

The Global Upheaval of Jupiter

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0. ABSTRACT

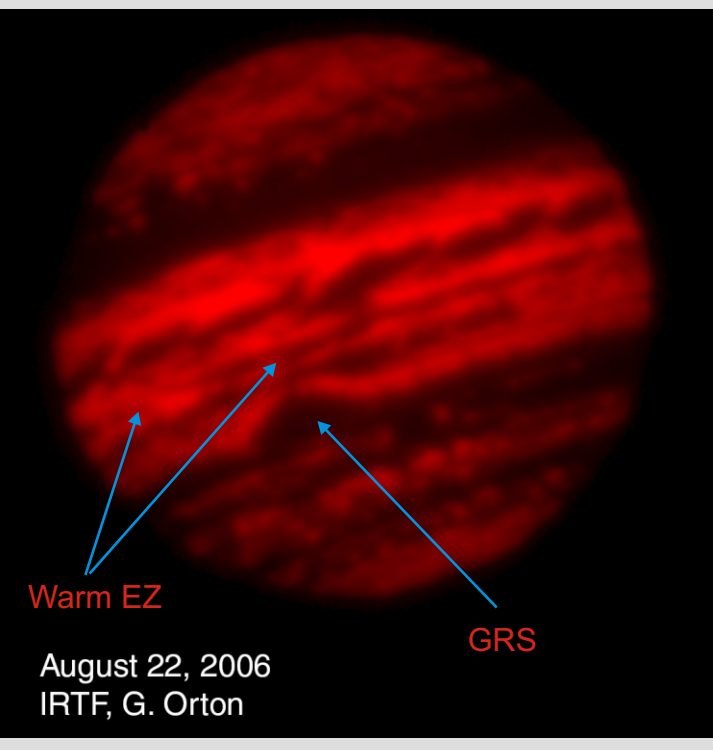
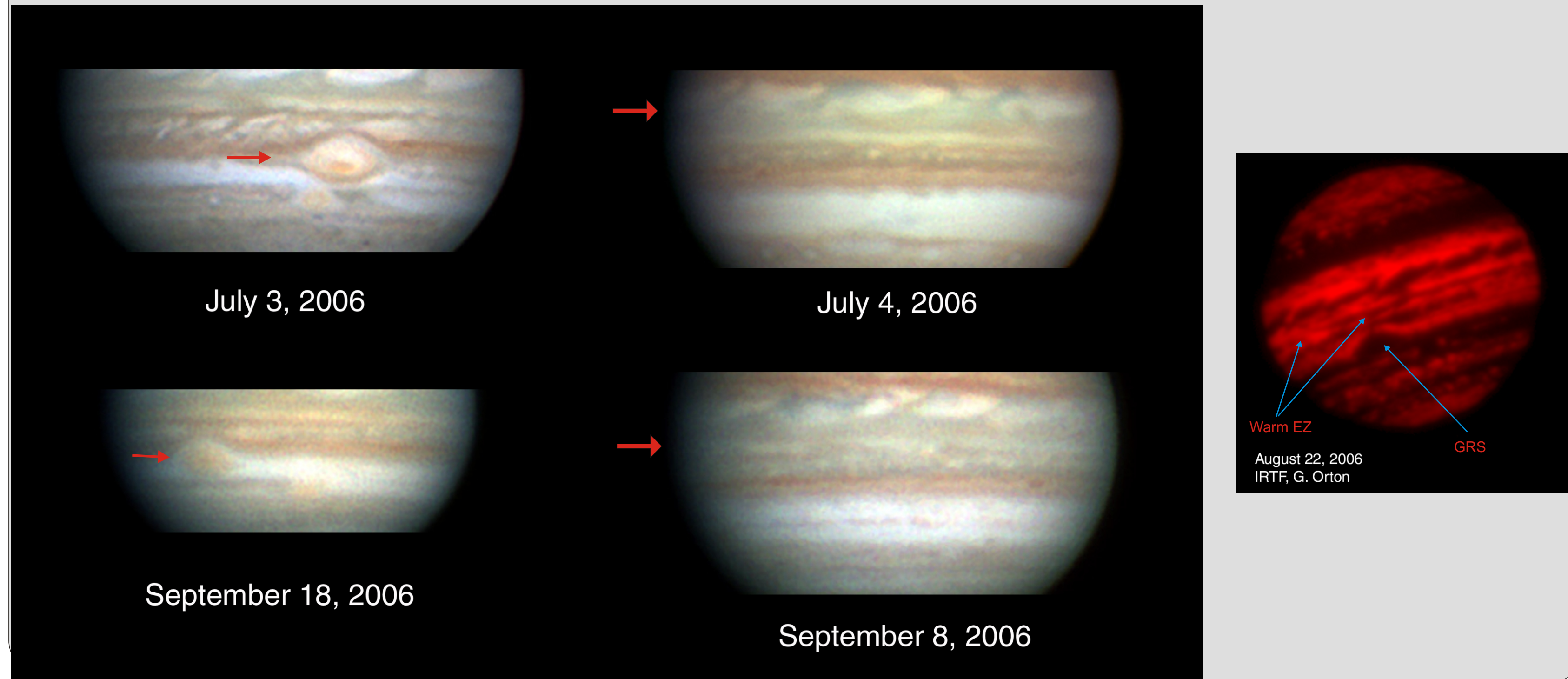
Jupiter underwent a Global Upheaval starting in summer, 2006, up to the present time. A Global Upheaval occurs when the different domains in Jupiter undergo dramatic changes, as last seen in 1990.

The current changes started in mid-2006 with the darkening of the central and southern Equatorial Zone, and the detachment of the Great Red Spot (GRS) from the South Equatorial Belt (SEB). At the start of 2007, long-running activity in the SEB had ceased and two South Tropical Disturbances had appeared. In 2007 April, the North Temperate Belt underwent a violent revival initiated by bright convective centers in the fastest jet stream, and the SEB slowly faded. Then a SEB outbreak appeared in mid-May leading to the start of the revival of the SEB, even though the SEB has not fully faded yet.

Fortunately, this event was covered in unprecedented detail by various amateur astronomers around the world. This event was also partially imaged by the New Horizons spacecraft, the Hubble Space Telescope and various ground based observatories around the world. Images will be presented to show how the current upheaval developed.

2. Prelude to the Upheaval

During the 2006 apparition, the central and southern part of the EZ darkened, and became warm at 4.8 microns. The GRS detached from the SEB, as retrograding spot activity on the SEB southern edge ceased.



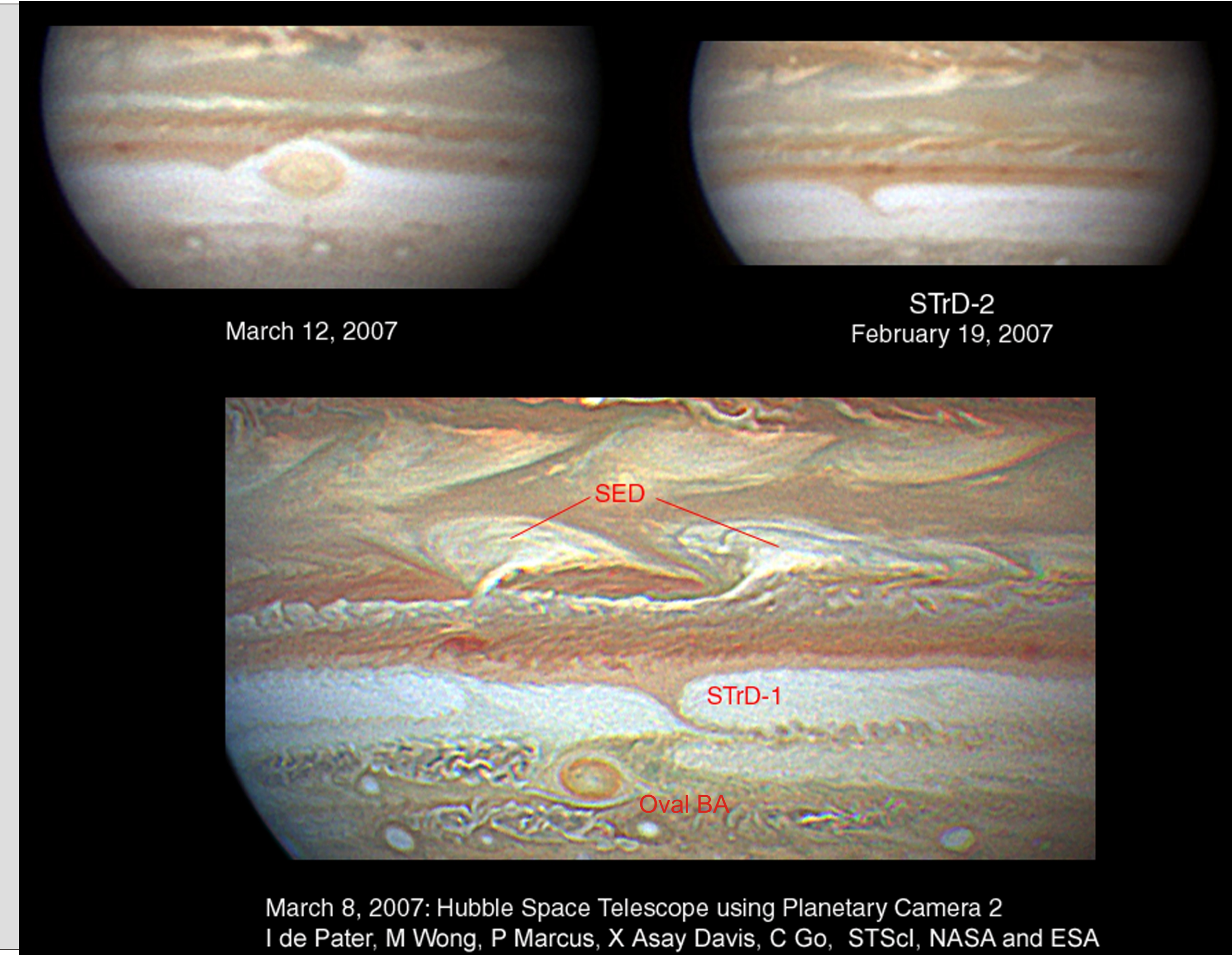
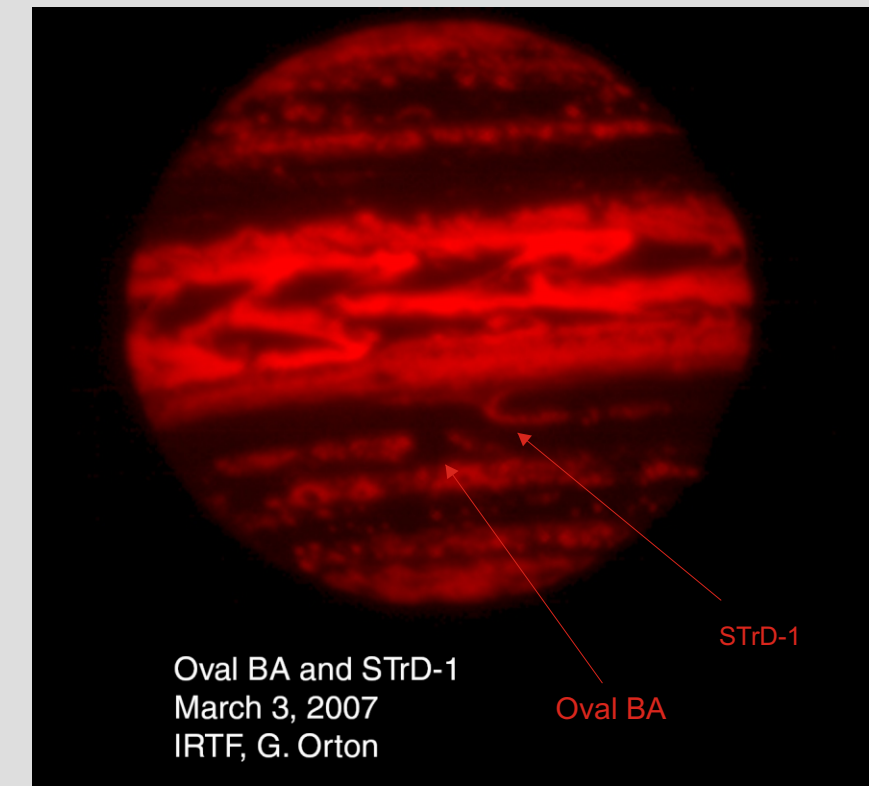
1. Introduction

From the middle of 2006 up to now, Jupiter underwent a global upheaval. This poster will present:

- The Prelude to the Upheaval
- The Southern Hemisphere Disturbances
- The NTB Revival
- The SEB Fade, Outbreak and Revival
- The Circulating Current of the South Tropical Zone
- The NNTB Revival

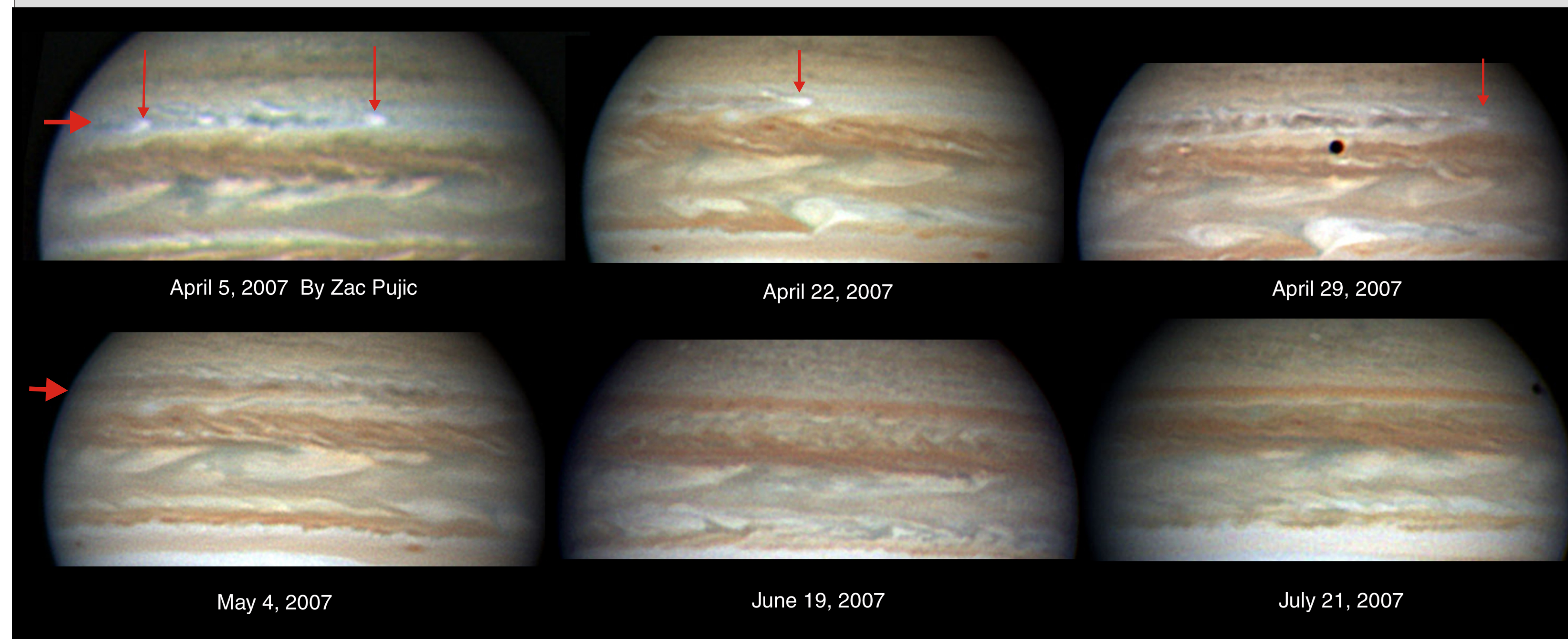
3. The Disturbances

At the start of 2007, the GRS had clearly detached from the SEB and the long-running convective activity in the SEB west of the GRS had ceased. Two South Tropical Disturbances (STrD) appeared. These disturbances appeared like a hook emanating from the southern portion of the South Equatorial belt. The two South Equatorial Disturbances (SED) became prominent. Fortunately, the Hubble Space Telescope was able to image these features in very high resolution. The EZ became very dark.



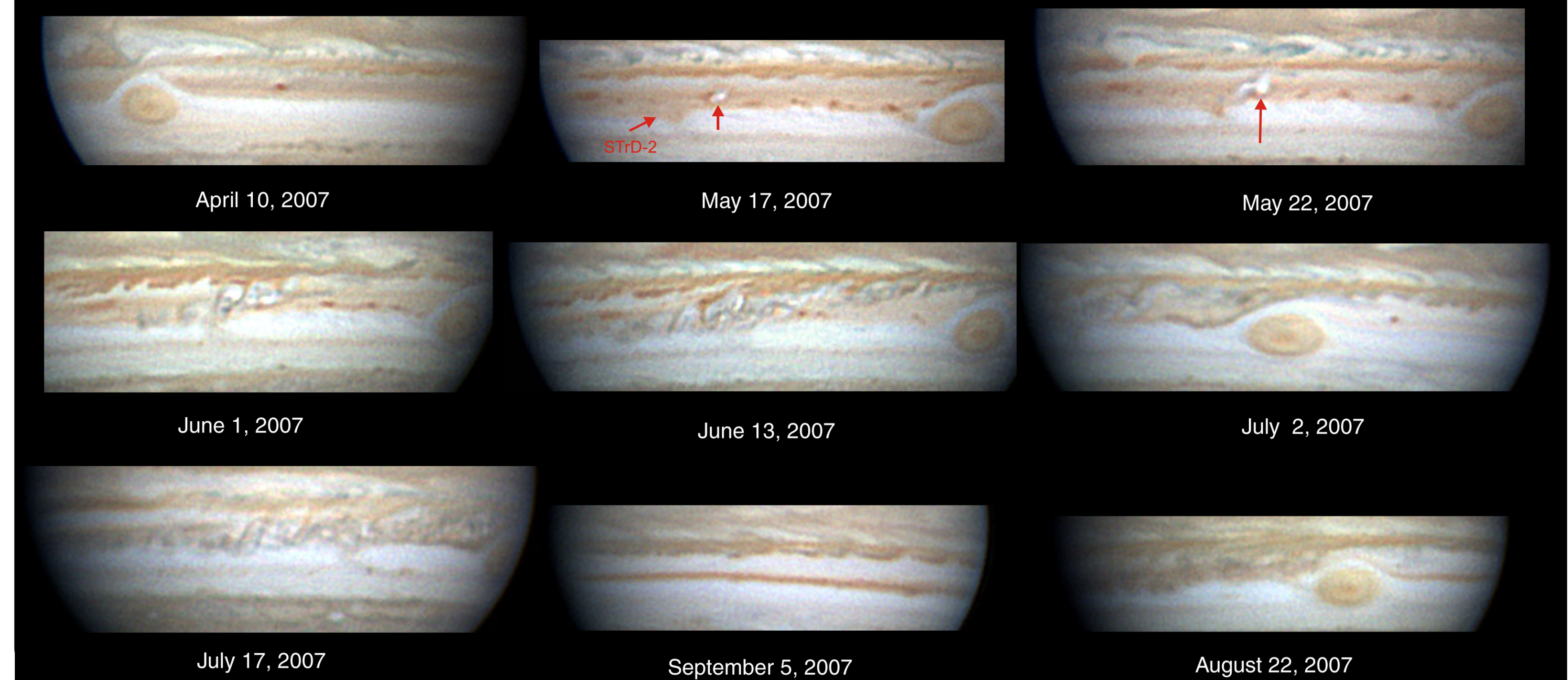
4. The NTB Revival

On late March 2007, white spots appeared in the North Tropical Zone of Jupiter. This outbreak started with two white spots. It took about 6 weeks for these spots to go around the planet. As these spots went around Jupiter, they left a trail of dark material. The outbreak ended in mid-May when the spots encountered the tail end of their wake. These dark materials slowly turned red then forming the North Temperate Belt (NTB). By August, the NTB had fully revive.



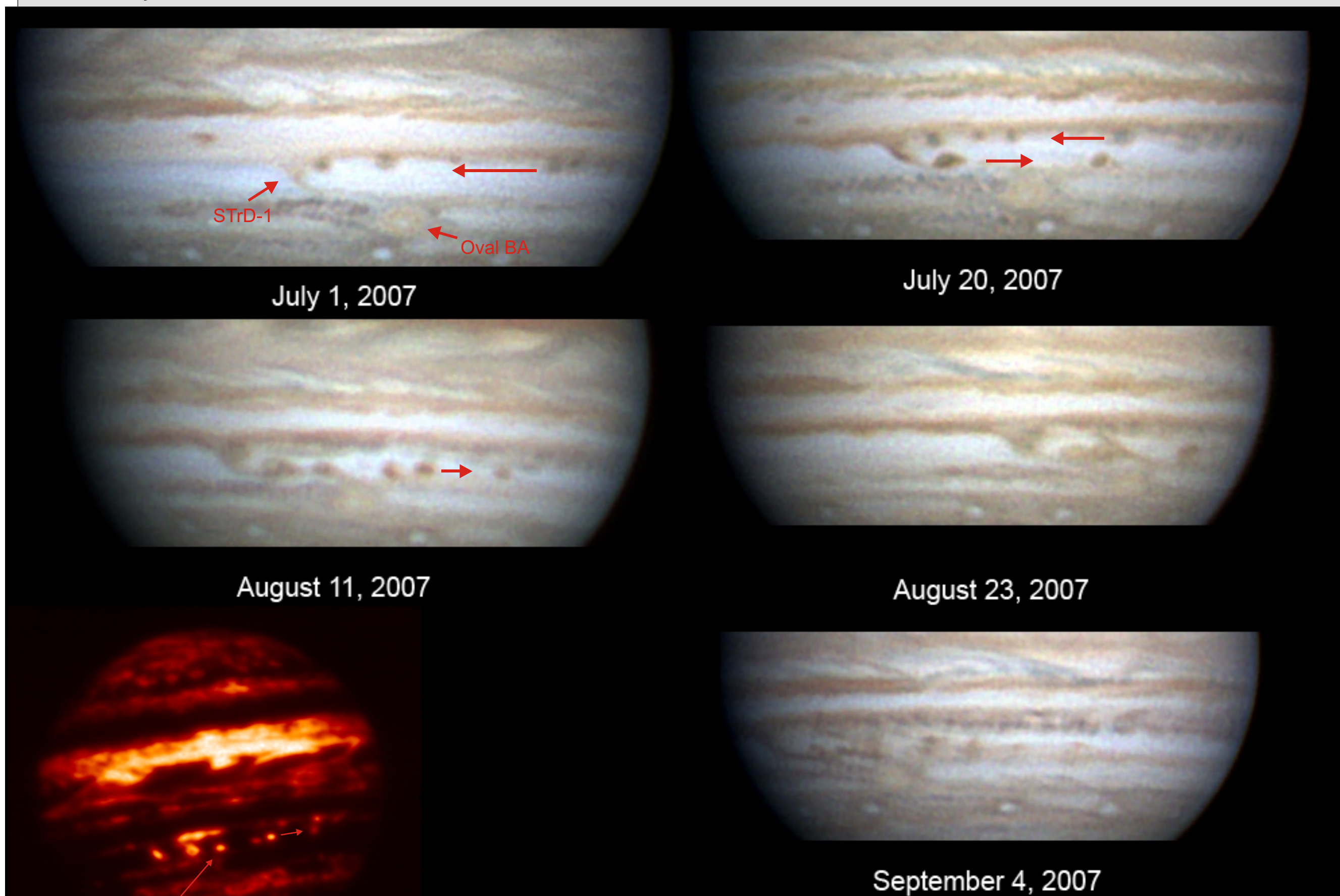
5. The SEB Fade, Outbreak and Revival

In April 2007, the southern portion of the SEB (SEBs) began to fade. Surprisingly, on May 17, a white spot appeared in the SEB close to STrD-2. This spot soon turned into a huge outbreak. Like the NTB outbreak, the spot generated a lot of dark material. But unlike the NTB spot, the SEB spot was slow moving and the dark spots emanating from it were retrograding. It took almost 3 months for the material to go around the planet. During this time, half of the SEB was fading while the other half was reviving.



6. The Circulating Current in the South Tropical Zone

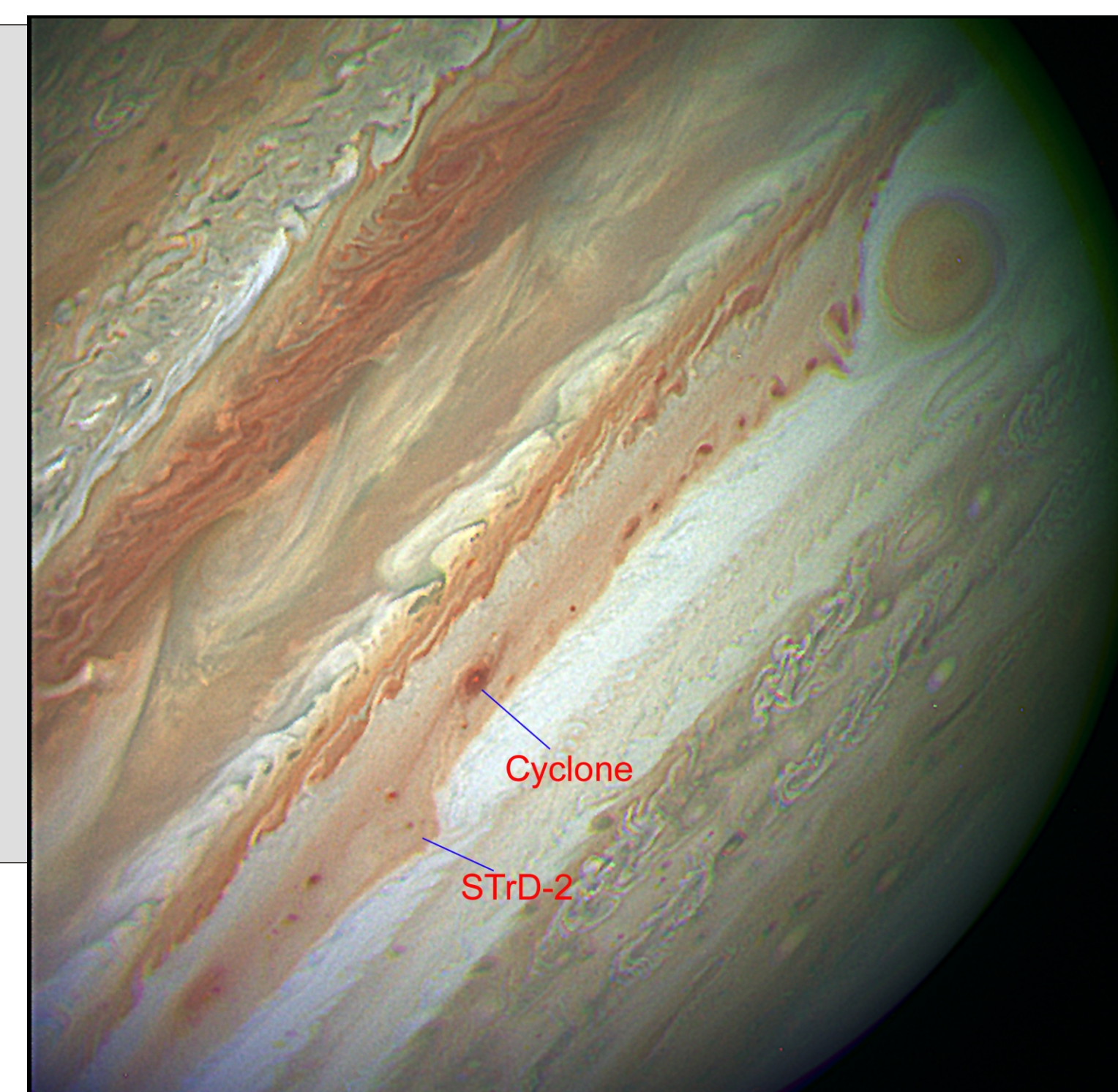
The dark material generated by the SEB outbreak reached STrD-1 in early July 2007. These spots then performed a U-turn at STrD-1, switching from the SEBs to the STBn jet stream. This phenomenon was discovered in 1920 and has not been clearly observed since the 1930s. These materials are distinct in 4.8 micron.



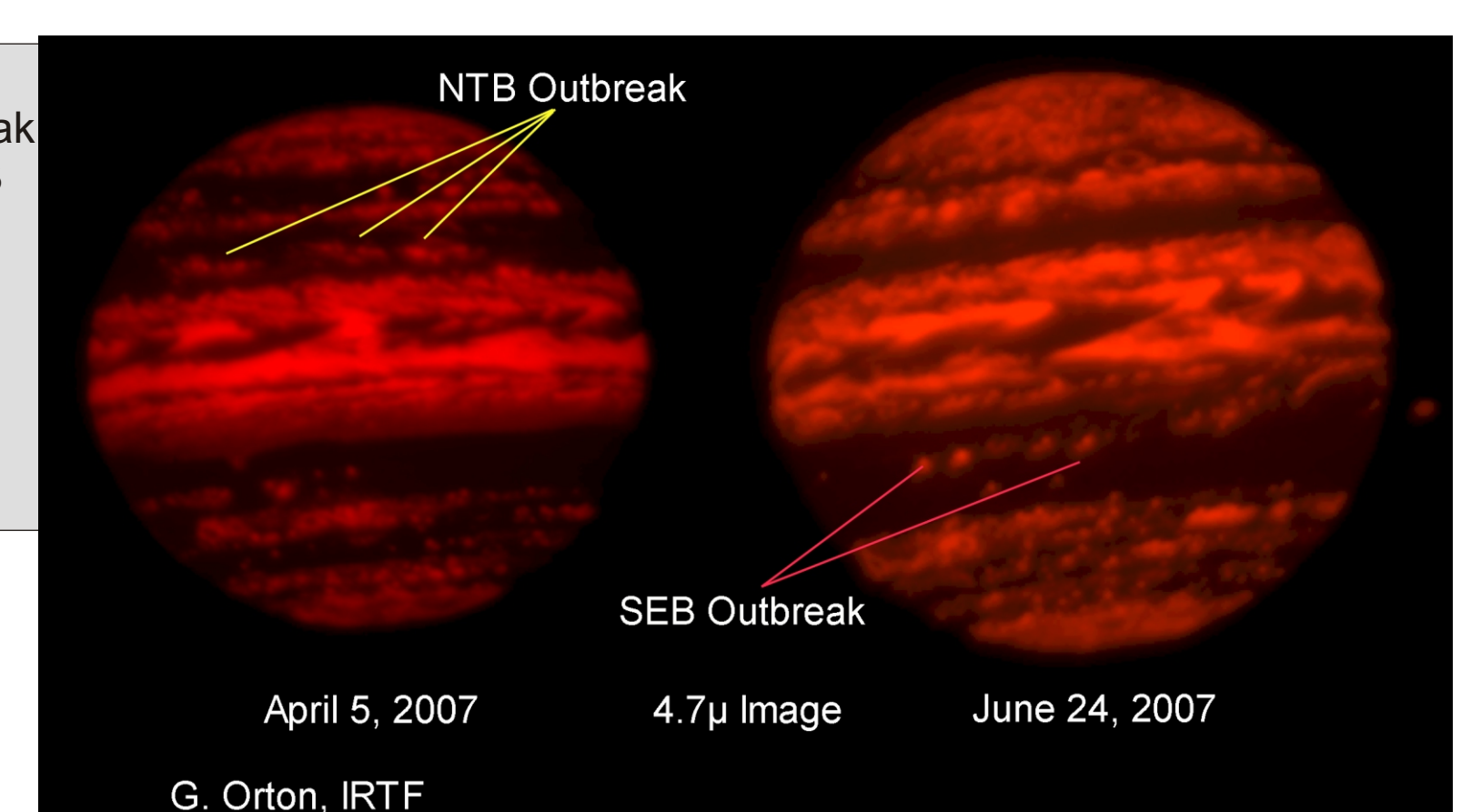
On May 11, 2007, the Hubble Space Telescope imaged the area around STrD-2. Note the faded SEB. There is a red cyclone east of STrD-2. It was in this feature that the SEB outbreak white spot appeared 6 days later. Voyager 1 observed a similar convective white spot outbreak to appear in a similar dark cyclone.

Hubble Space Telescope WFPC2

Credits: I. de Pater, M. Wong, P. Marcus, X Asay-Davis, C. Go, STScI, NASA and ESA.

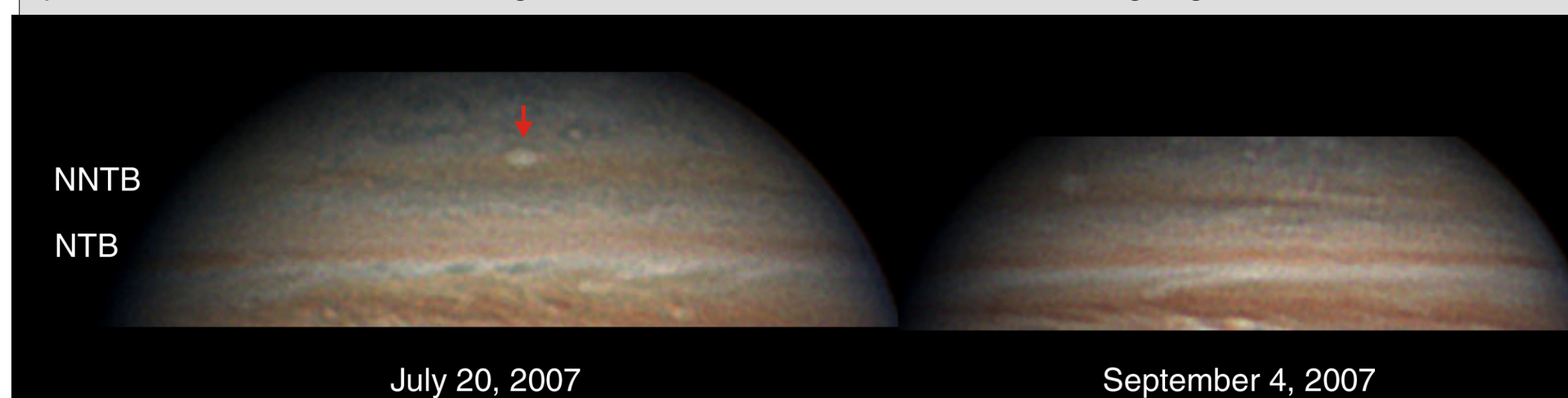


It is interesting to note that the outbreak of the NTB and SEB are distinct in 4.8 microns.



7. Revival of the NNTB

The North North Temperate Belt revived during early July. Interestingly, this revival is associated with a white spot which can be seen in the images below. The revival of this belt is still ongoing.



8. The Future

Global Upheavals of Jupiter has been observed for more than a hundred years. But it is only during this upheaval that details of its development have been observed at high resolution.

The upheaval has affected what are thought to be separate domains in both hemispheres of Jupiter. The scale and speed of the upheaval is breathtaking. What process in Jupiter could cause such large scale upheaval? Why are global upheavals periodic?

It is also interesting to note that all revivals involve a white spot outbreak. These spots seem to be the vehicle used to transport dark material from Jupiter's interior to the cloud top.

Our group will use the Hubble Space Telescope (Proposal ID. 11102) next year to view the aftermath of the upheaval.

References:

Rogers, J.H., 1995. *The Giant Planet Jupiter*. Cambridge Univ. Press, Cambridge, UK.
 A. Sanchez-Lavega, et al, The 2007 Jupiter's North Temperate Belt Disturbance: I. Overview and jet stream changes. DPS 2007 poster