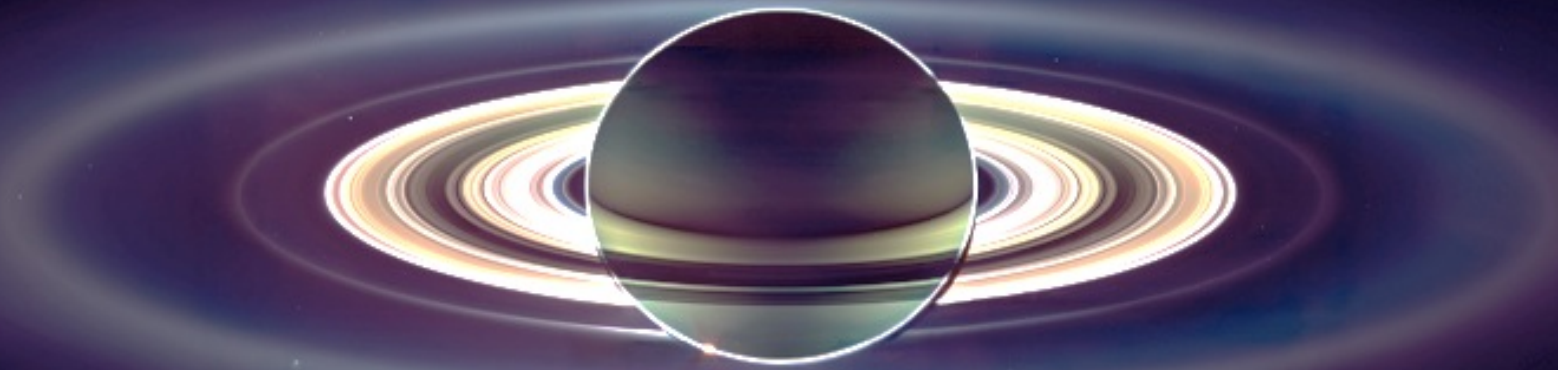
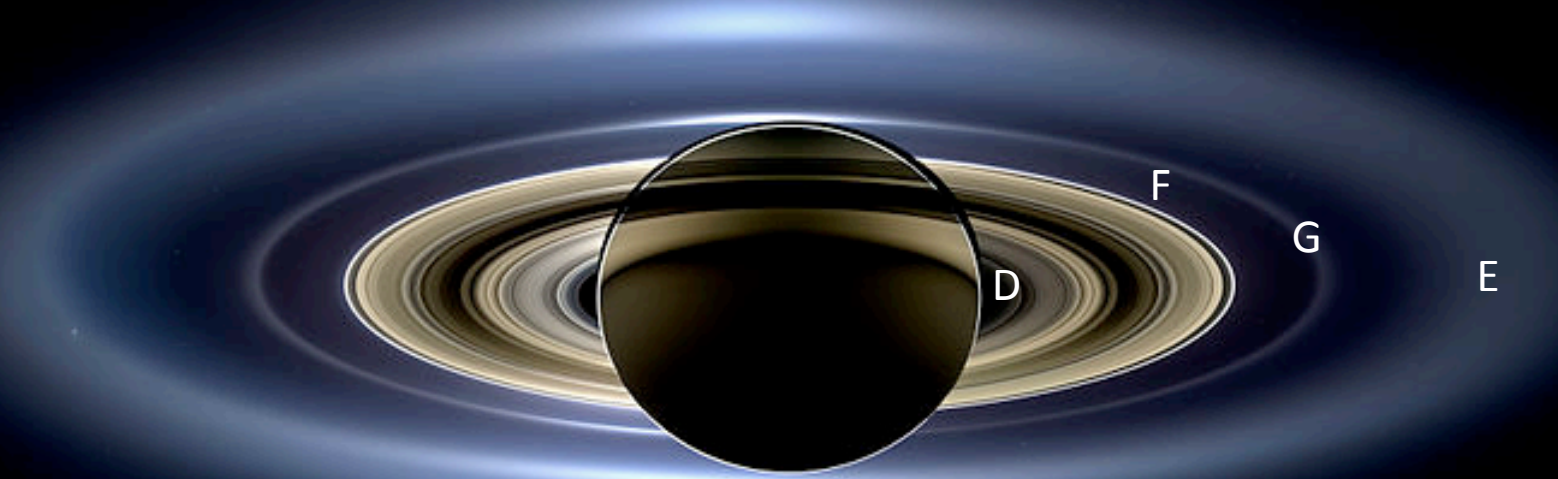


A Few New Things in Saturn's D Ring

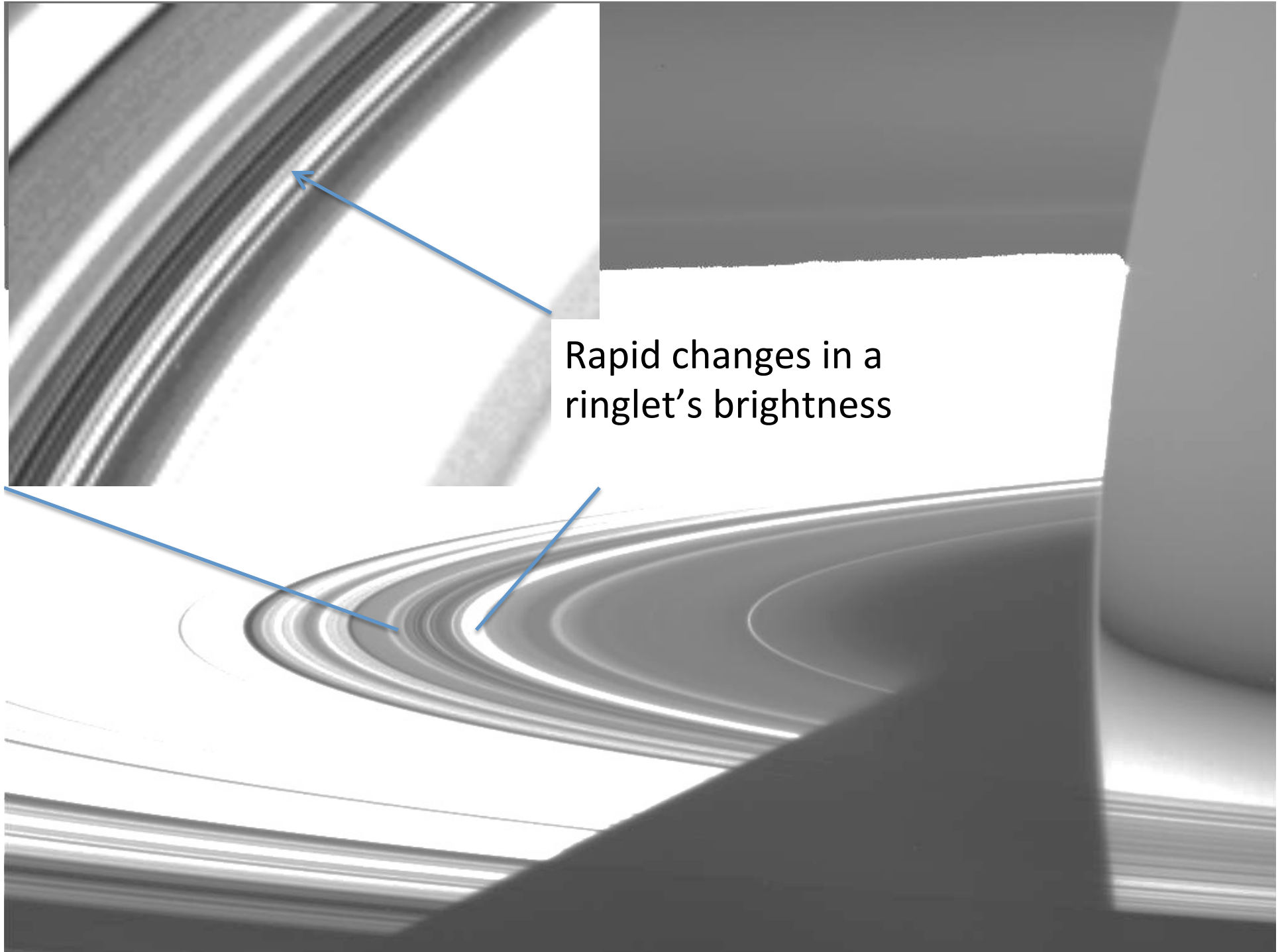
M.M. Hedman, J.A. Burns, Z. Pontrantolfi, P.D. Nicholson, M.S. Tiscareno



2006



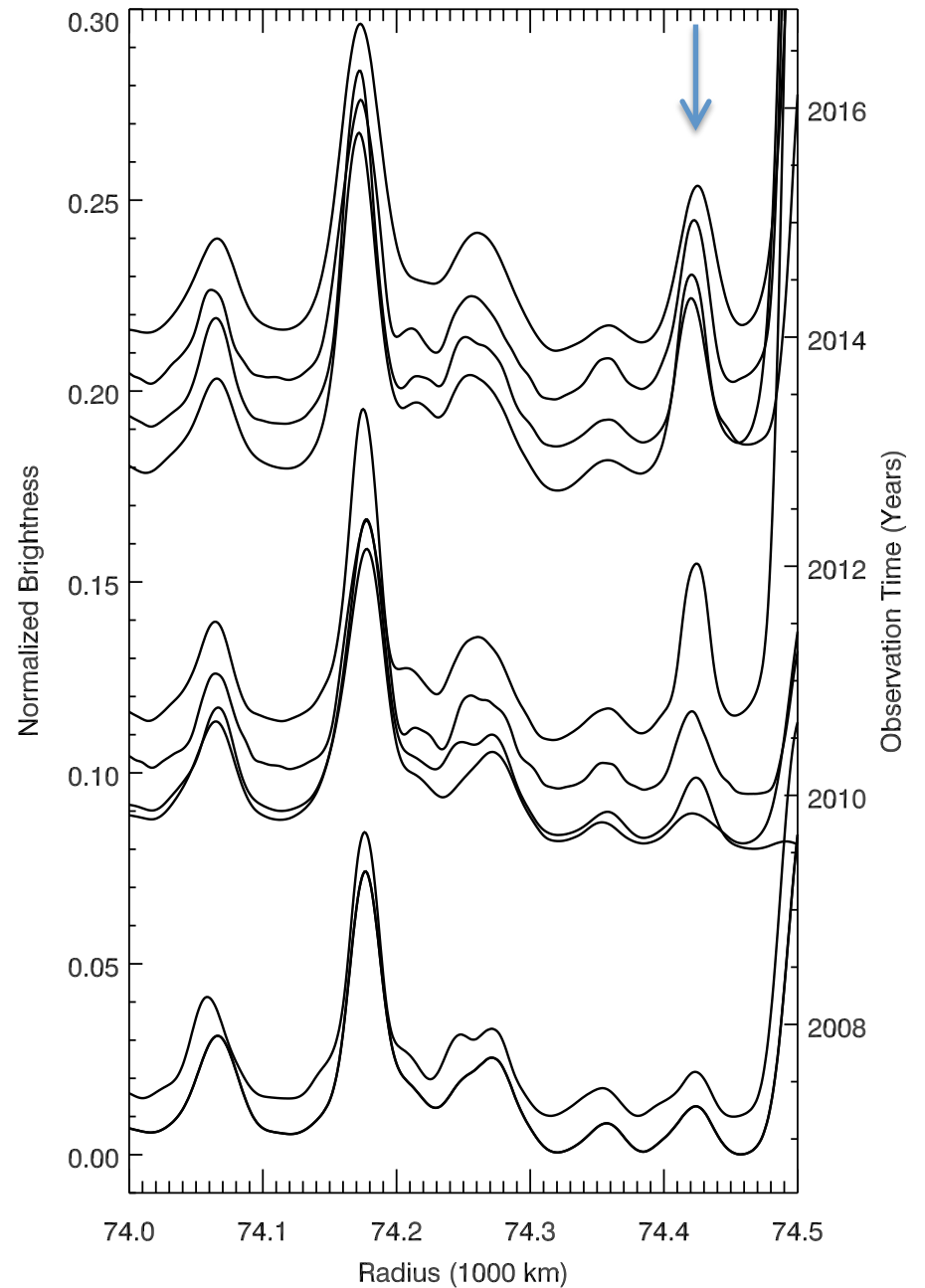
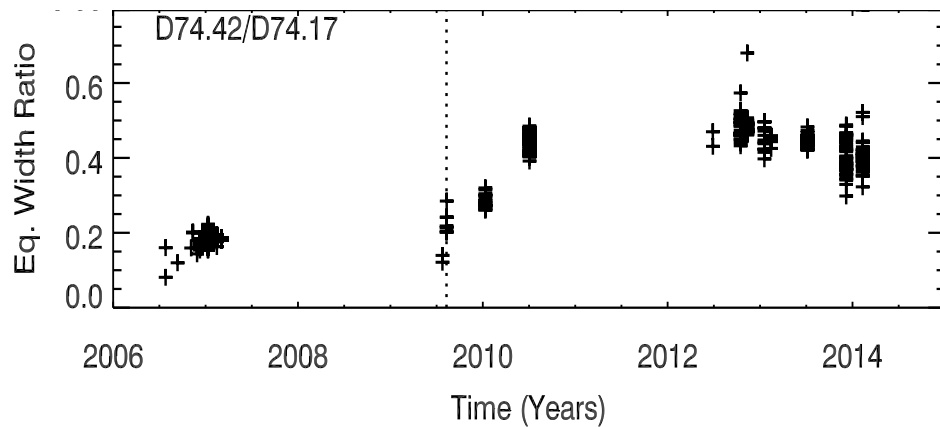
2013

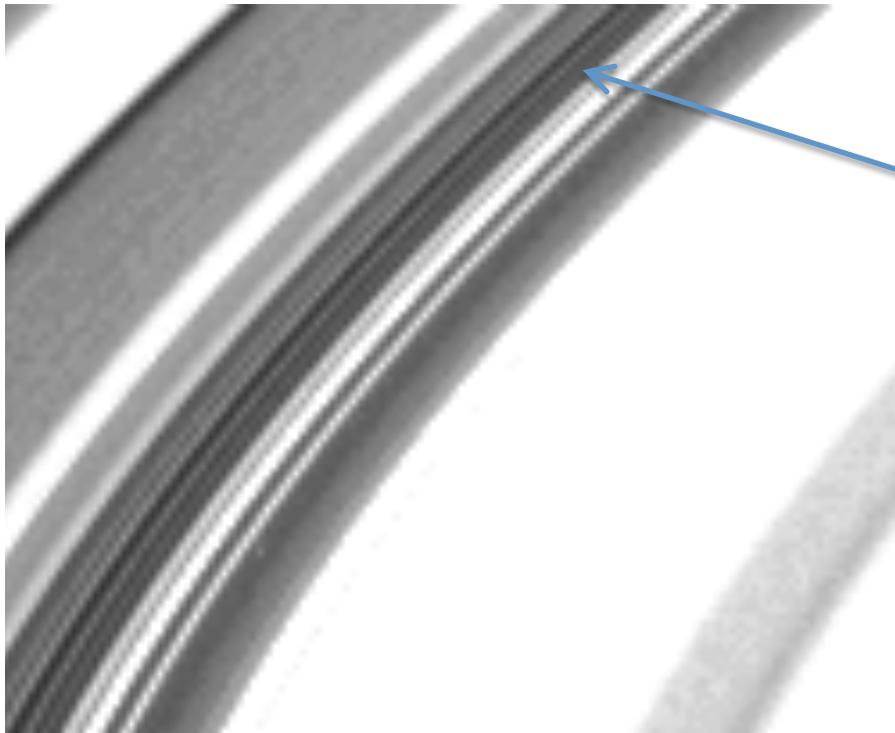


Rapid changes in a ringlet's brightness

• After equinox, the outermost ringlet's brightness changes by about a factor of 3 relative to other dusty ringlets in this region

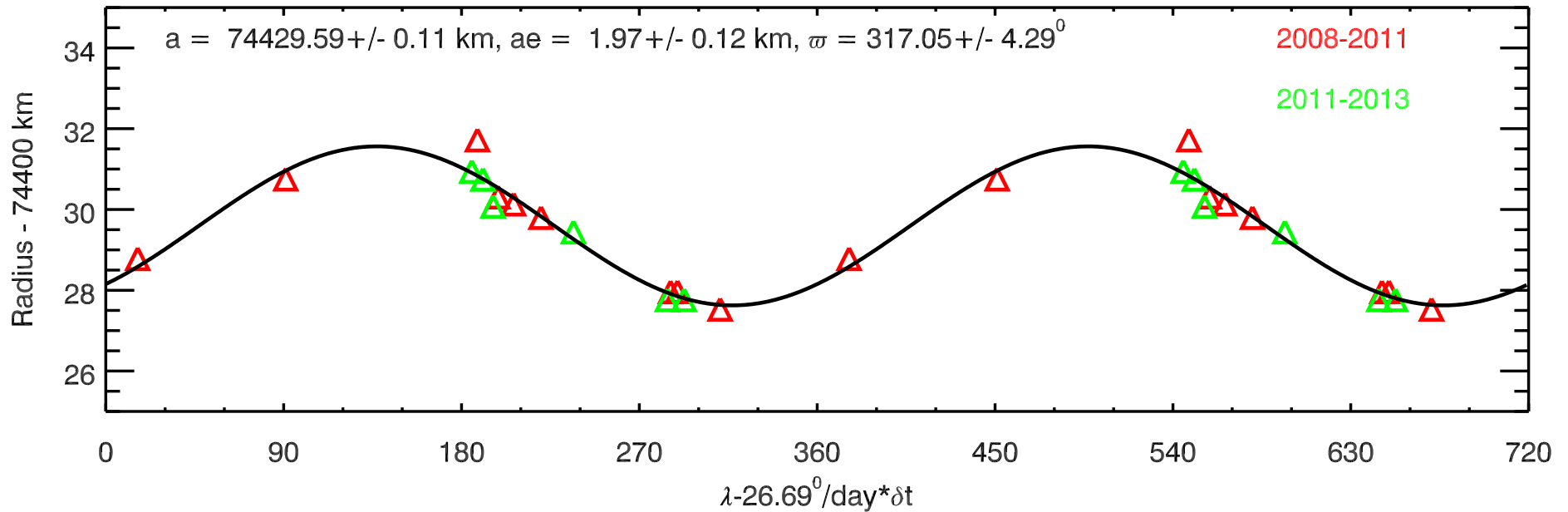
Credit: Z. Pontrantolfi
(Western Washington)





The outermost ringlet in the D ring is unusual in that it appears consistently in occultation data.

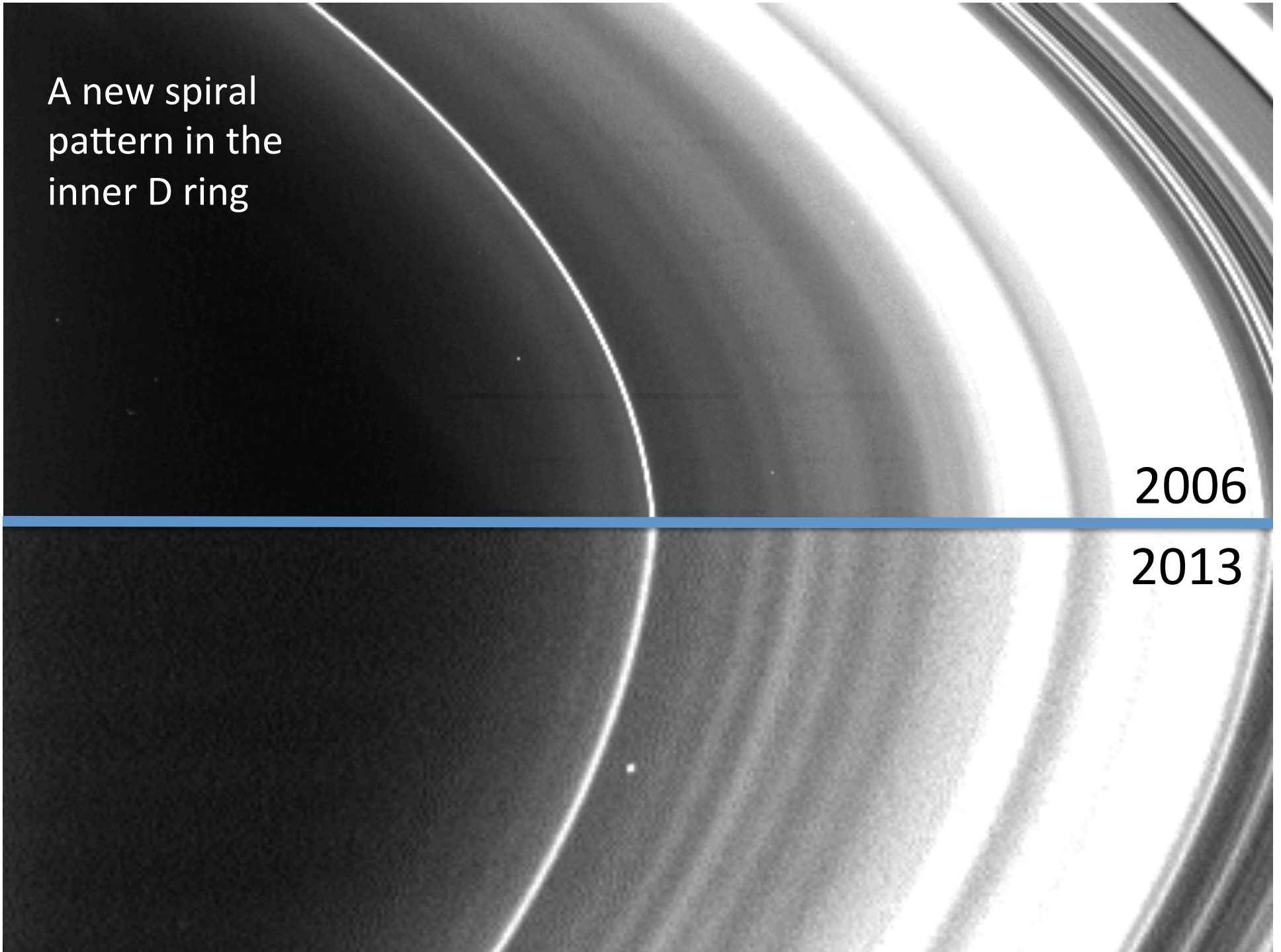
The “core” of this ringlet might be the source of the dust, but why did its dust output suddenly increase after equinox?



A new spiral
pattern in the
inner D ring

2006

2013

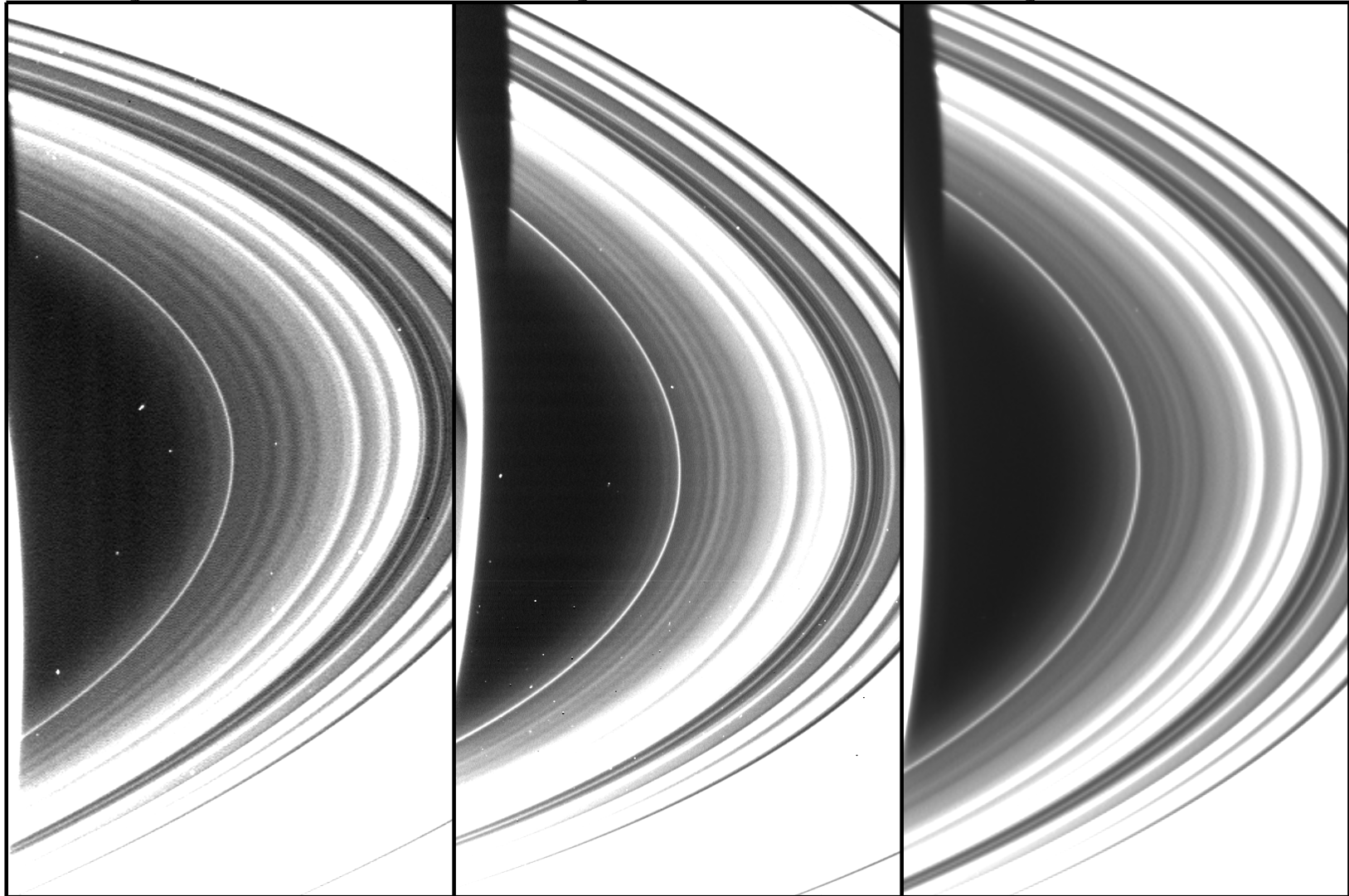


In 2012-2013, a periodic structure with a time-variable wavelength appeared in the inner D ring

Day 2012-291

Day 2013-044

Day 2013-200



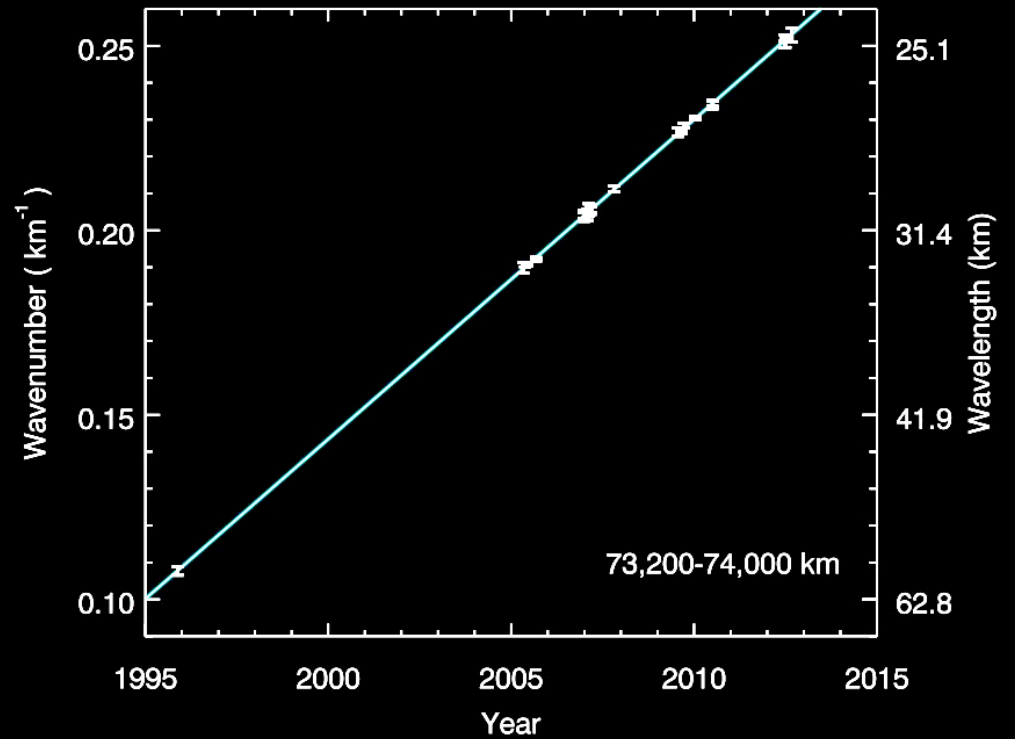
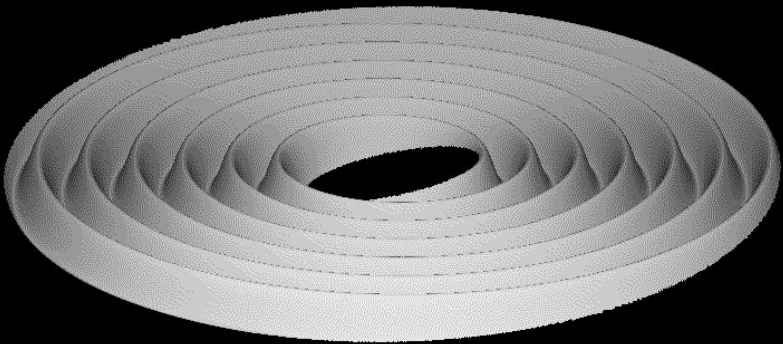
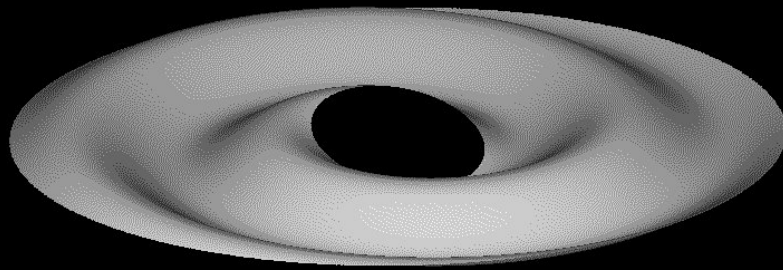
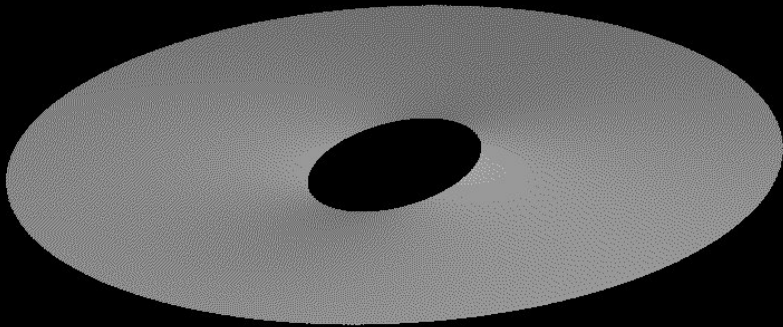
W1729154335

W1739485780

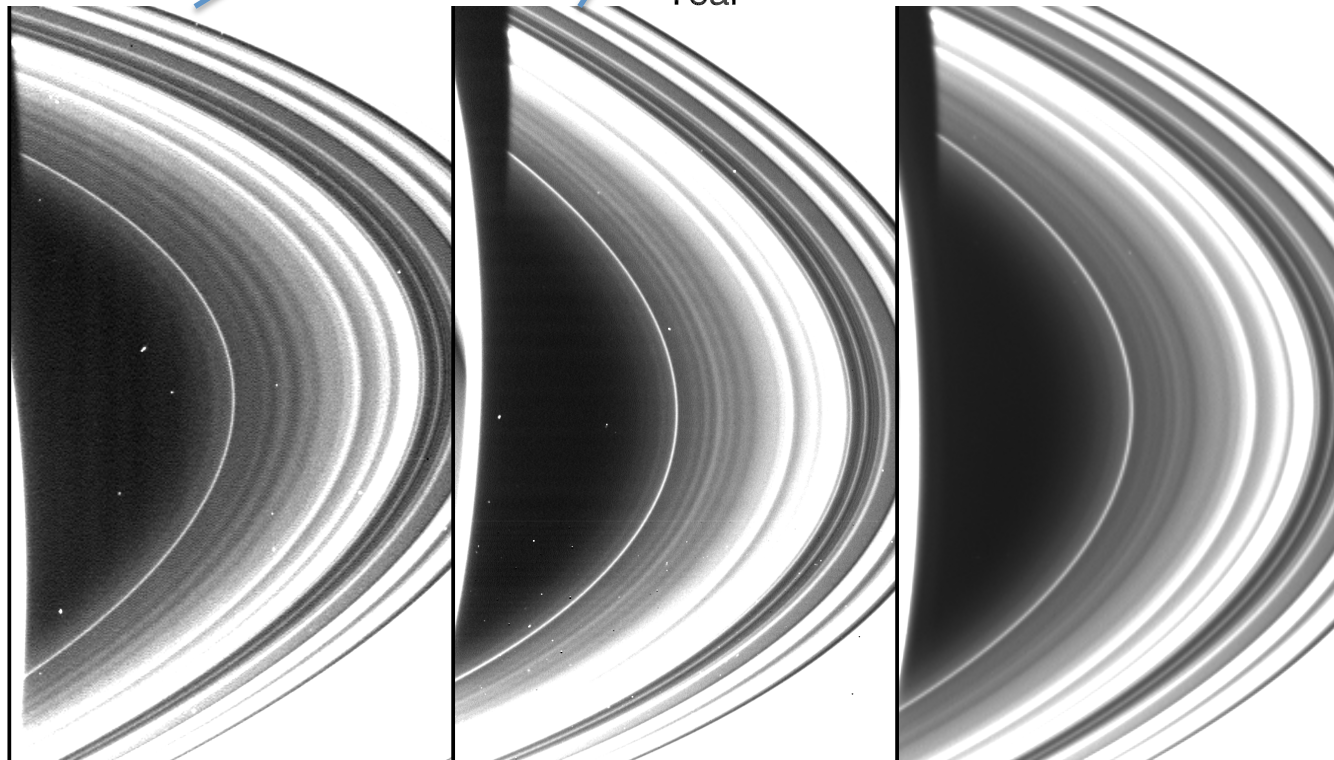
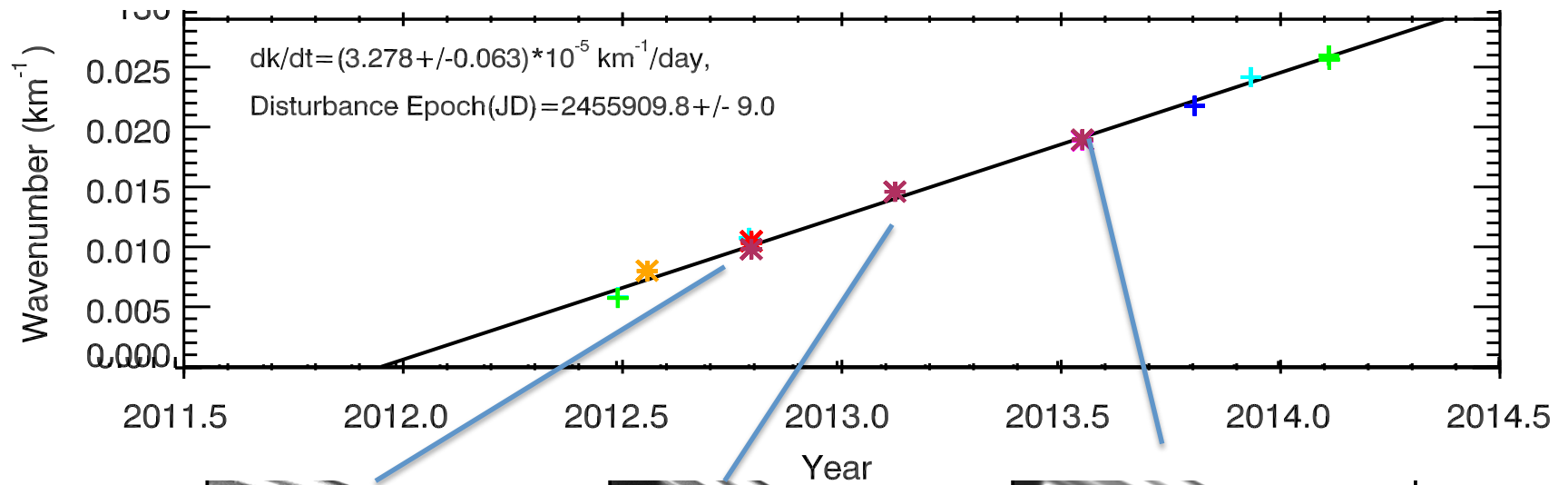
W1752976214



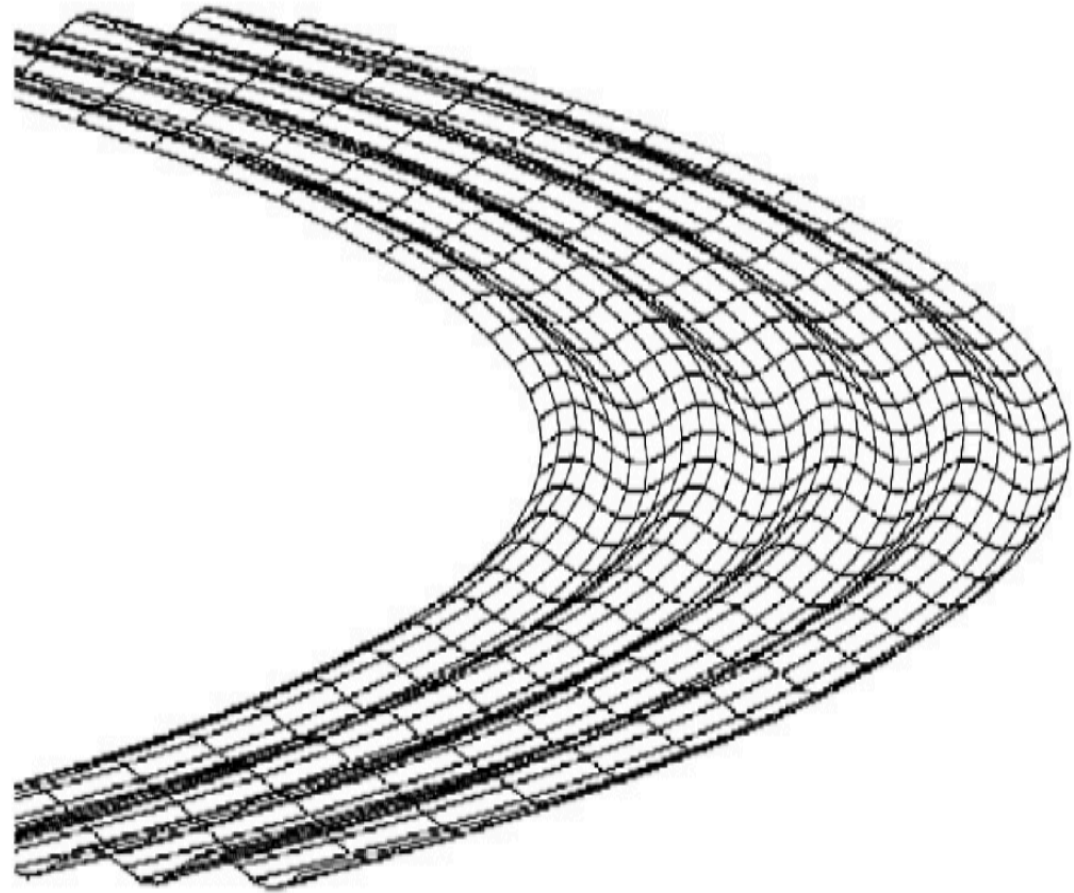
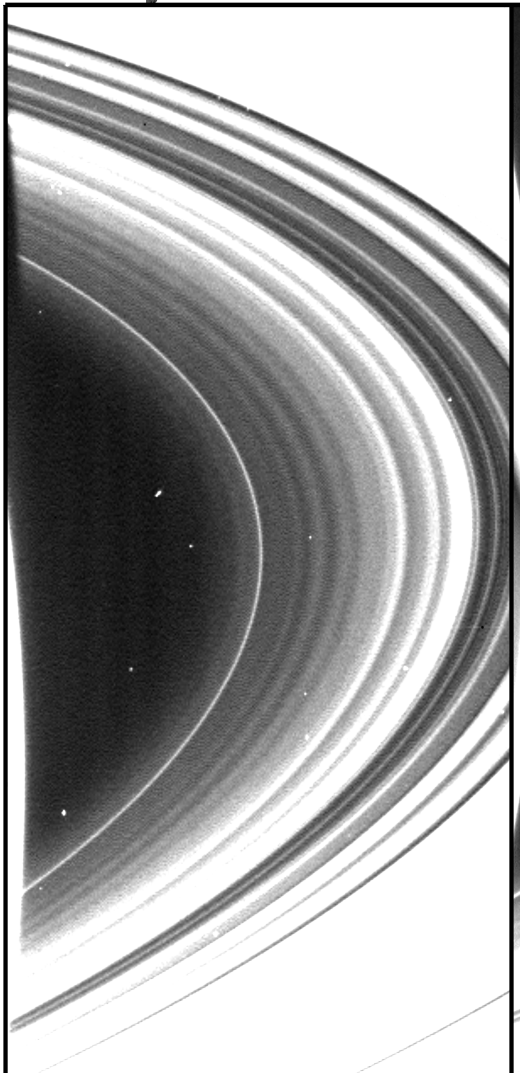
Images taken throughout the Cassini Mission had shown a periodic brightness variation whose wavelength changed systematically with time. We interpreted this feature as a corrugation that arose from an event (possibly a cometary impact) in 1983 that caused the ring to become tilted



The radial wavenumber of the new pattern also increases at a steady rate.

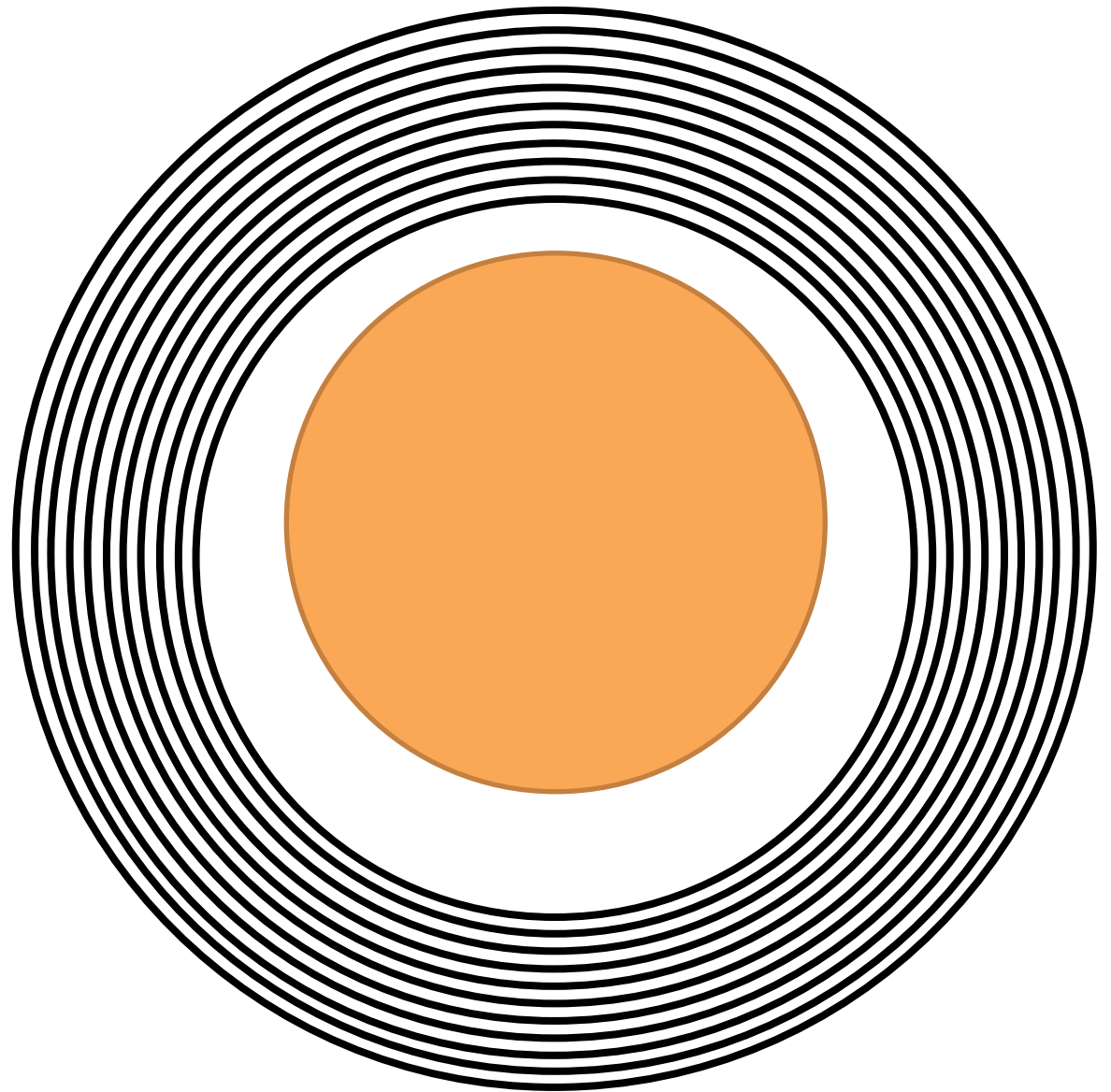


This pattern does not appear to be a vertical corrugation, because there is no “contrast reversal” near the ansa.



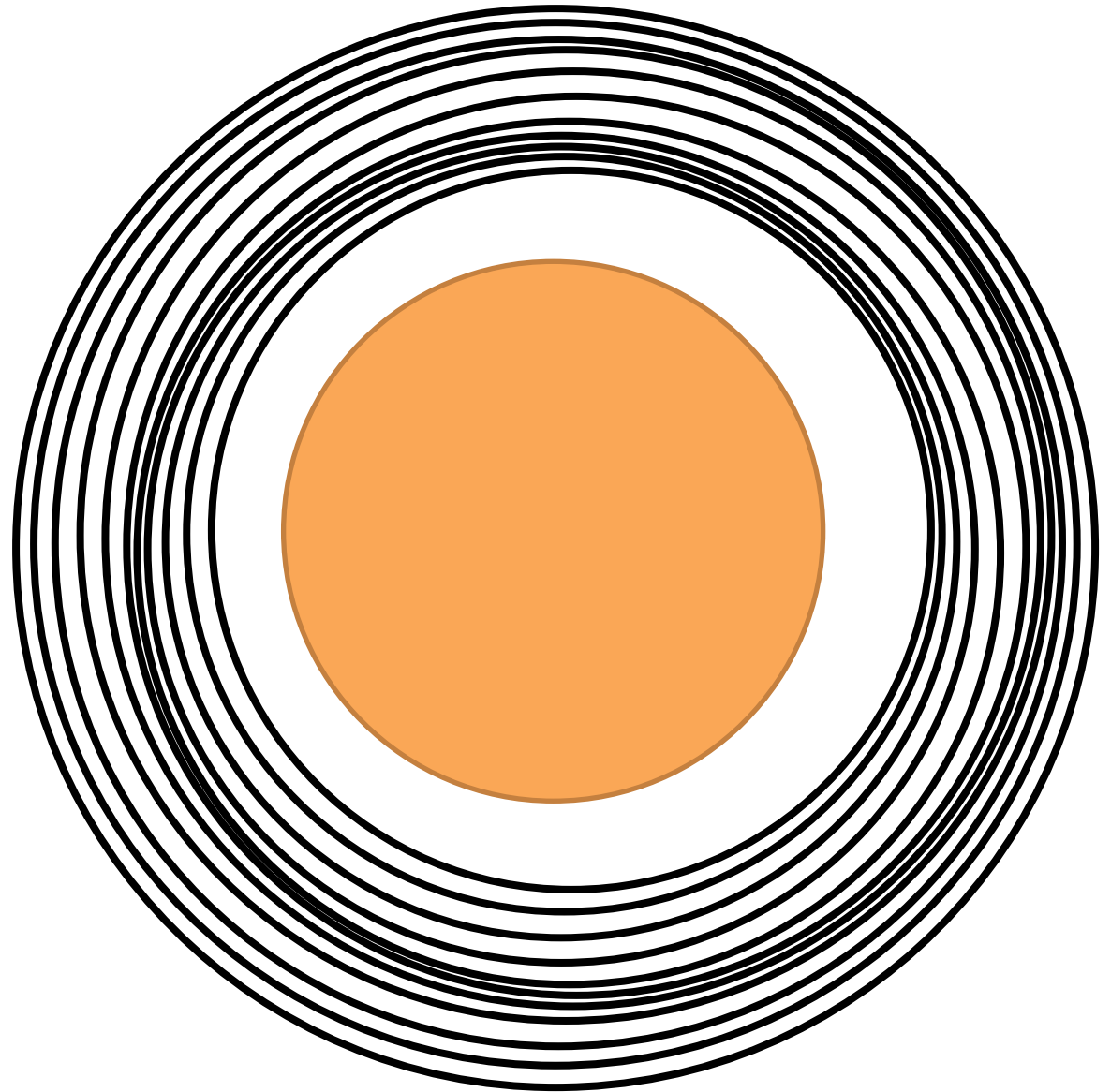
This pattern appears to be an eccentric spiral.

If some event in the past gave all the particles free eccentricities, then differential precession would cause the shifted orbits to transform into a spiral pattern with a linearly increasing radial wavenumber.

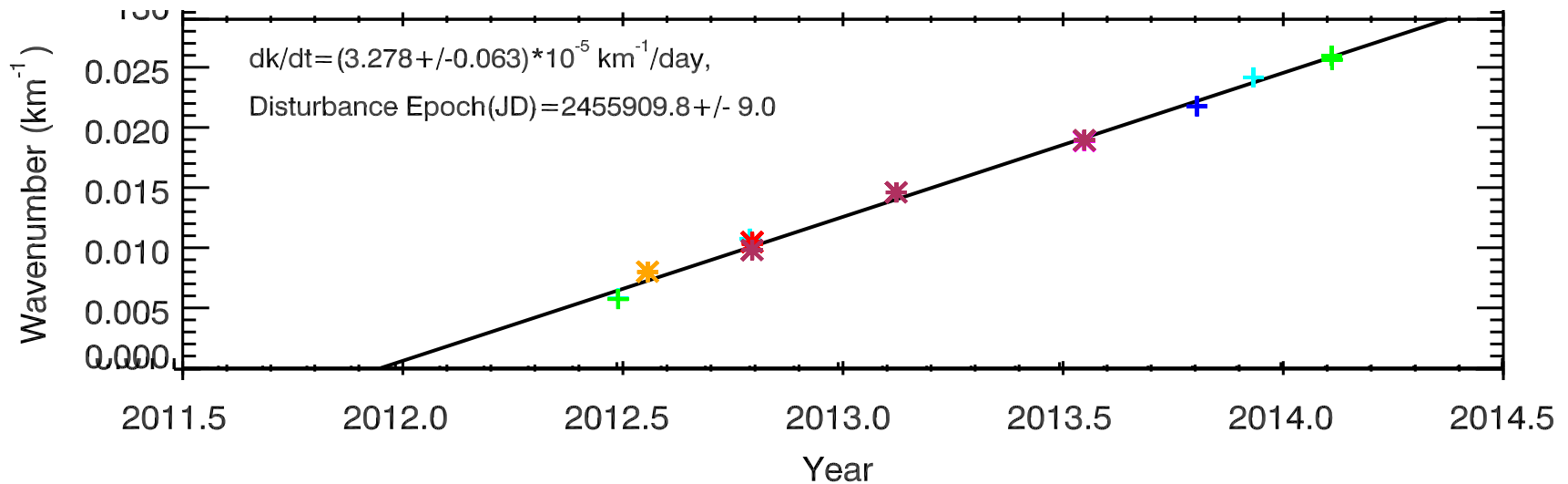


This pattern appears to be an eccentric spiral.

If some event in the past gave all the particles free eccentricities, then differential precession would cause the shifted orbits to transform into a spiral pattern with a linearly increasing radial wavenumber.



The observed trend in the radial wavenumber is consistent with this model.



Extrapolating backwards, we may infer that something disturbed the rings in late 2011, while Cassini was in orbit around Saturn!

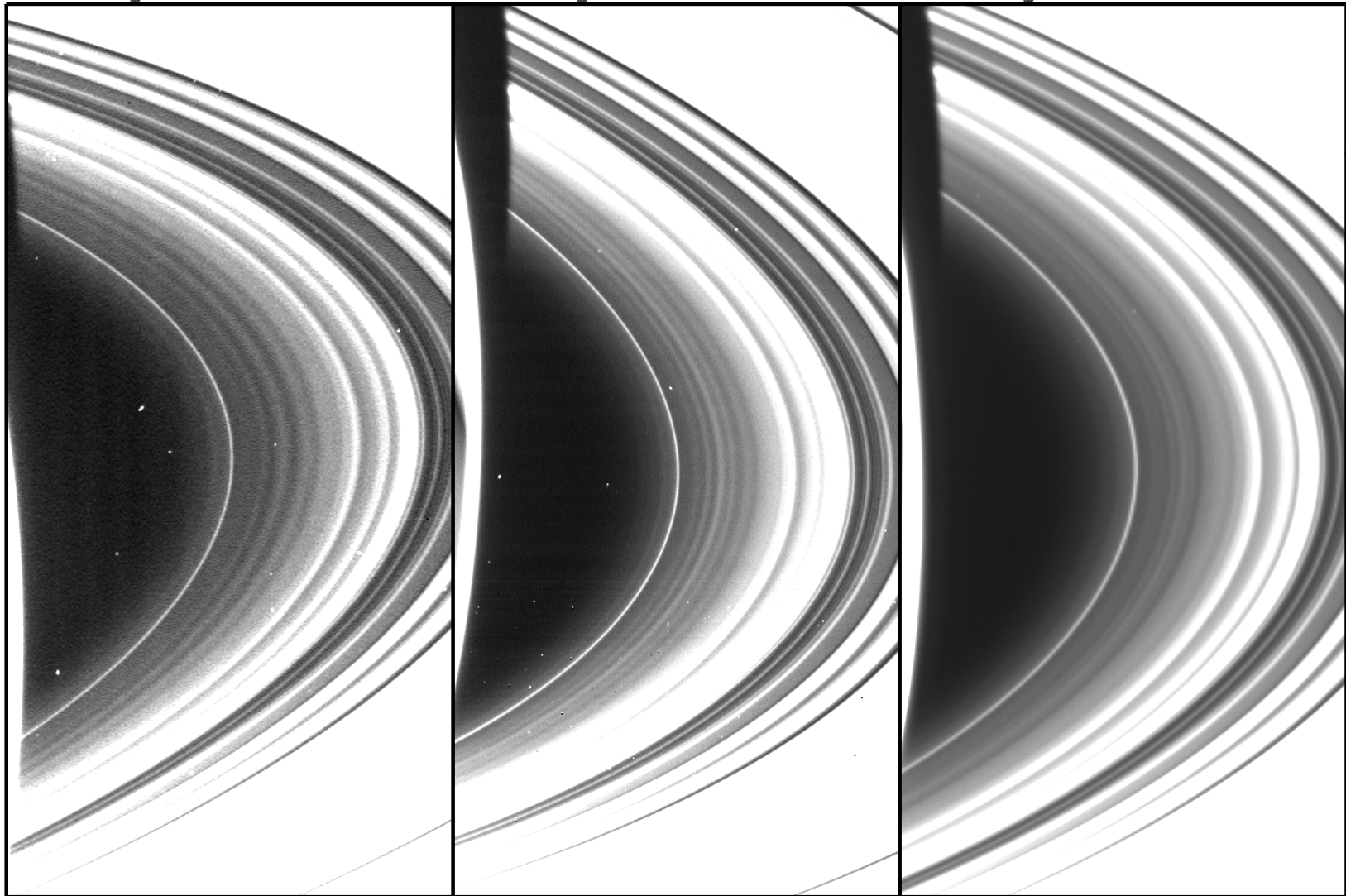
Was this an impact?
Or a disturbance in the magnetosphere?

Surprisingly, the amplitude of the pattern is also changing

Day 2012-291

Day 2013-044

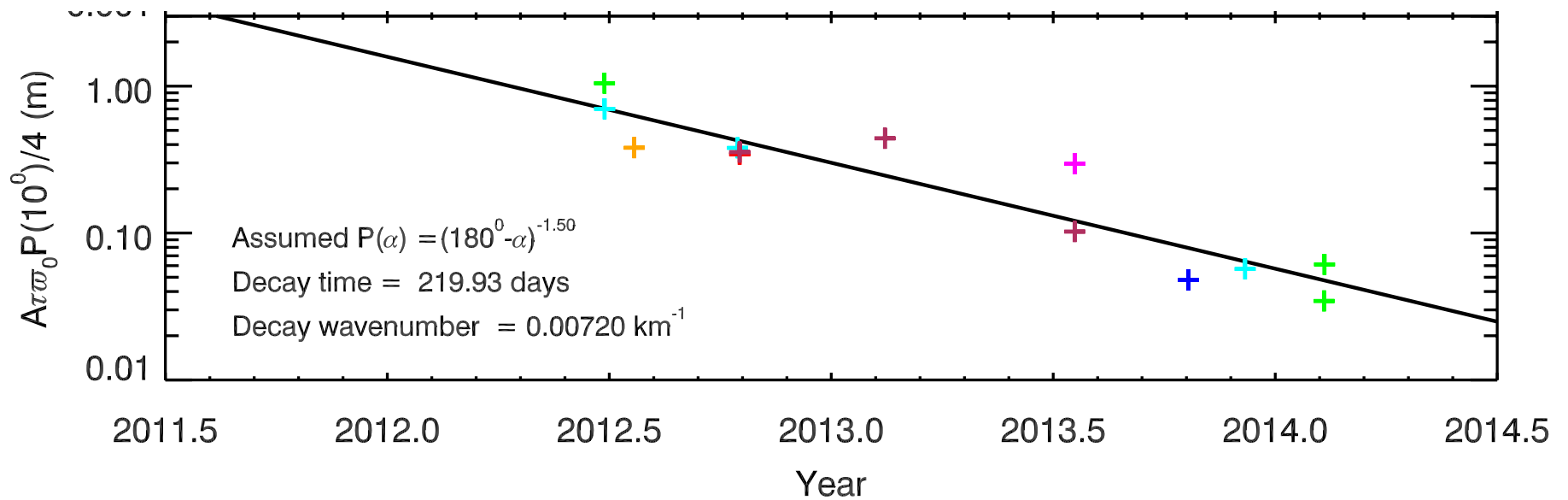
Day 2013-200



W1729154335

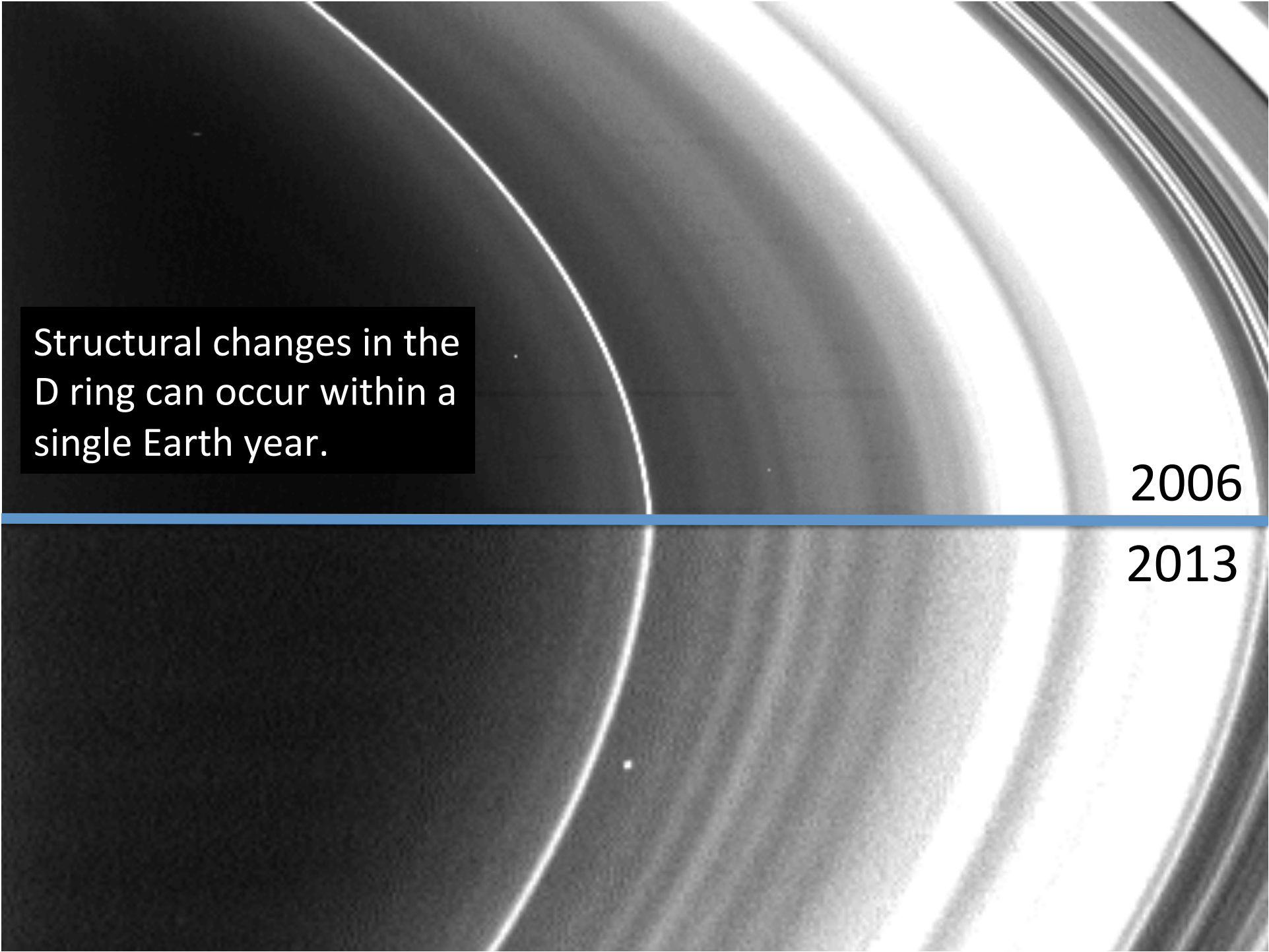
W1739485780

W1752976214



The amplitude of the pattern has been decaying with a time constant of around 200 days. This is unlike previous patterns.

This implies something is damping the particles' orbit eccentricities very quickly!



Structural changes in the
D ring can occur within a
single Earth year.

2006

2013

Simultaneous observations of the periodic pattern at both ring ansae reveal that the brightness variations are anticorrelated on opposite sides of the planet.

This is consistent with a one-armed spiral pattern

