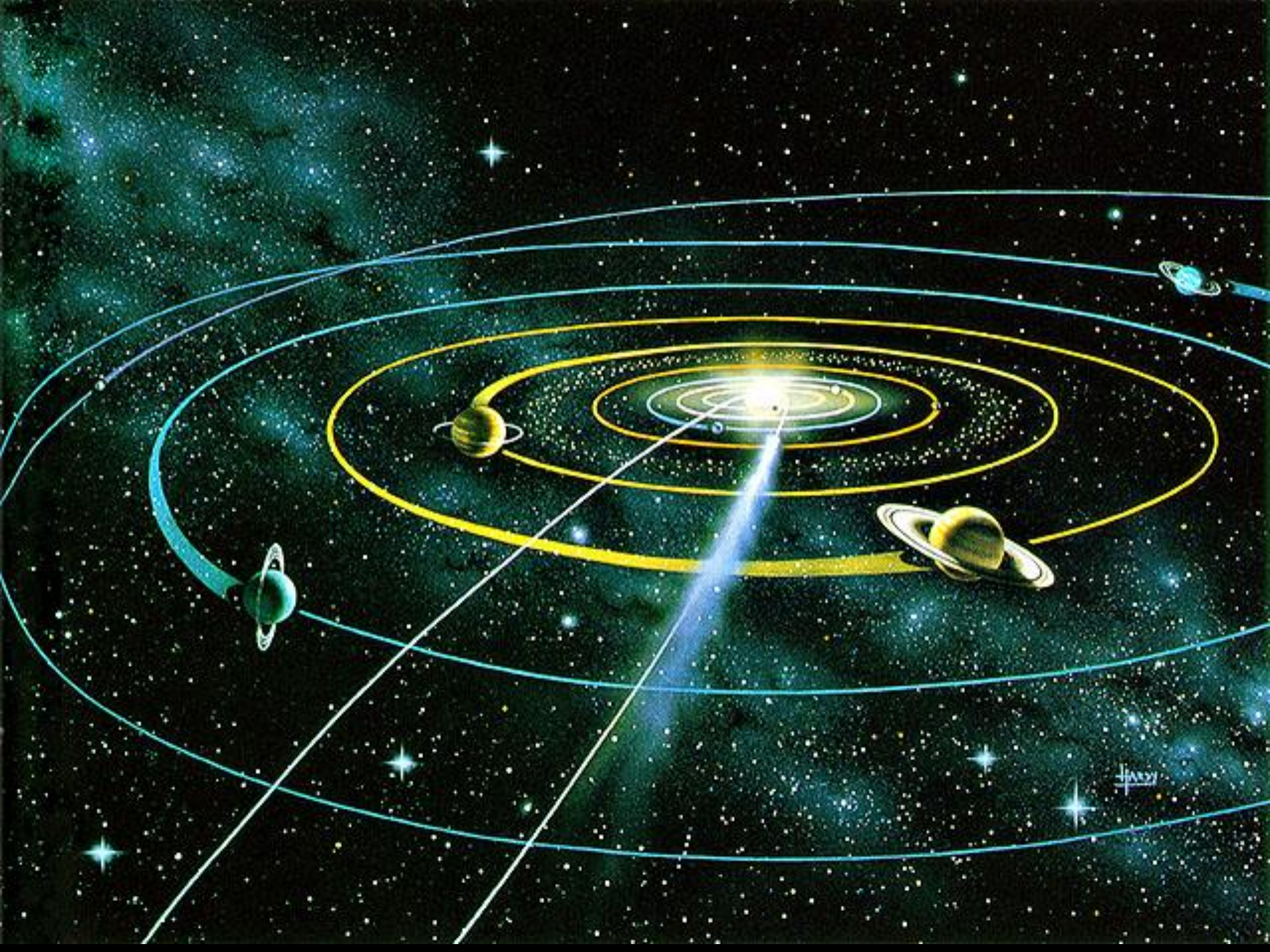


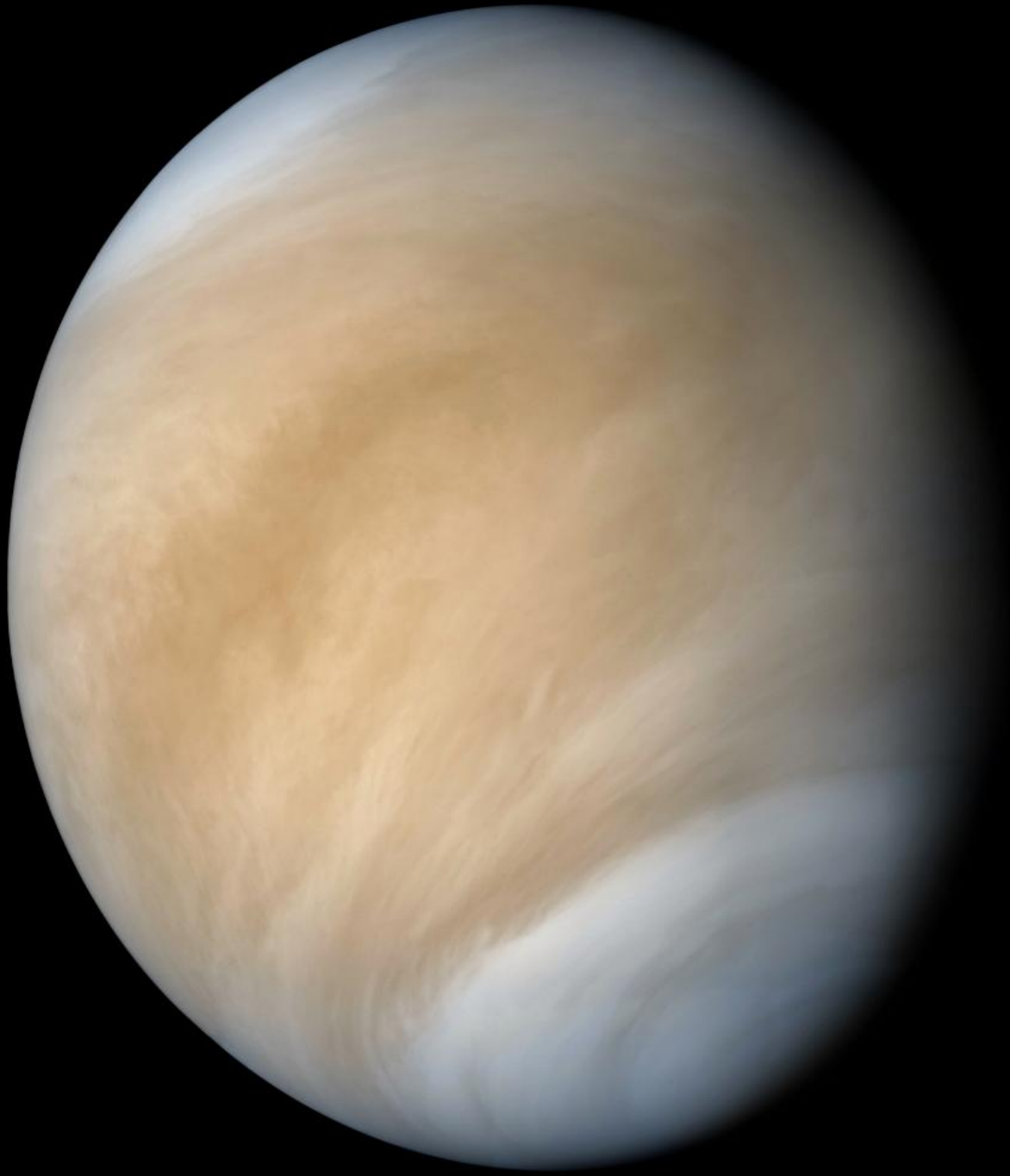

NASA *Cassini* mission

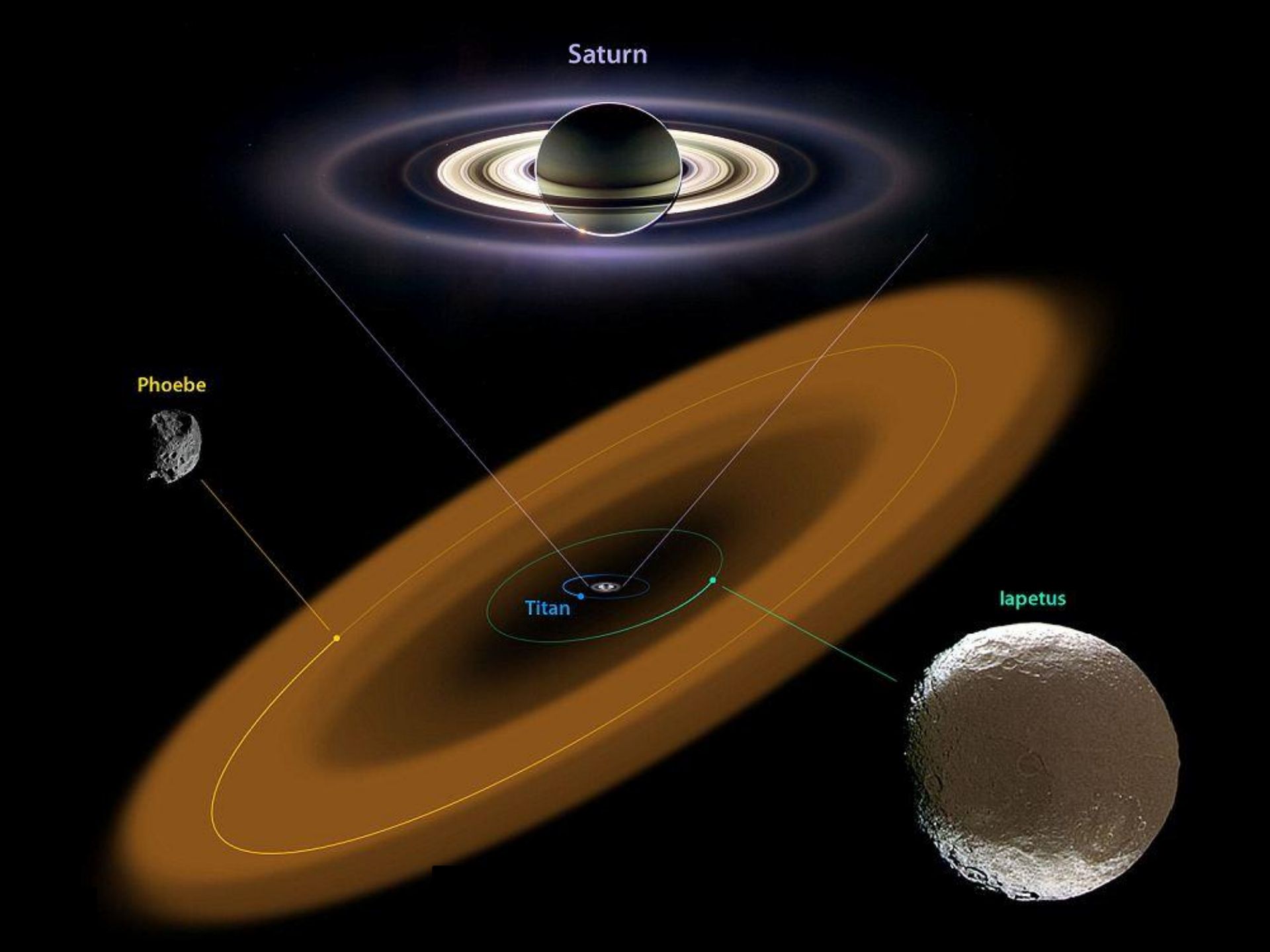
NASA/ESA/Hubble Heritage Team

NASA/ESA/ESO (Ricci)



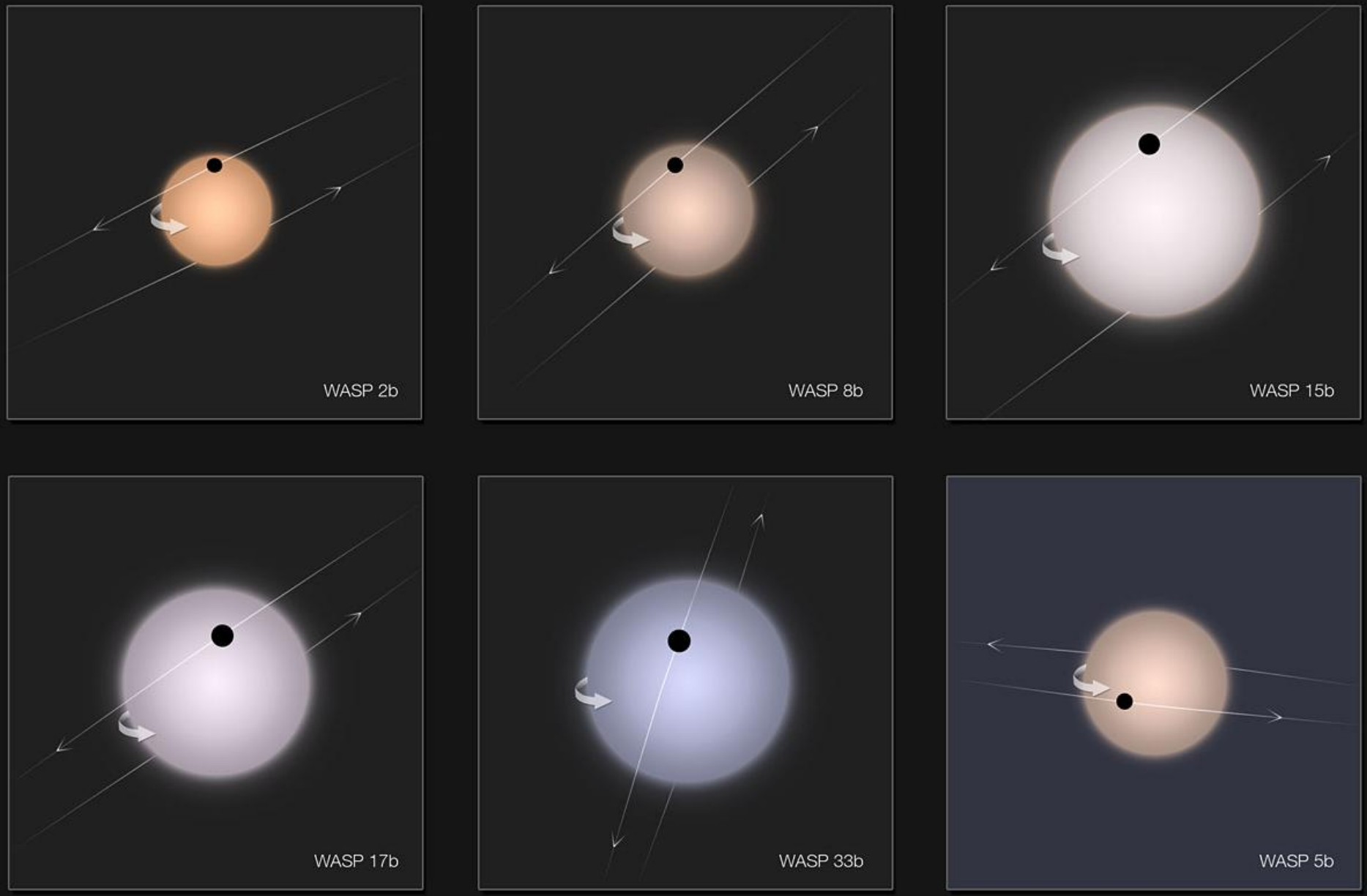




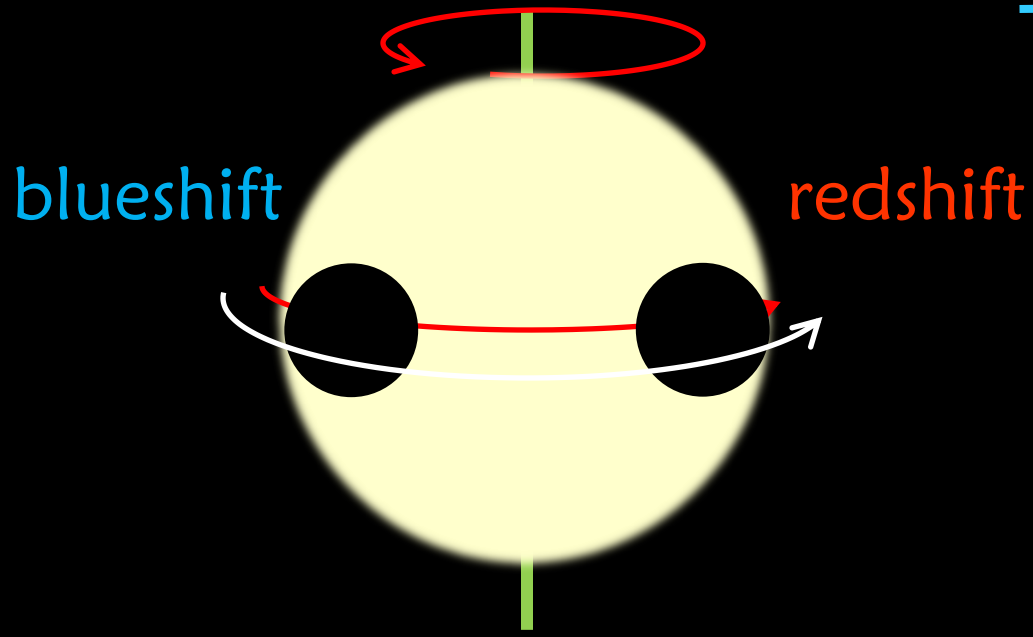

Saturn
Phoebe
Titan
Iapetus

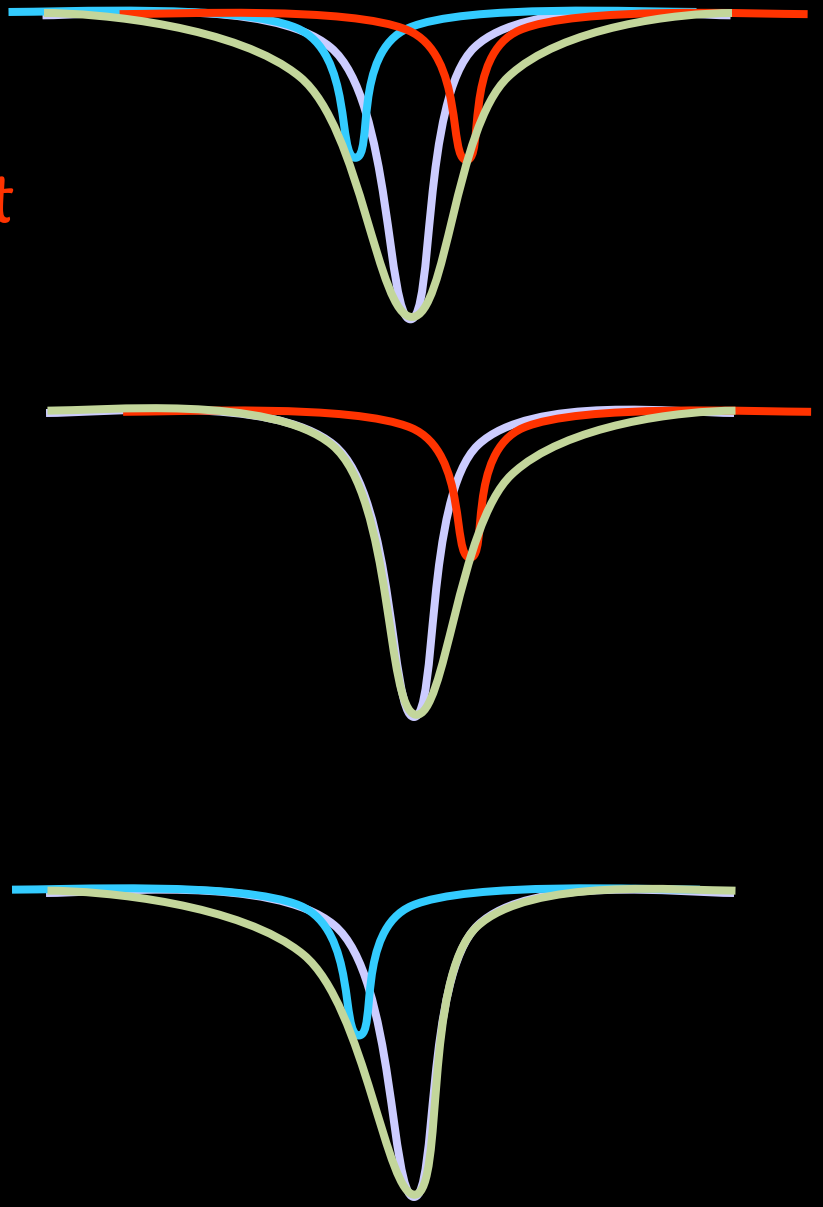
NEAR mission NASA

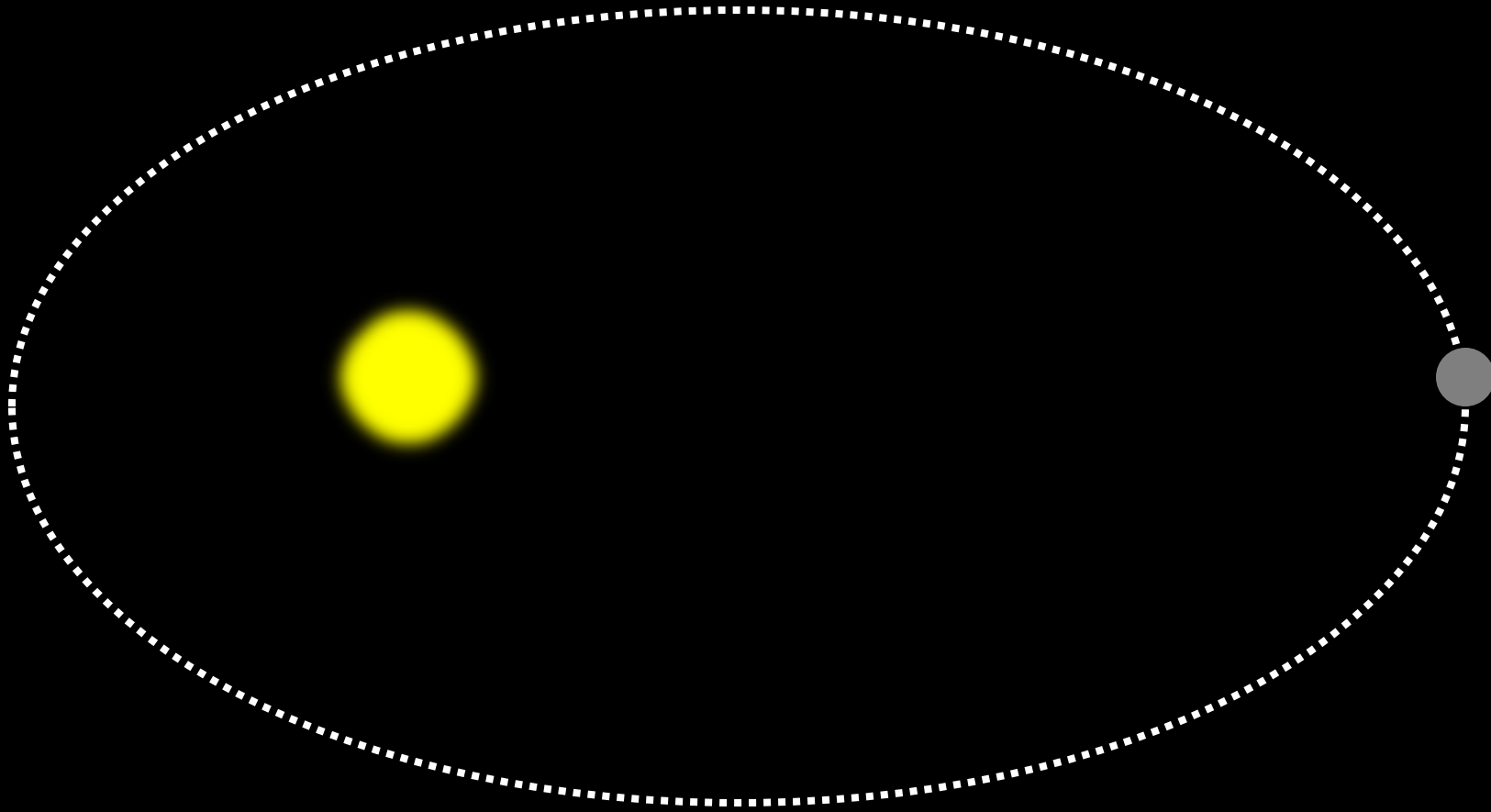
NEAR mission NASA

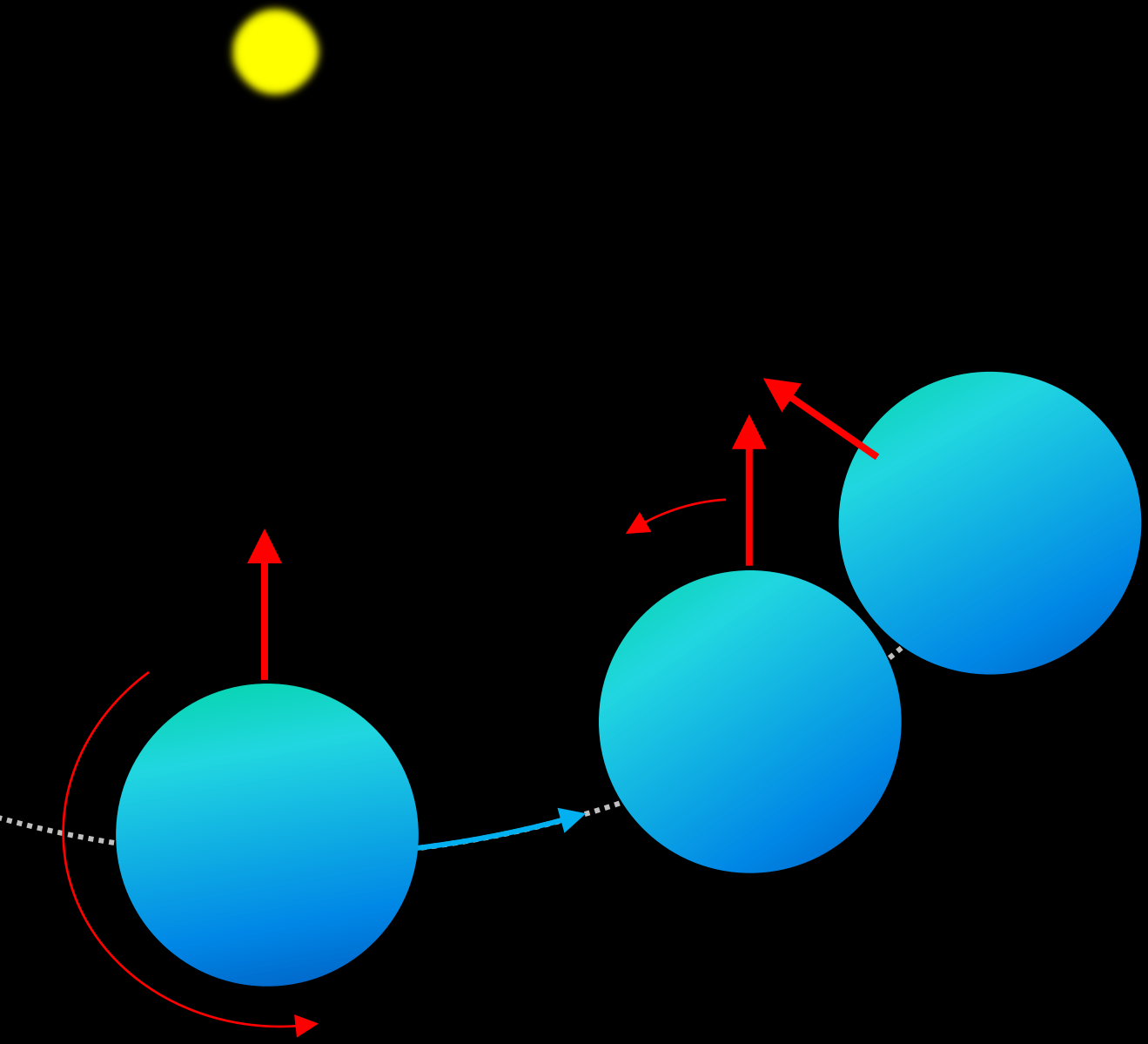


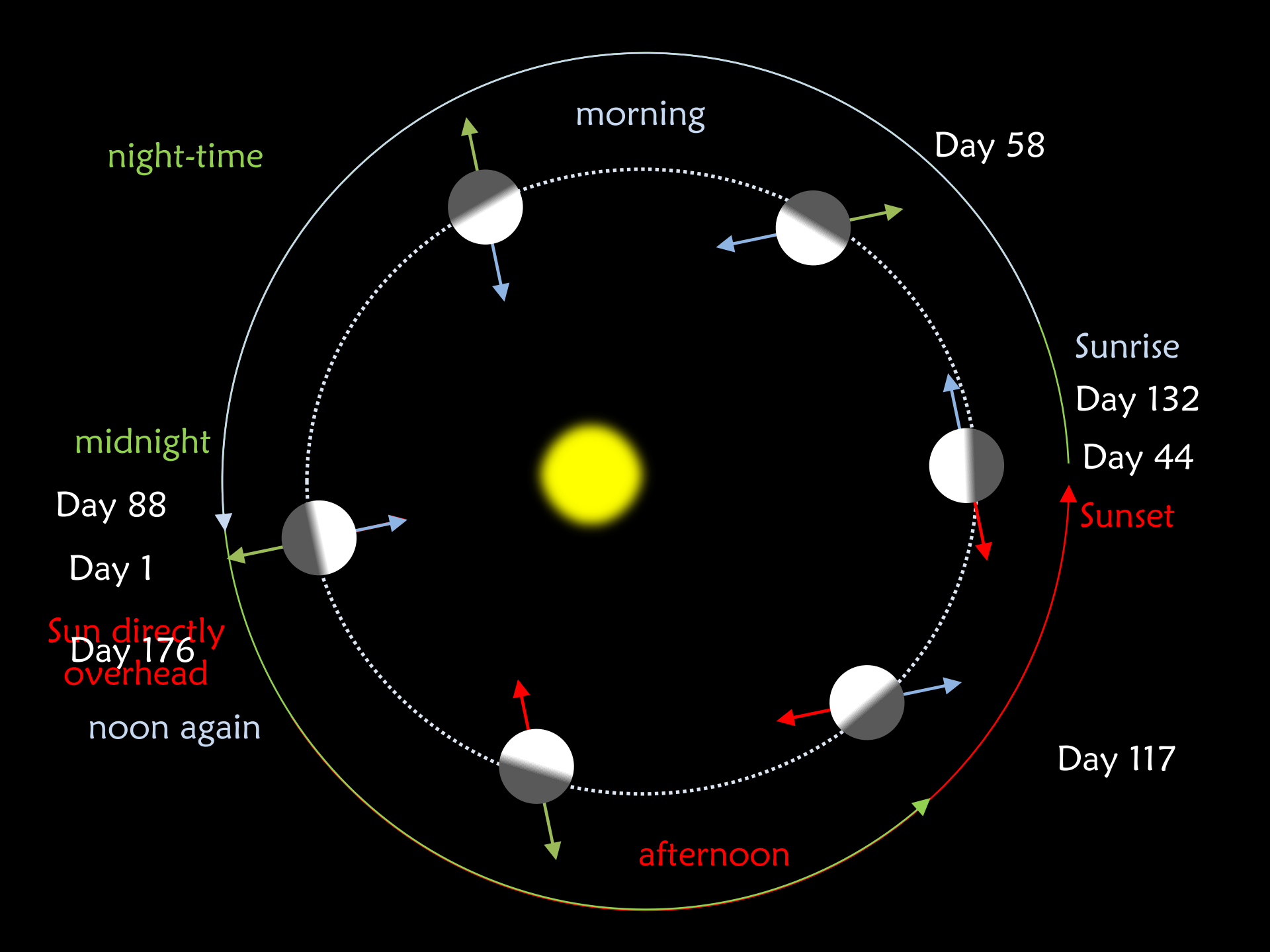
ESO/AC Cameron

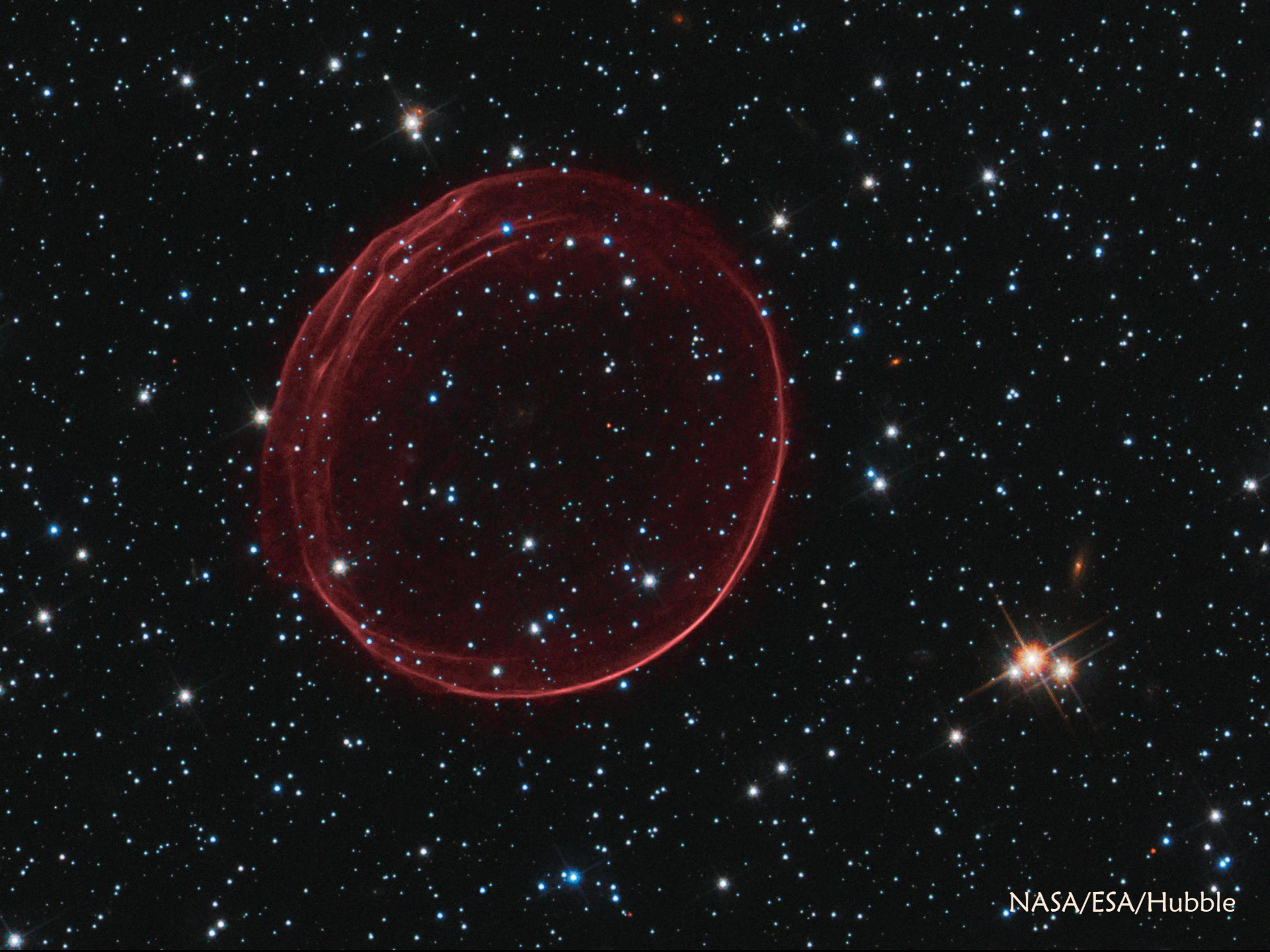

blueshift
redshift

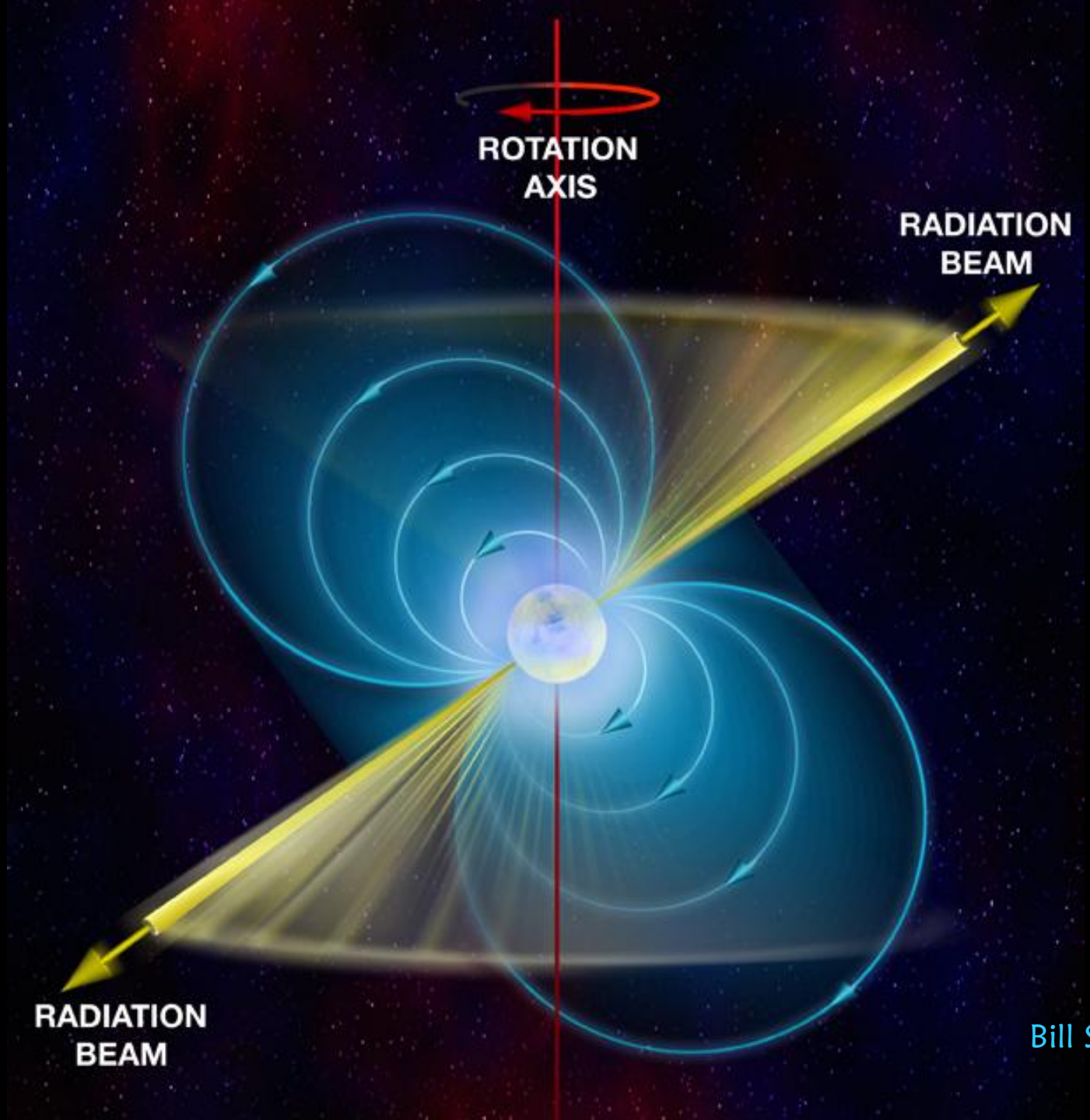




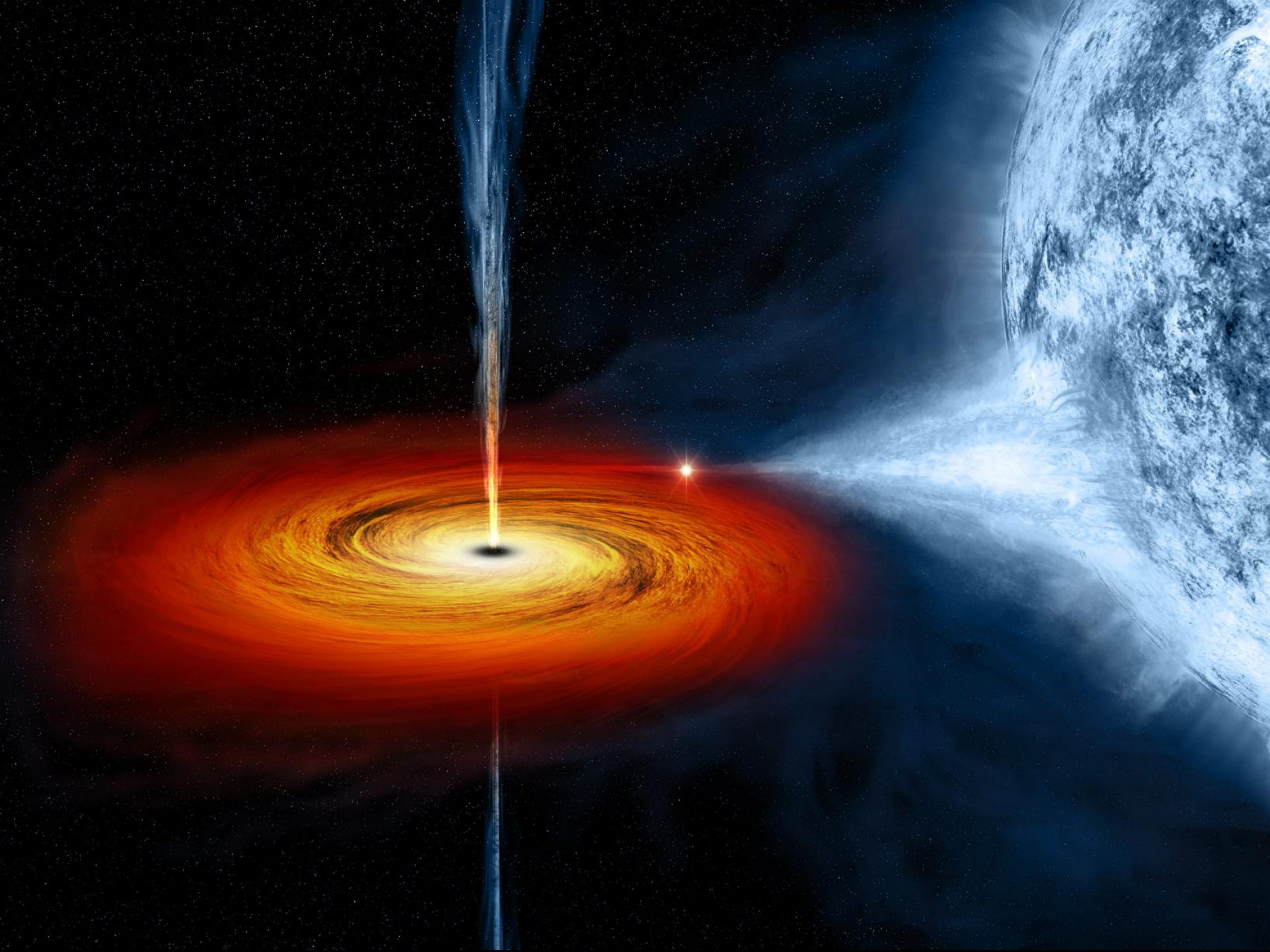


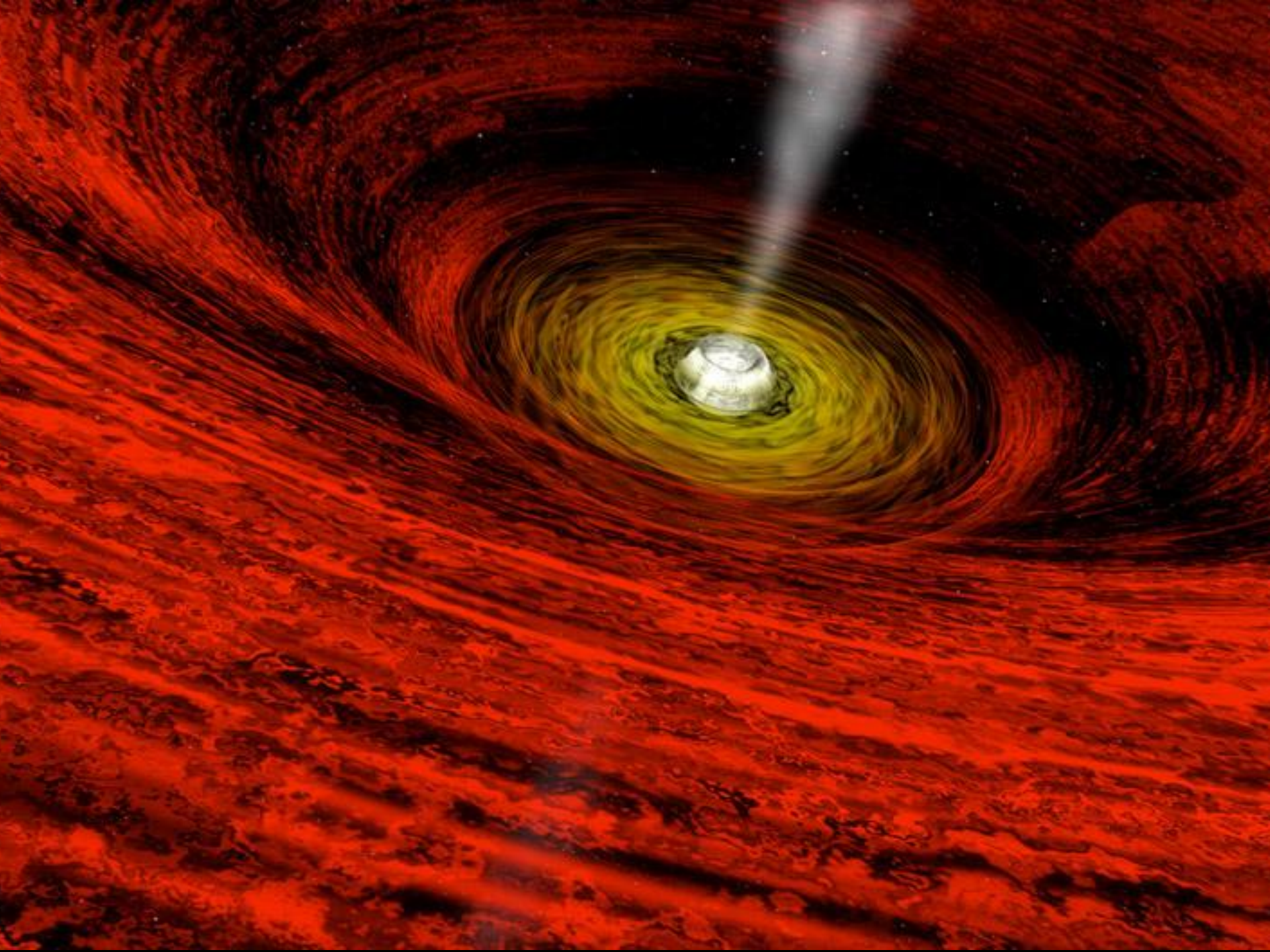

night-time
morning
Day 58
Sunrise
Day 132
Day 44
Sunset
midnight
Day 88
Day 1
Sun directly overhead
Day 176
noon again
Day 117
afternoon

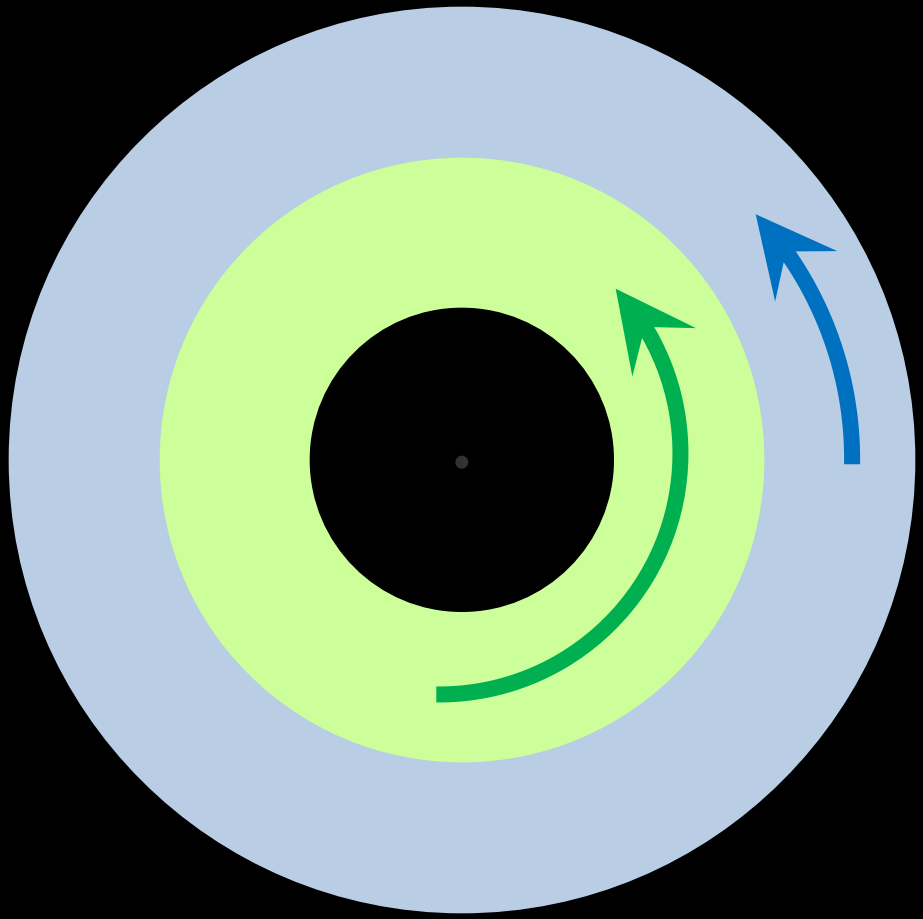

NASA/ESA/Hubble

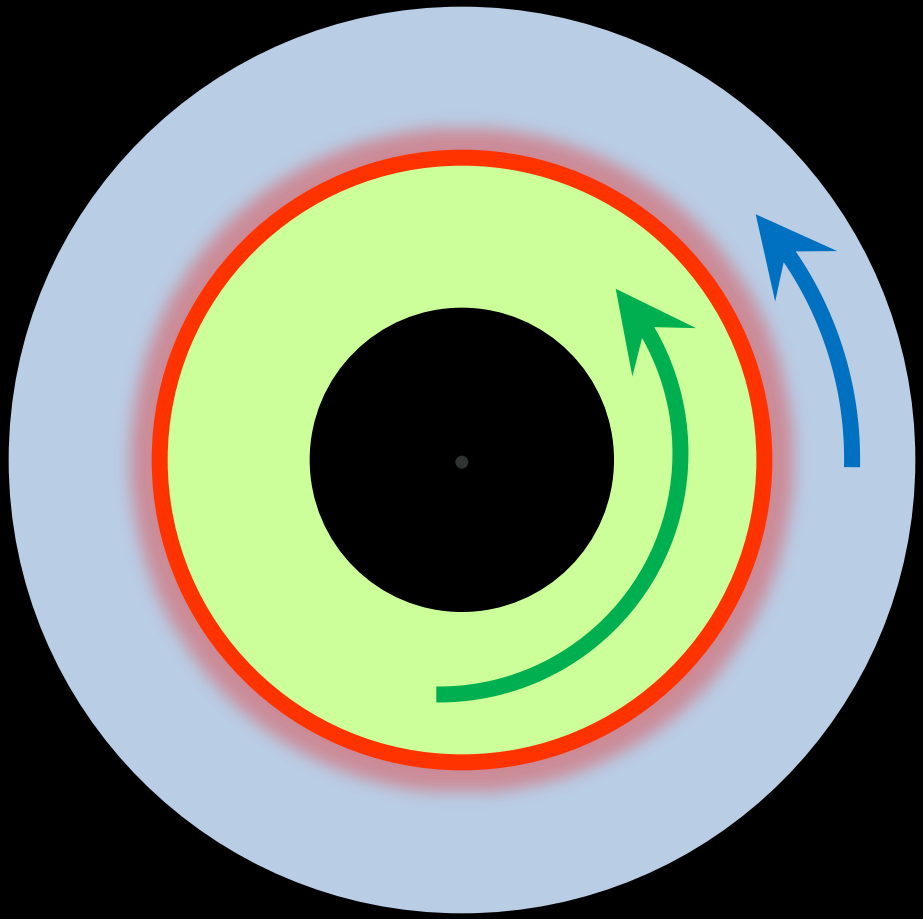


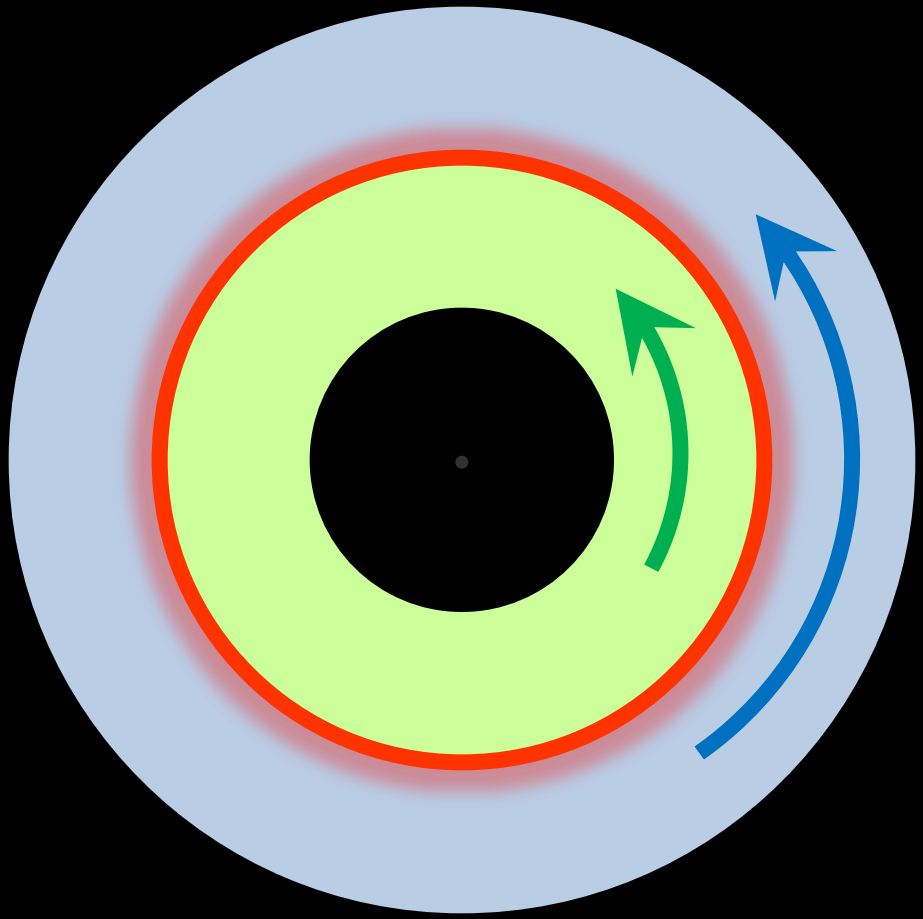
Bill Saxton, NRAO/AUI/NSF



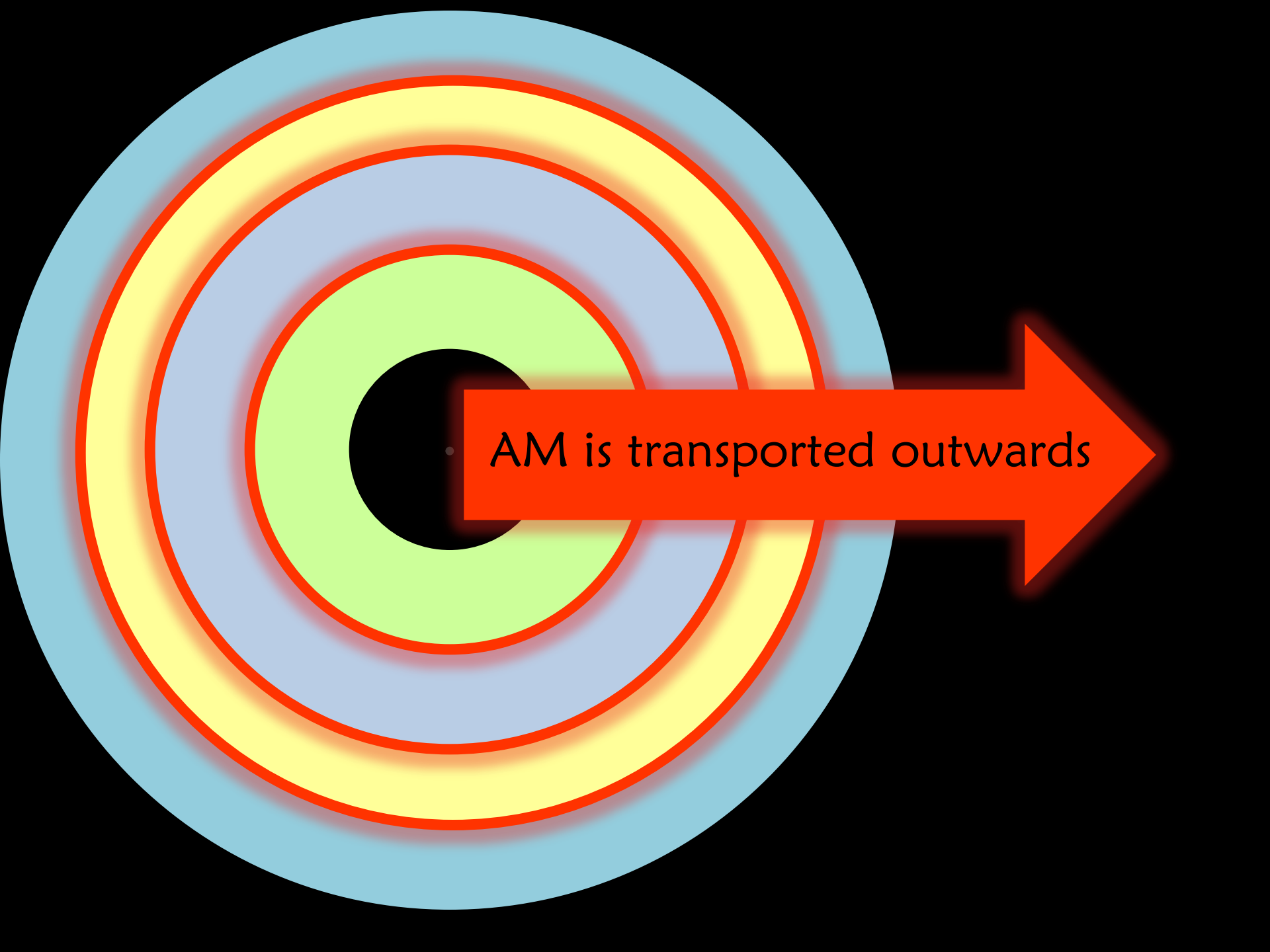


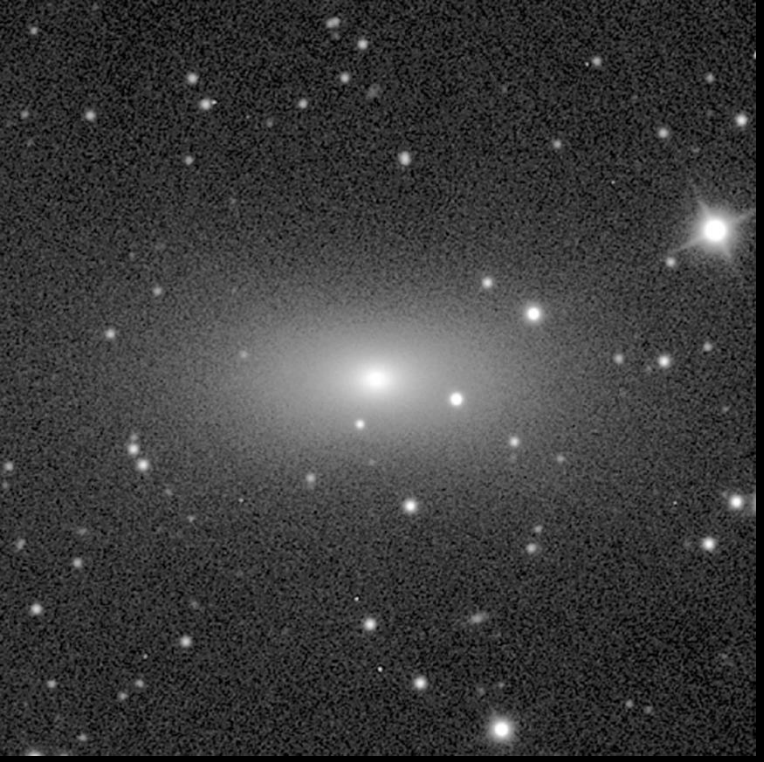


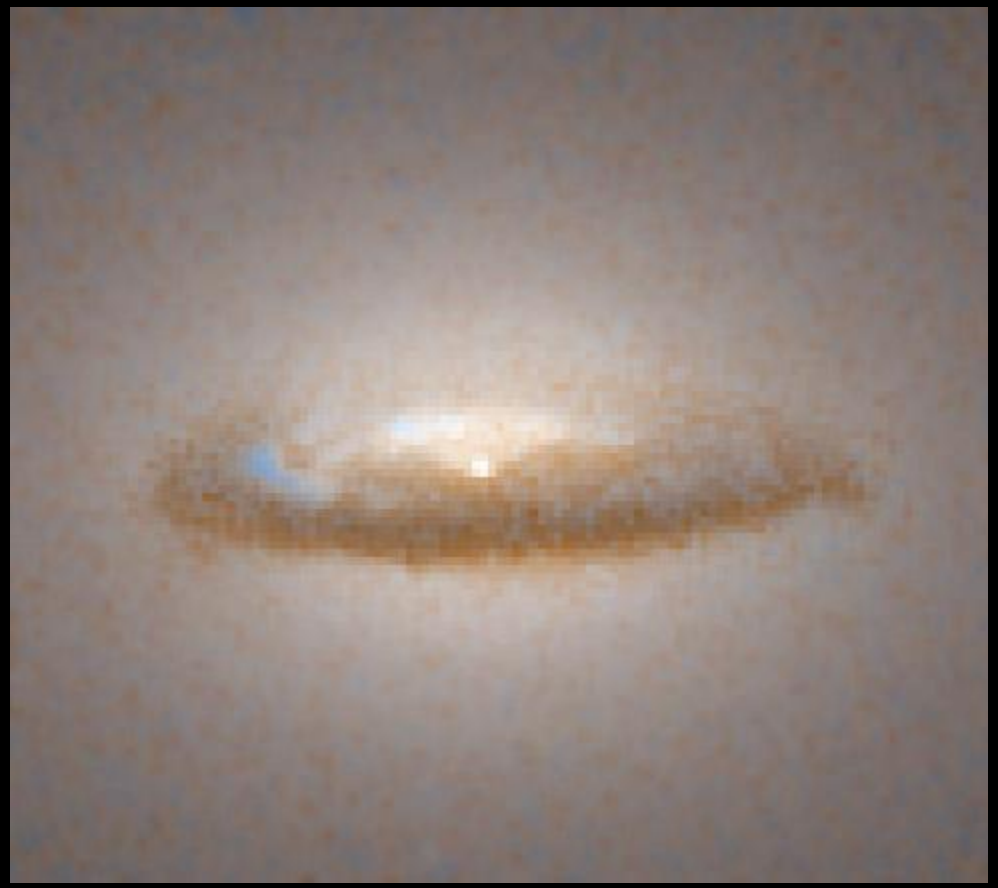




mass x rotational rate x radius^2

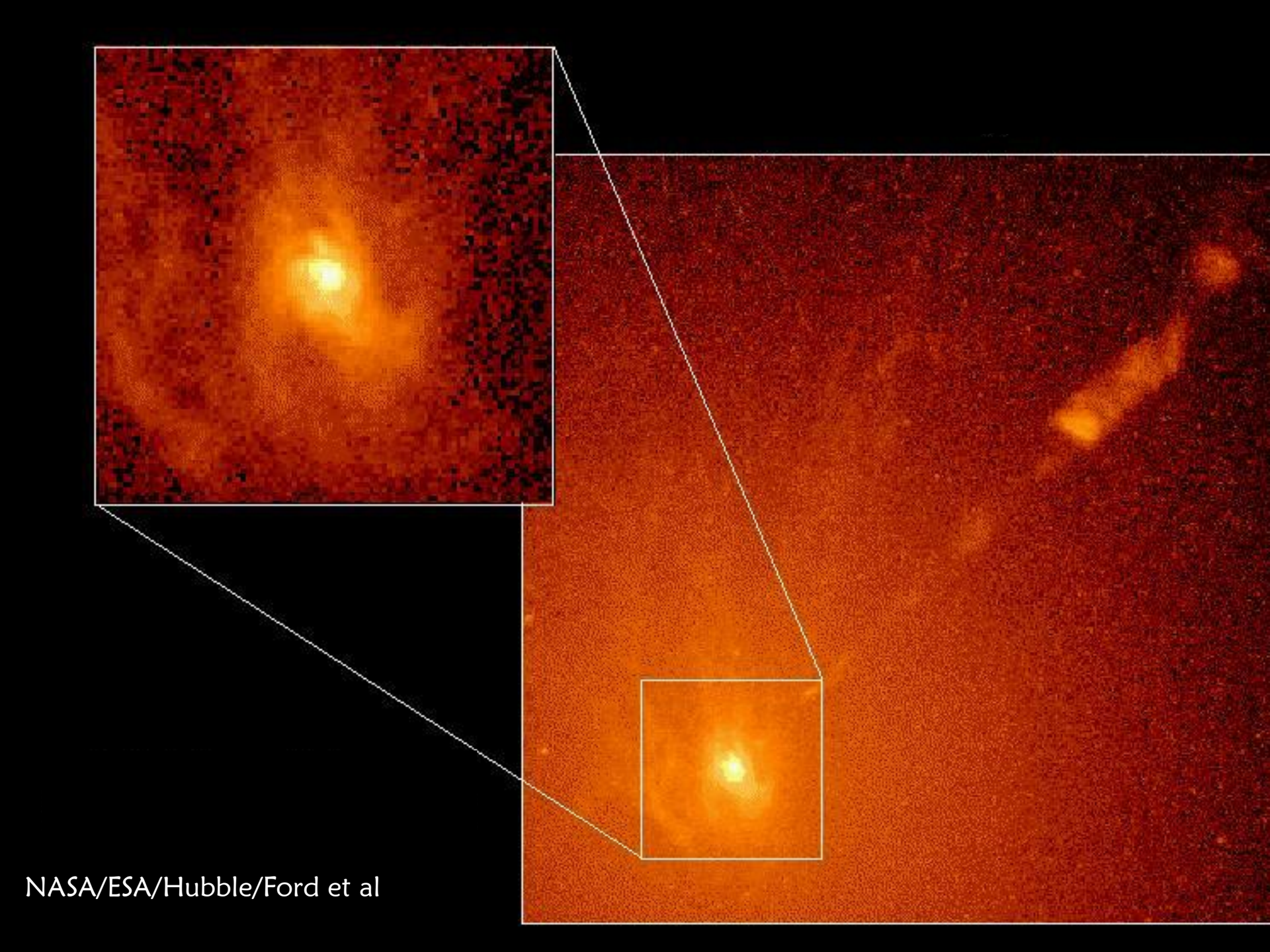

AM is transported outwards



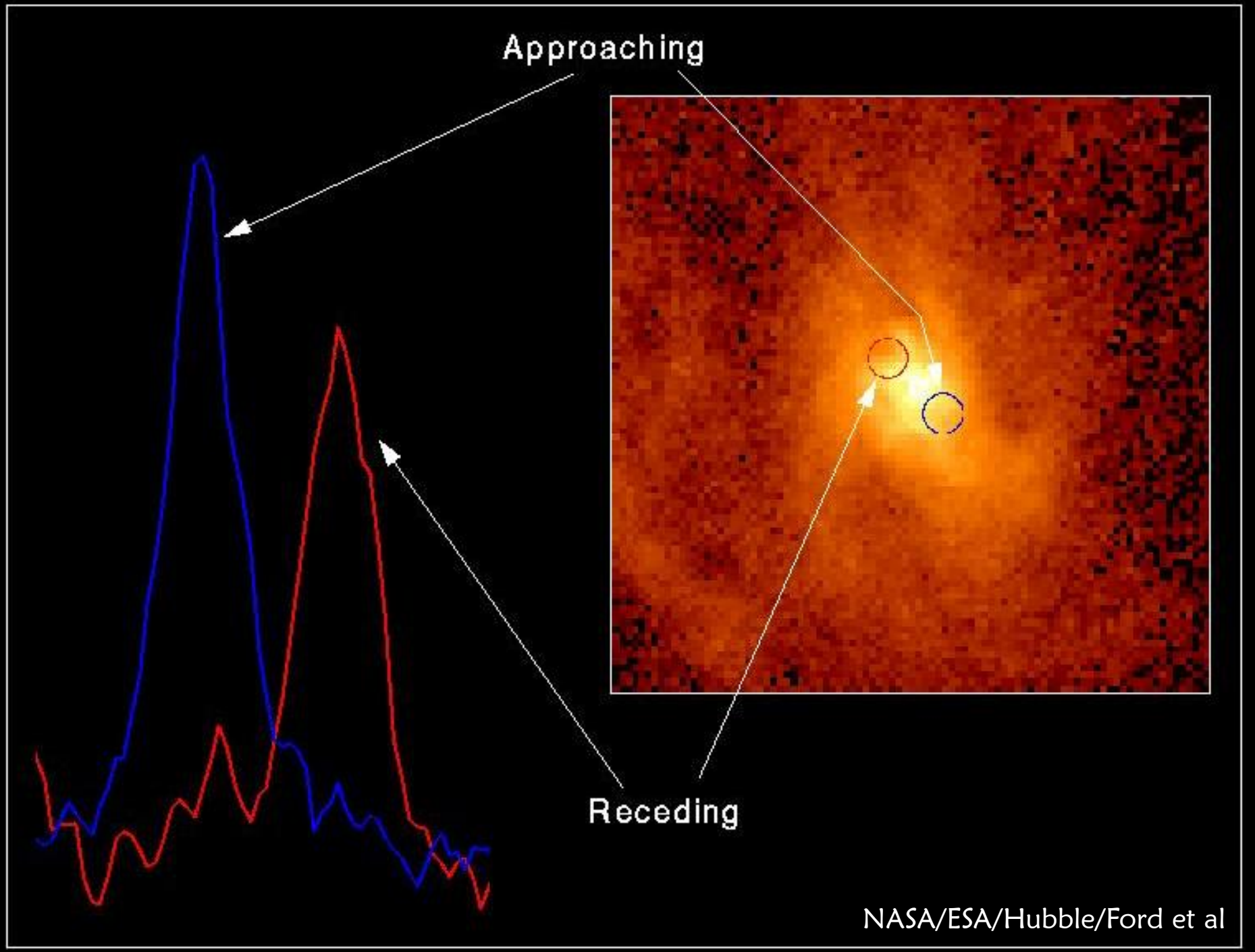


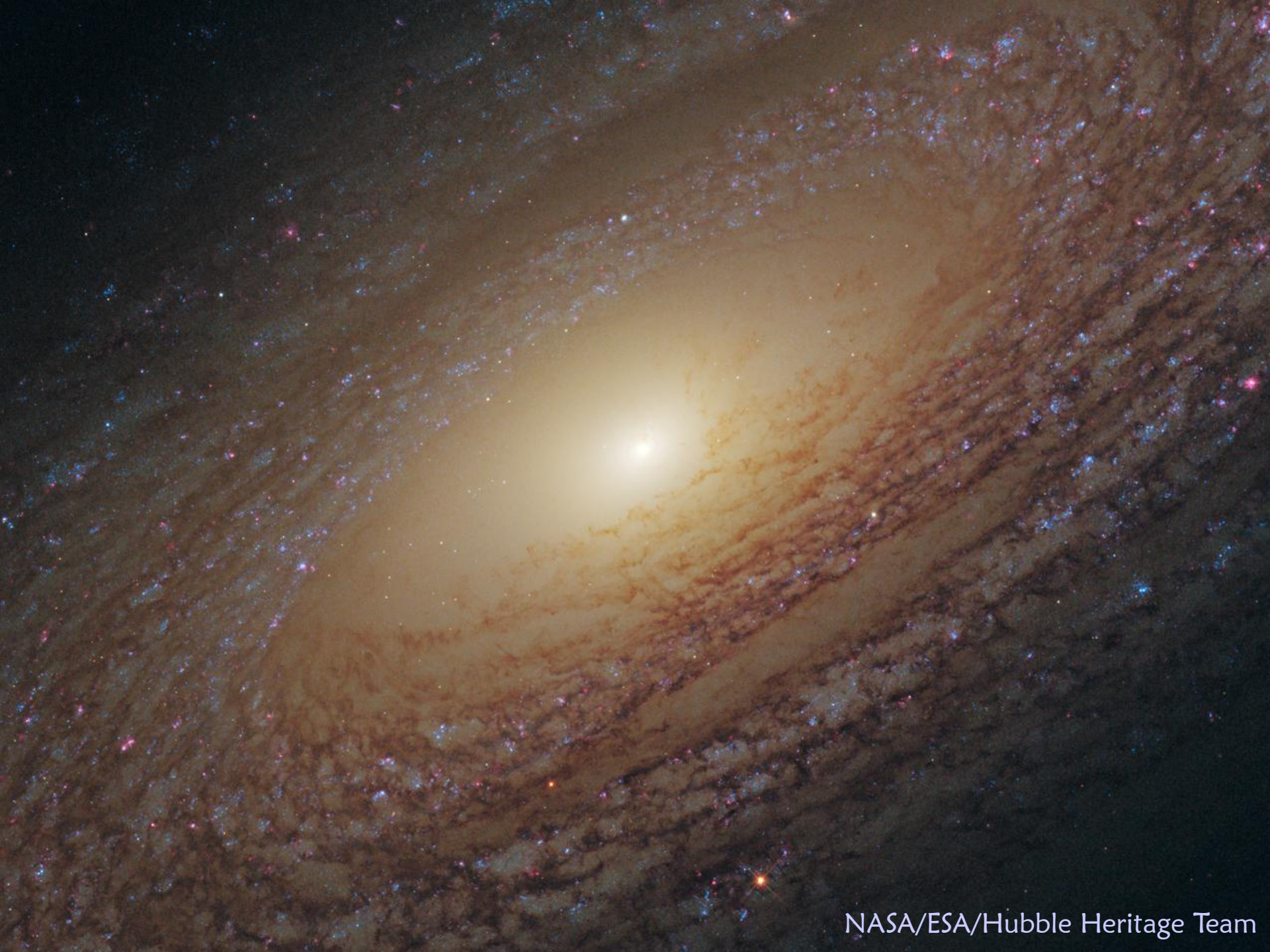
NASA/Hubble/van der Marel/van den Bosch


NASA/ESA/Hubble

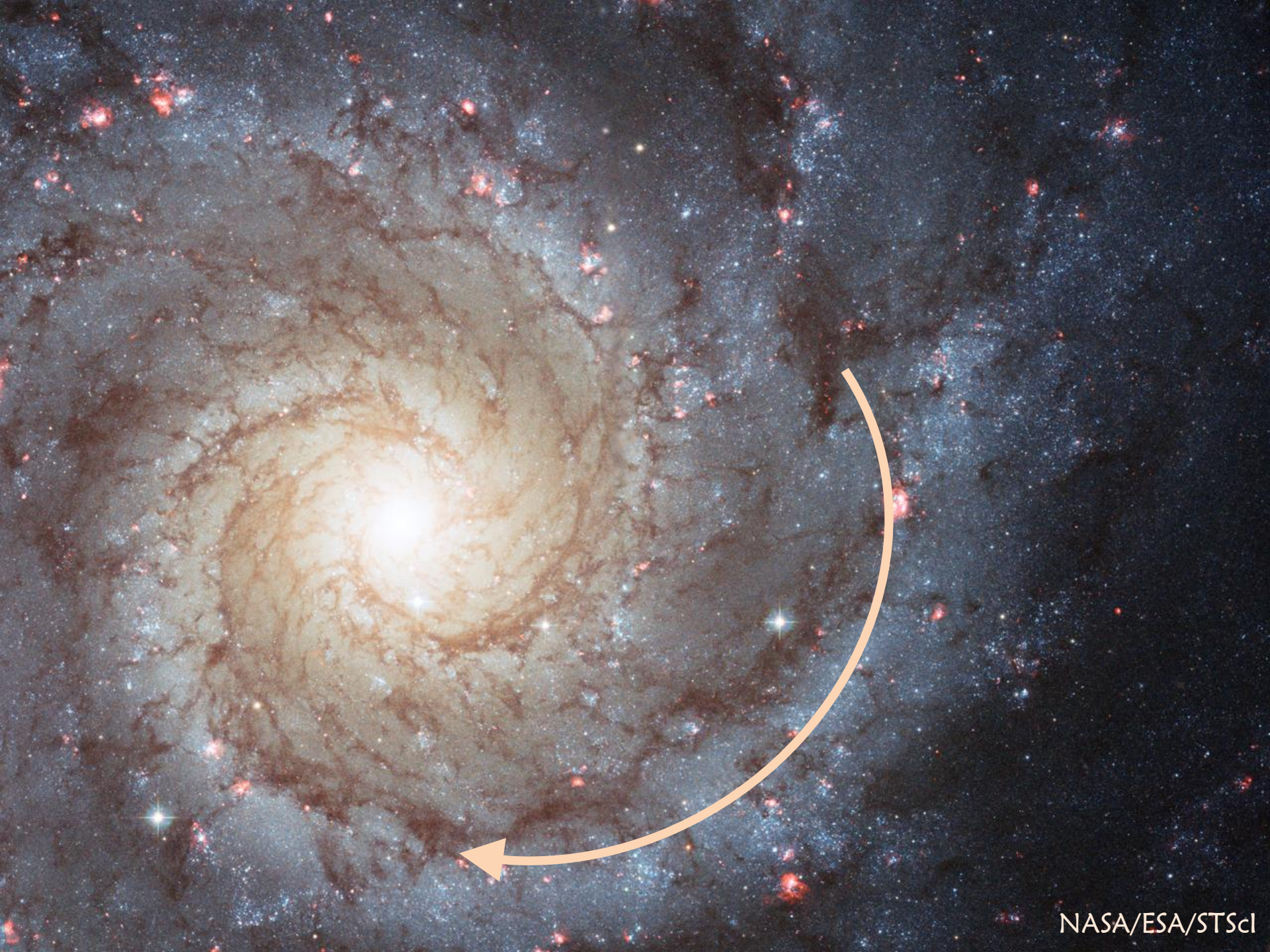


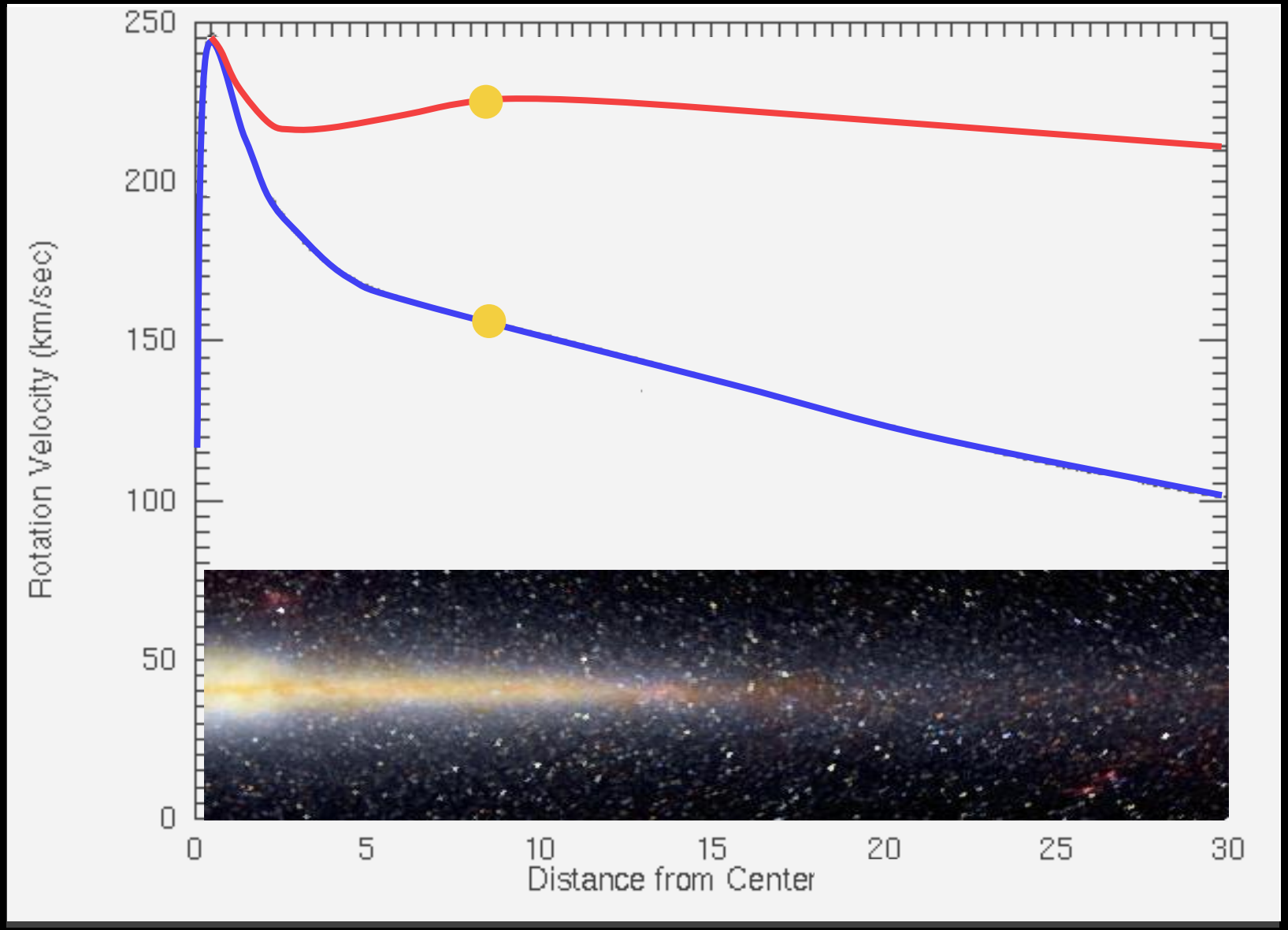
NASA/ESA/Hubble/Ford et al


Approaching
Receding
NASA/ESA/Hubble/Ford et al

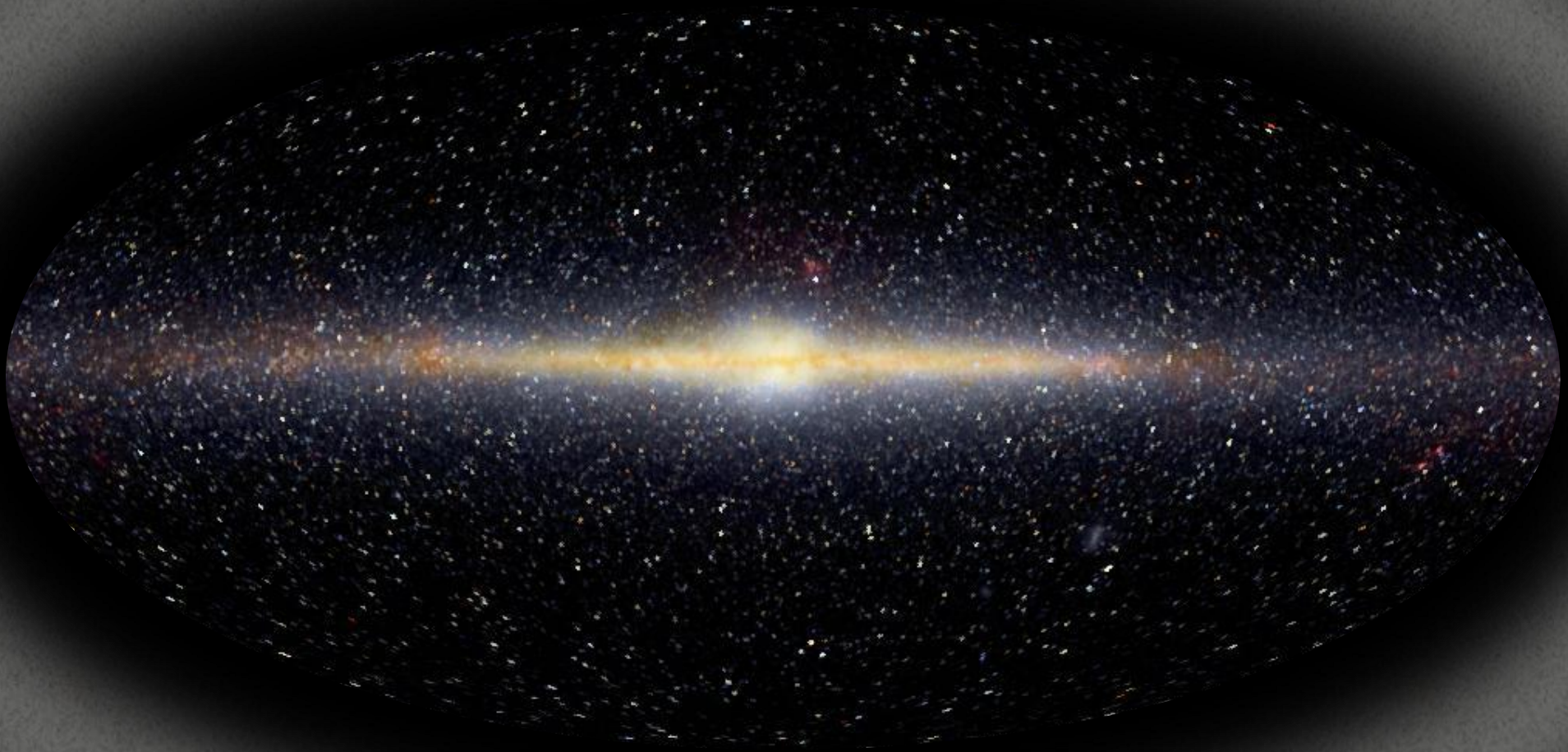

NASA/ESA/Hubble Heritage Team


NASA/ESA/STScI


NASA/ESA/STScI


250
200
150
100
50
0
Rotation Velocity (km/sec)
0
5
10
15
20
25
30
Distance from Center

Dark Matter



Clusters of Galaxies

Wednesday 7th March 2012 1pm