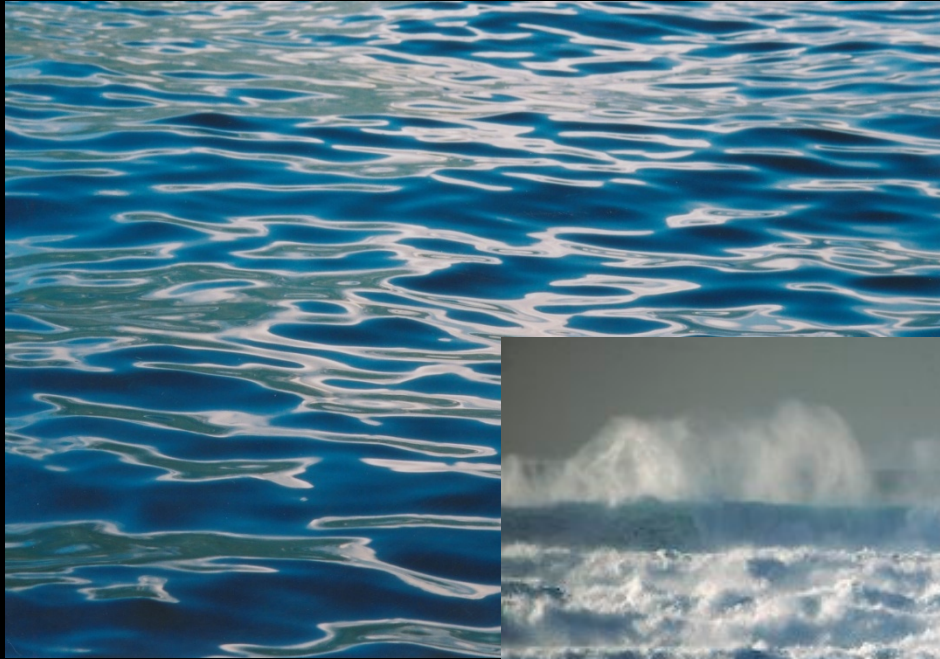




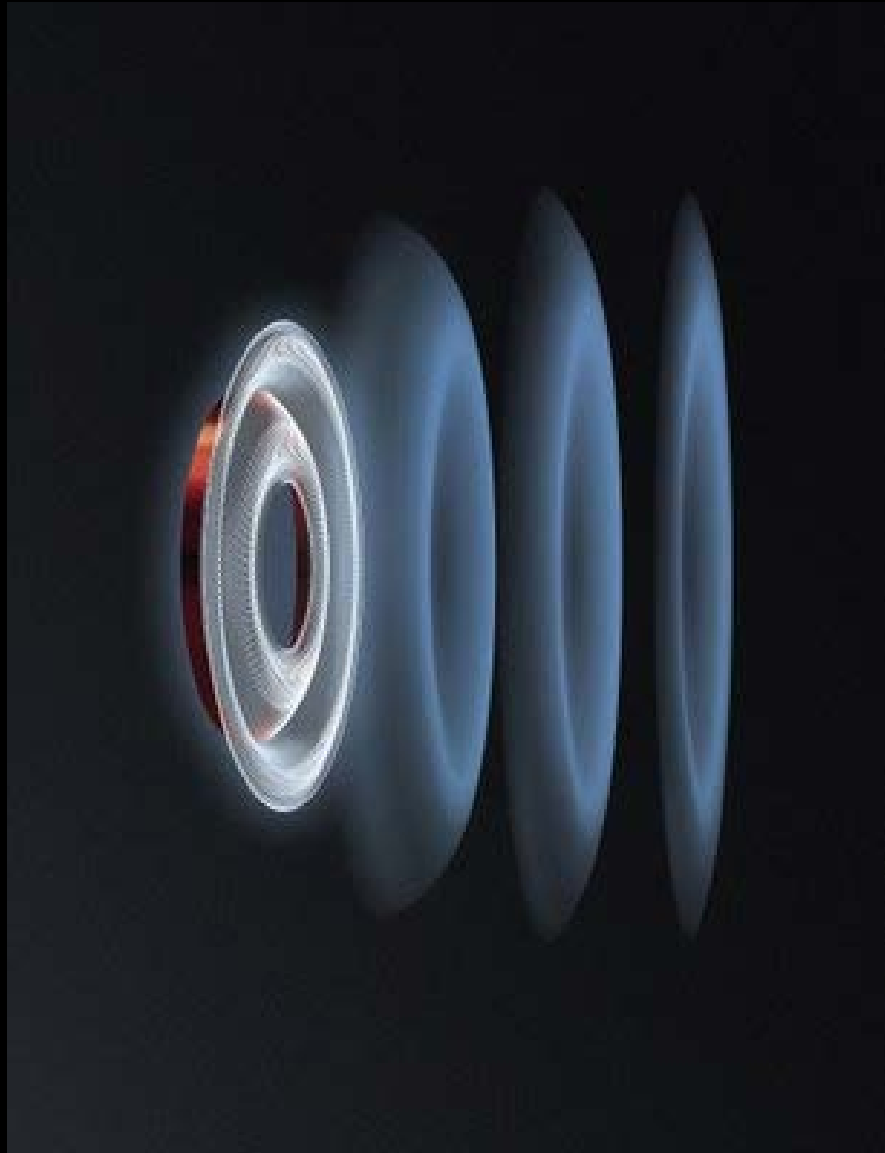
Astrophysical Fluid Dynamics

Fluid Picture Book

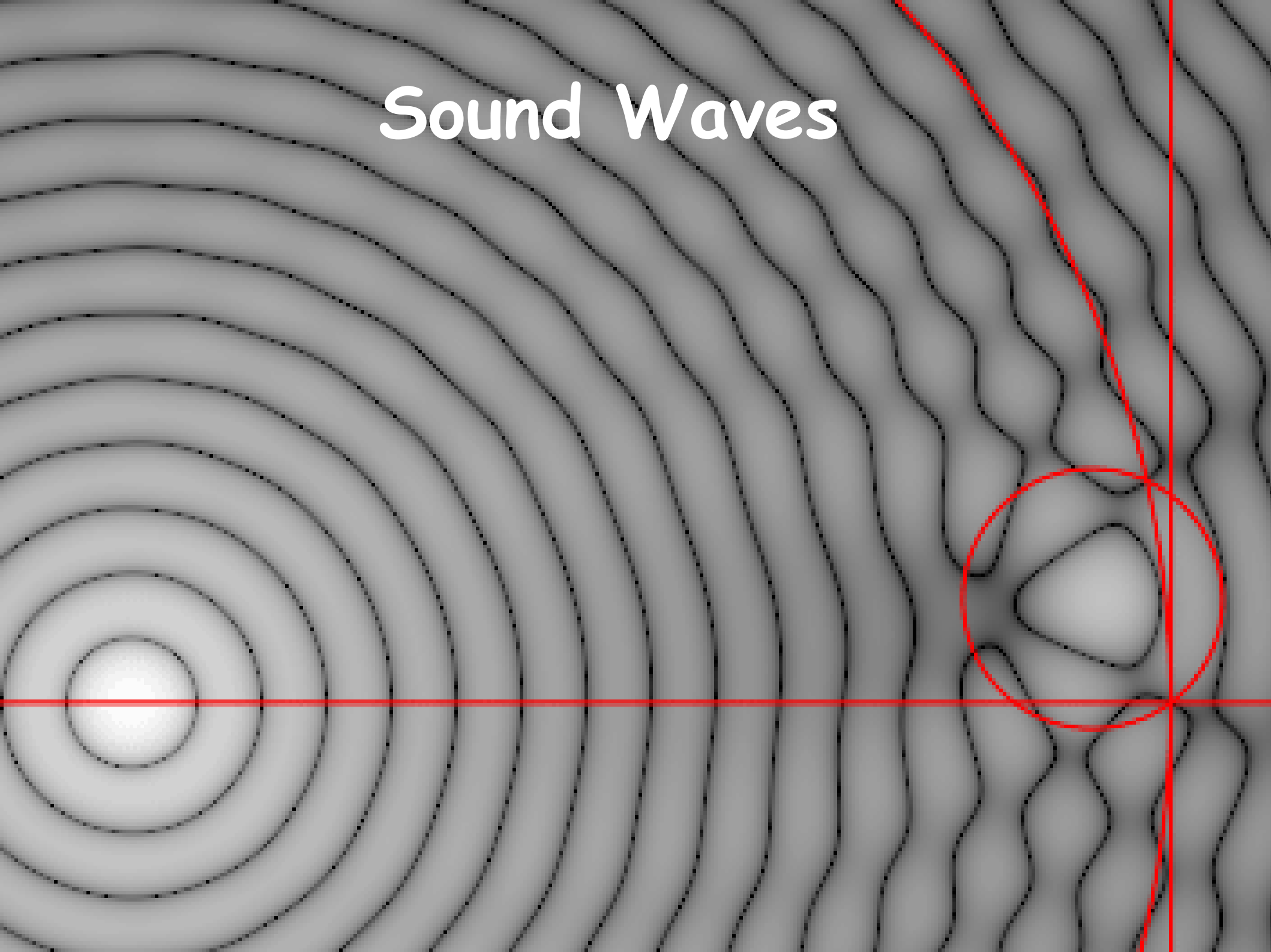
Waves: sea & ocean waves



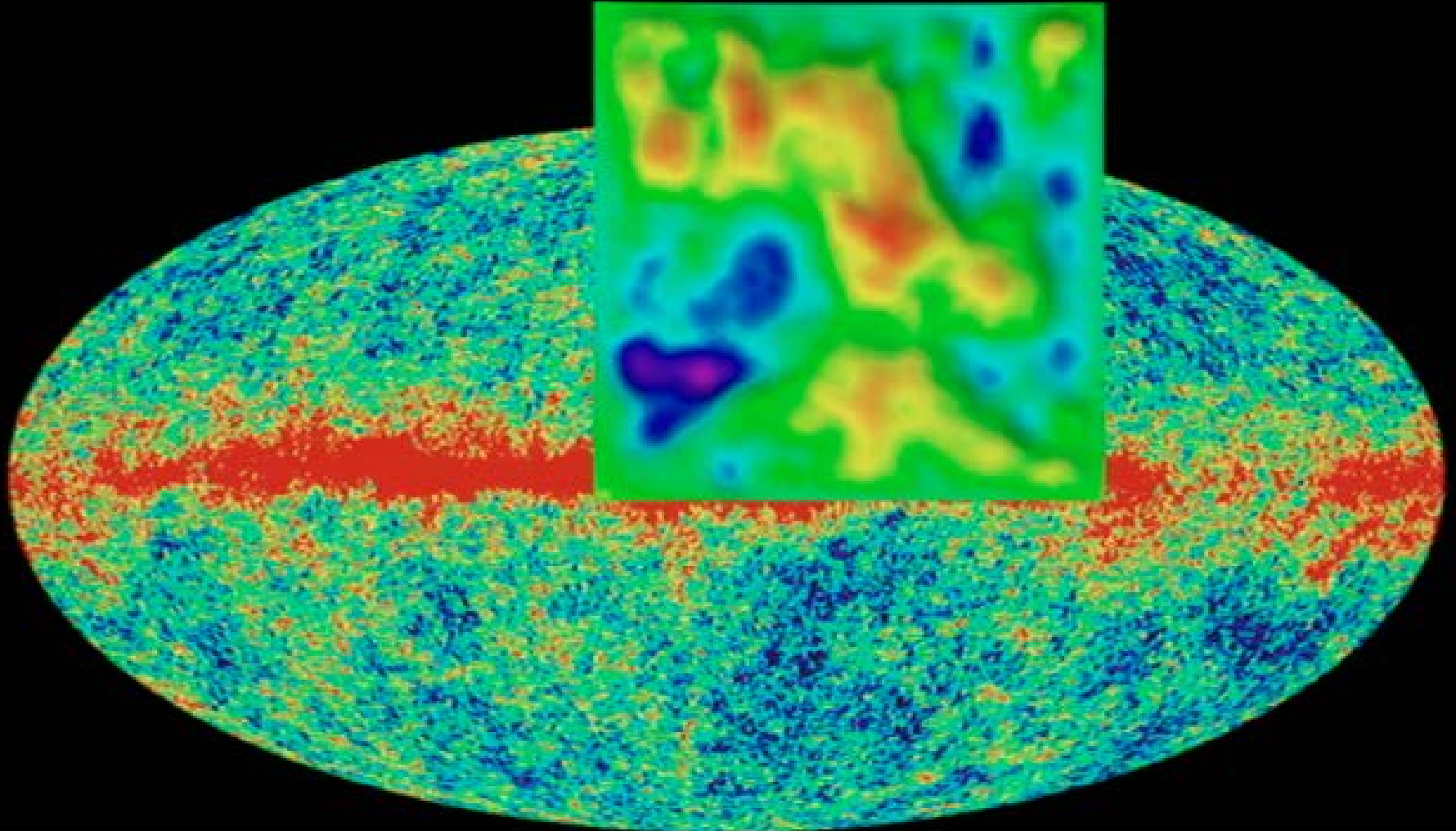
Sound Waves:



Sound Waves

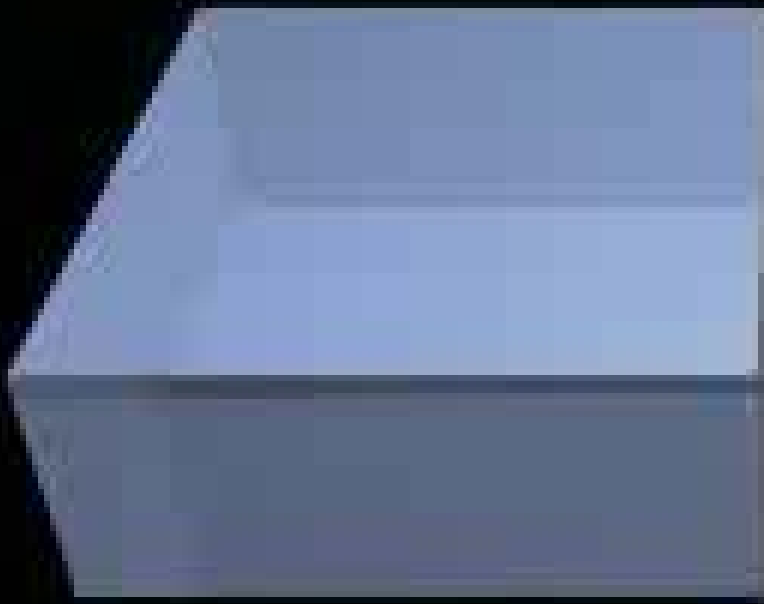


Cosmic Sound Waves

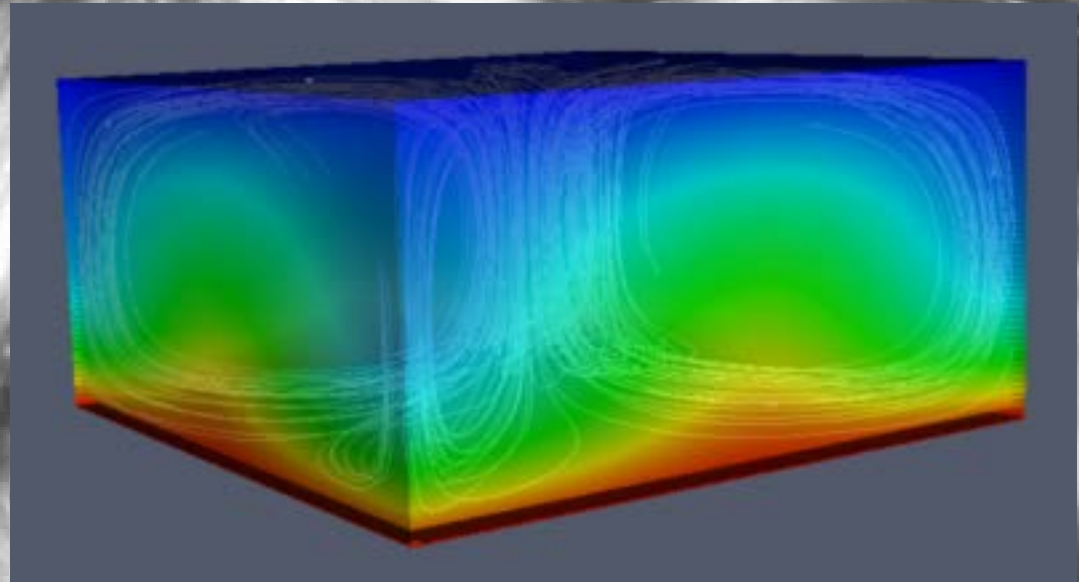


Primordial Sound Ripples seen in
WMAP Cosmic Microwave Background

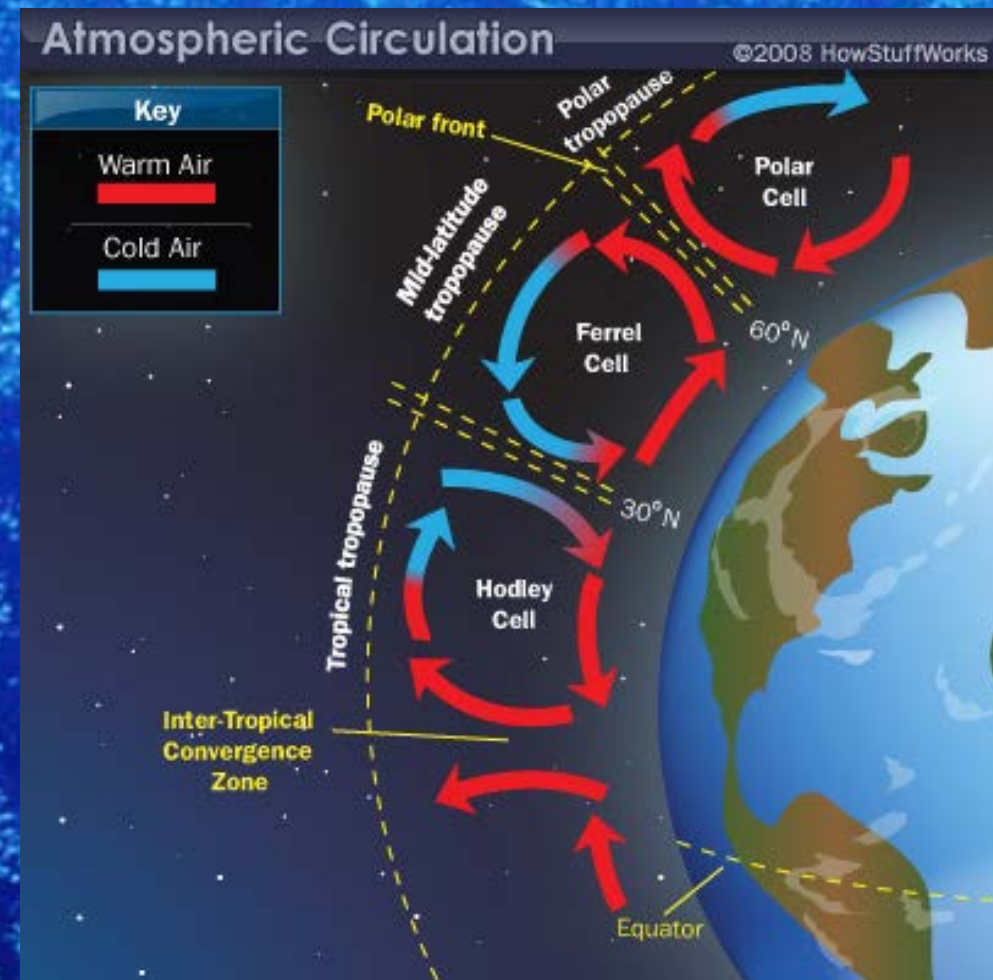
Cosmic Sound Waves

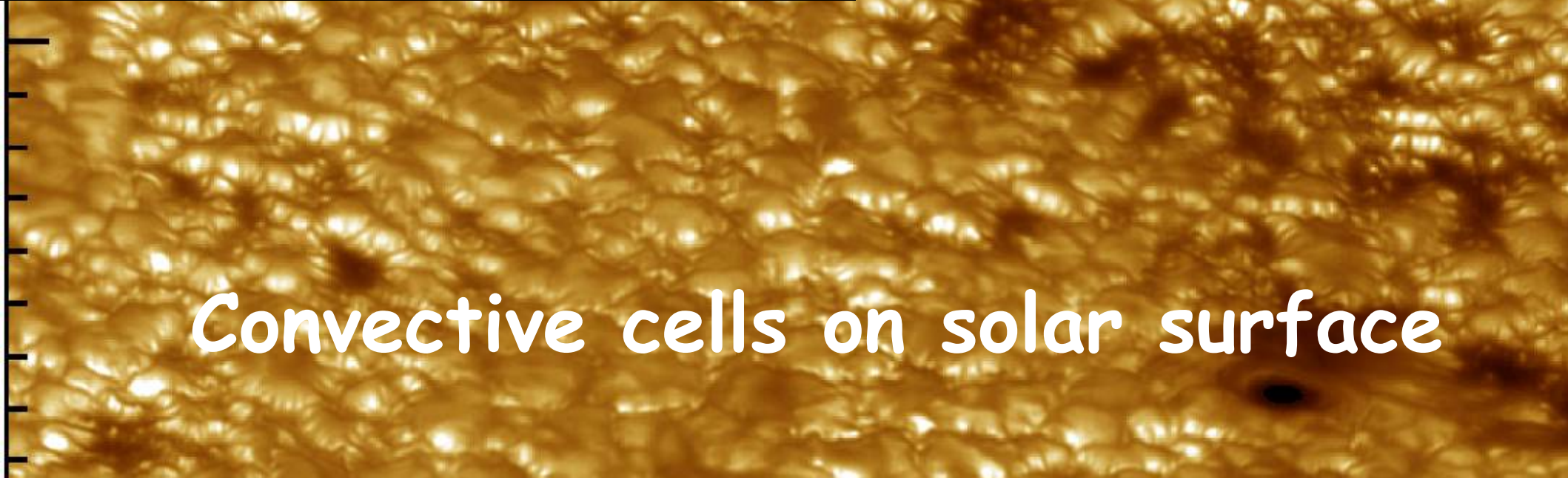
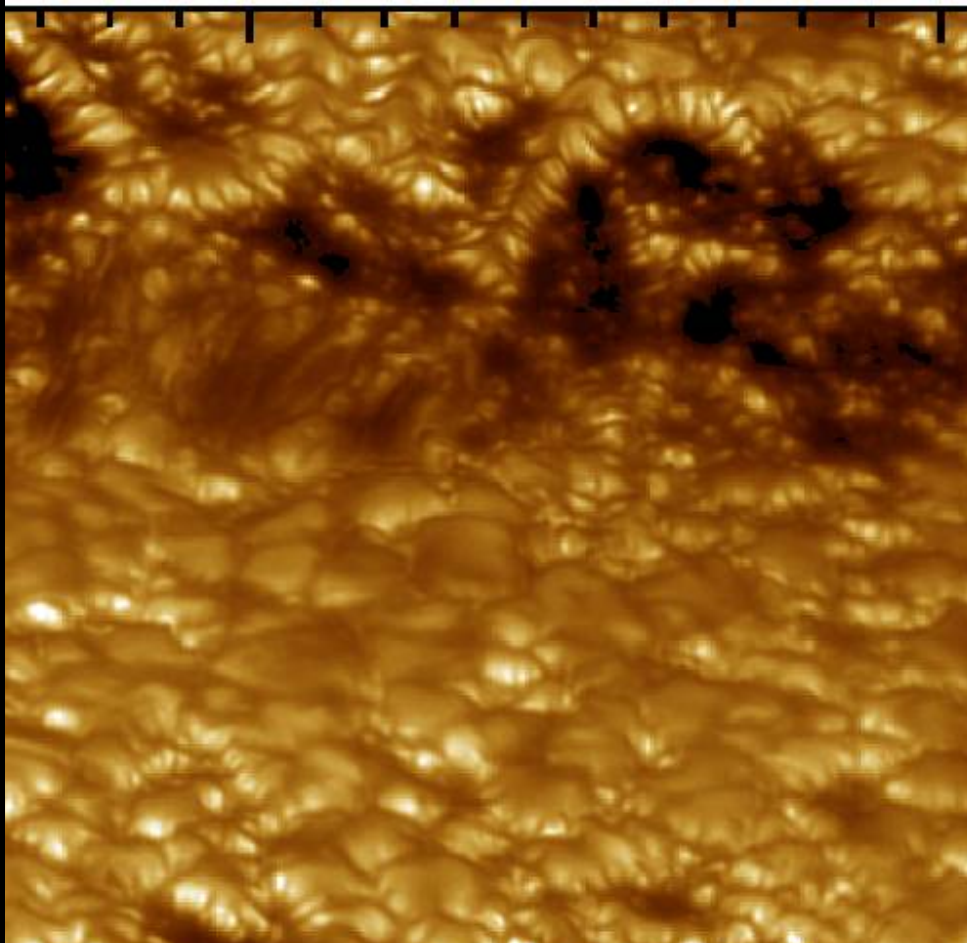
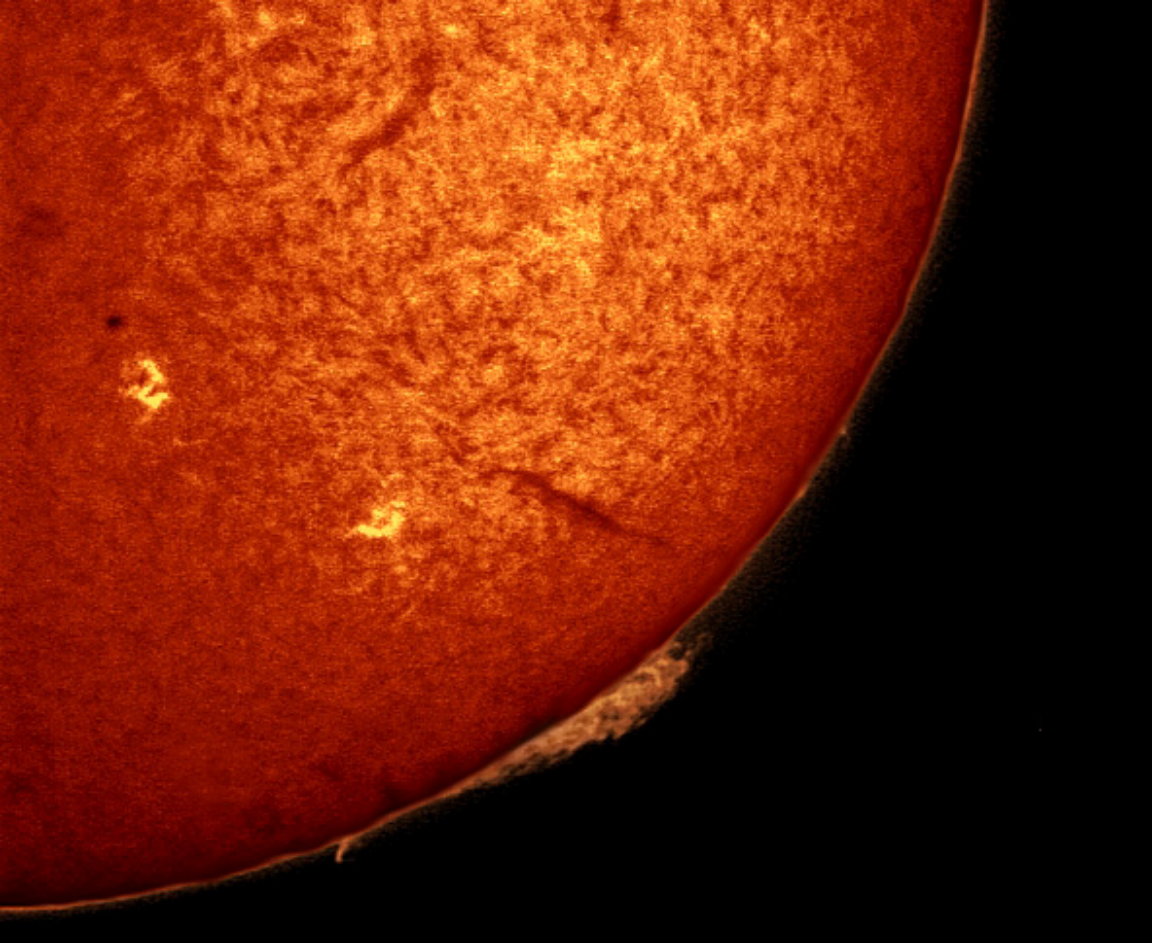


Convection: Benard cells



Convection: Earth Atmosphere





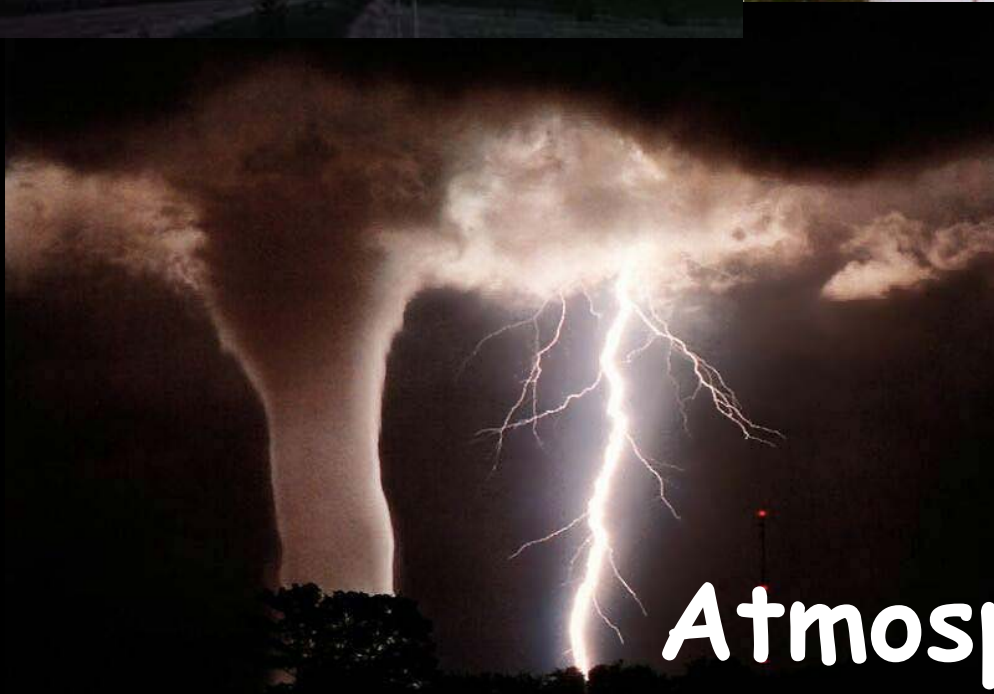
Convective cells on solar surface



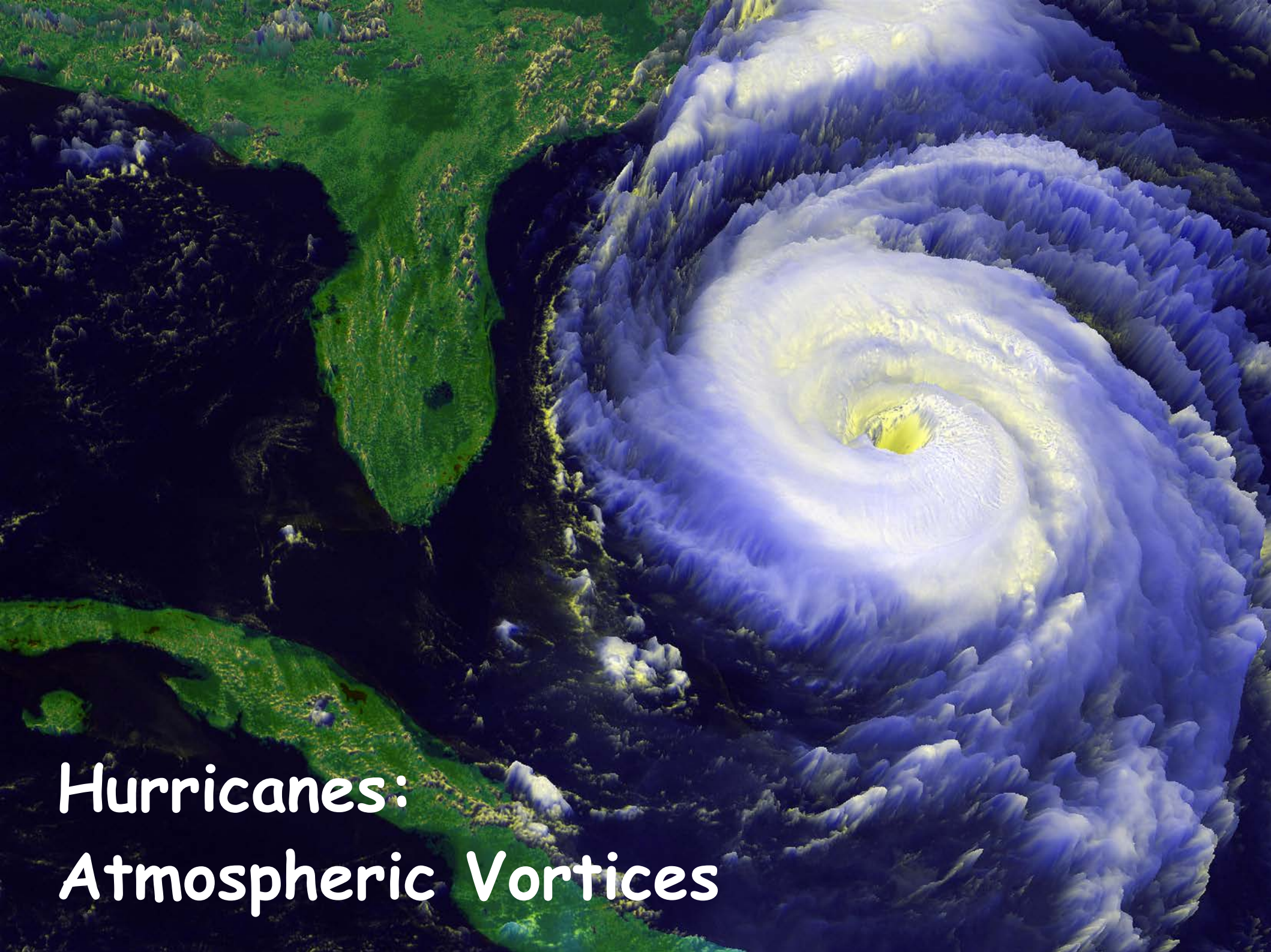
Vortex & Vorticity

Vortices in Shear Flow



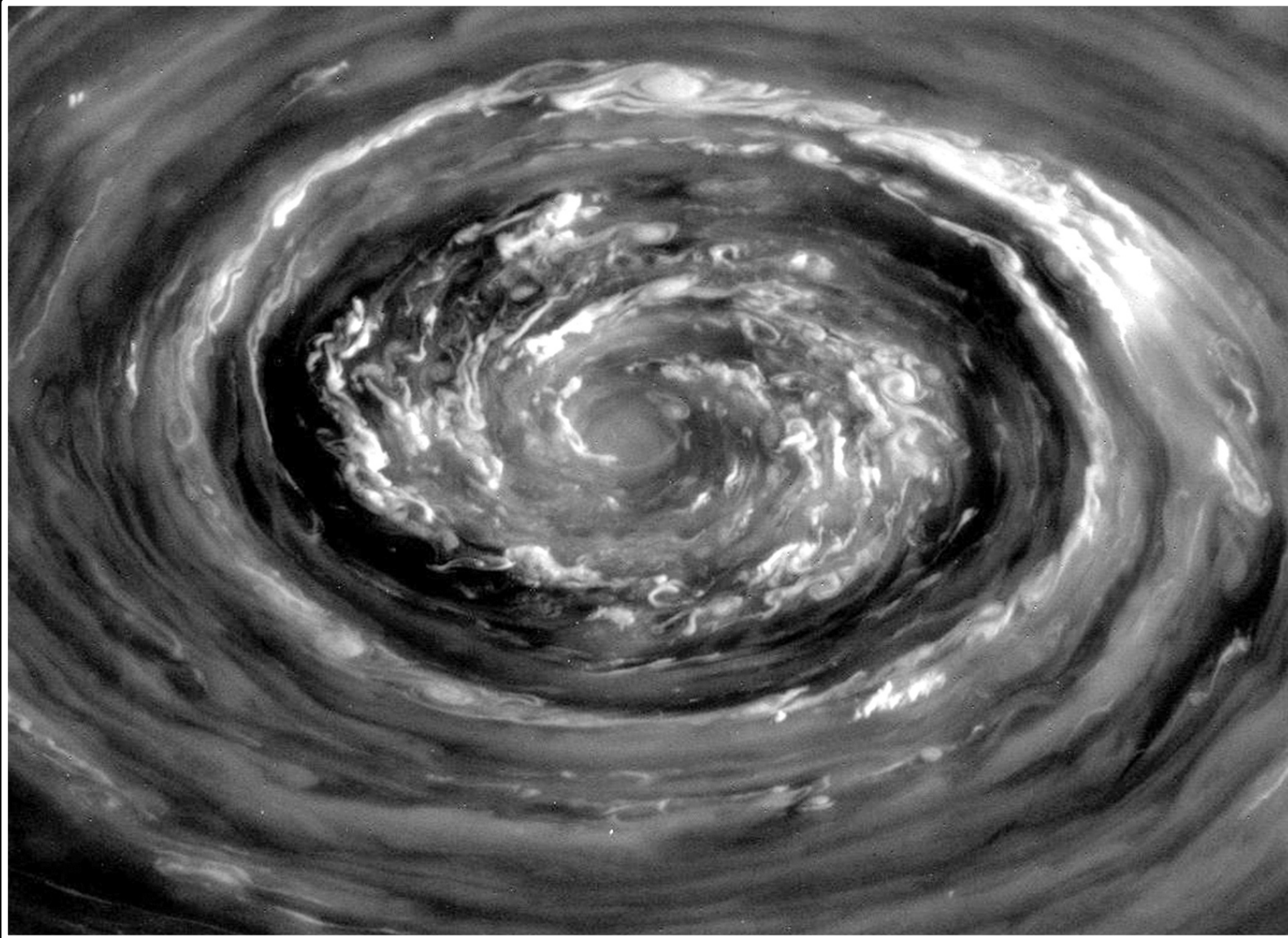


Tornados: Atmospheric Vortices



**Hurricanes:
Atmospheric Vortices**

Saturn's North Pole Vortex



Cassini

400,048 km.



Vortices and Eddies:
Jupiter's turbulent atmosphere

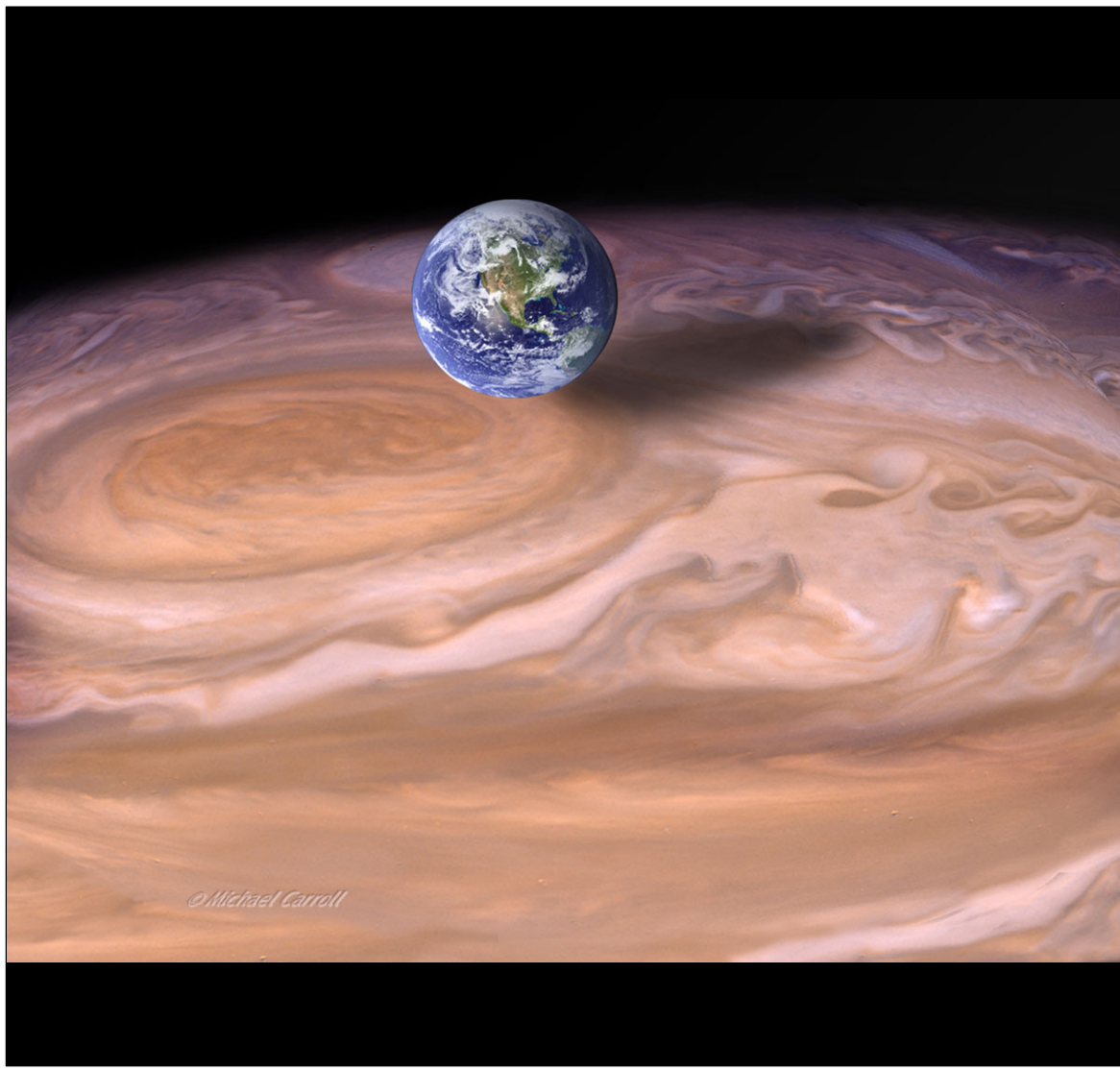


**Vortices and Eddies:
Jupiter's turbulent atmosphere**

The image displays a close-up view of Jupiter's atmosphere, characterized by intricate, swirling patterns of white, yellow, and brown. These patterns represent vortices and eddies, which are common features in the planet's turbulent atmosphere. The central part of the image shows a large, prominent vortex with a distinct eye-like structure, surrounded by smaller, more chaotic eddies. The overall appearance is that of a highly dynamic and complex fluid system.

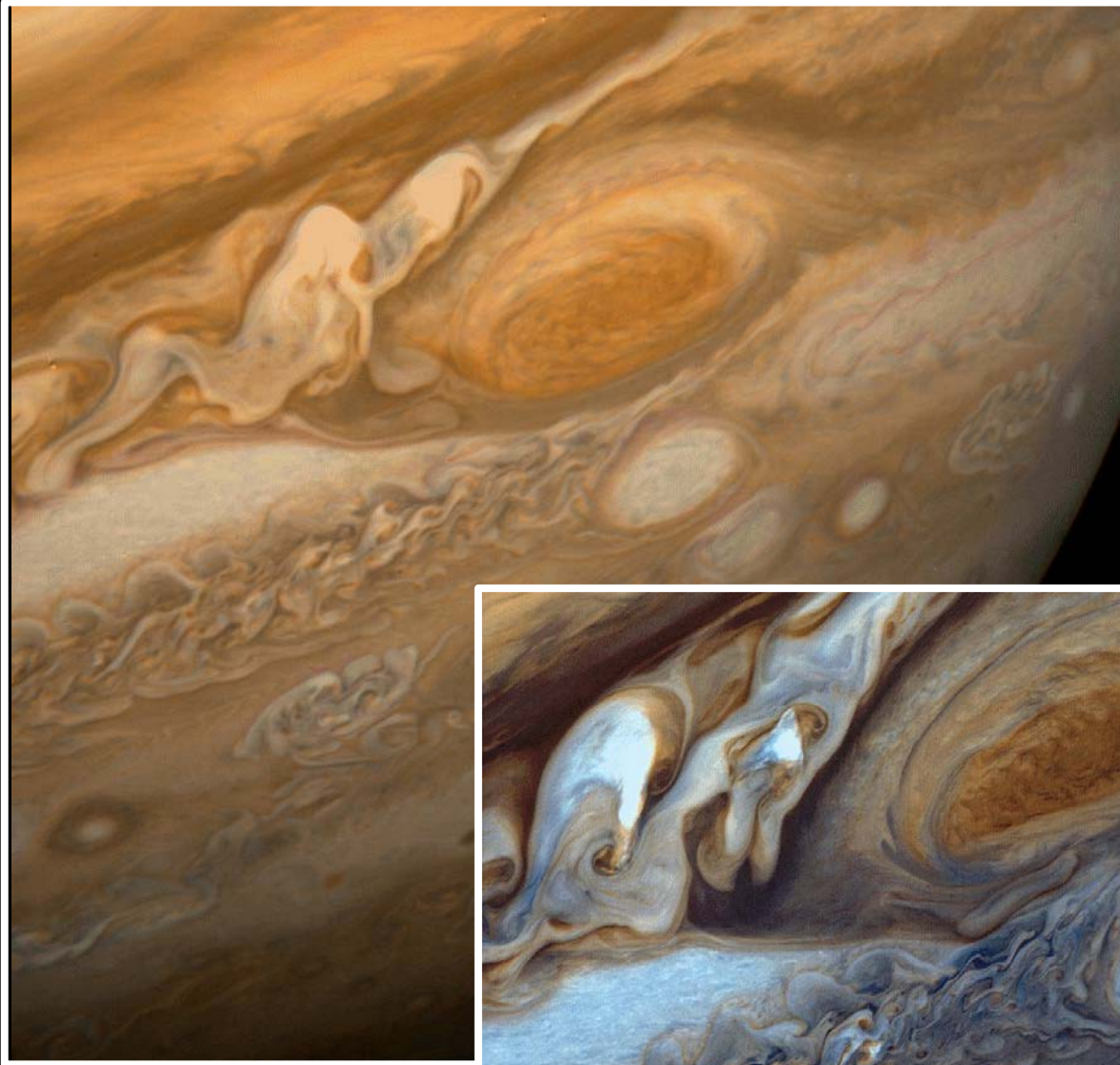
**Vortices and Eddies:
Jupiter's turbulent atmosphere**

Jupiter's Great Red Spot



- Persistent Anticyclonic Storm
- > 190-300 years old
- rotates counterclockwise, period ~ 6 (earth)days
- 24-40,000 km E-W
12-14,000 km N-S
- winds around the edge ~120 m/s
~430 km/h
- confined by
 - modest east jetstream south
 - very strong west jetstream north

Jupiter's Great Red Spot

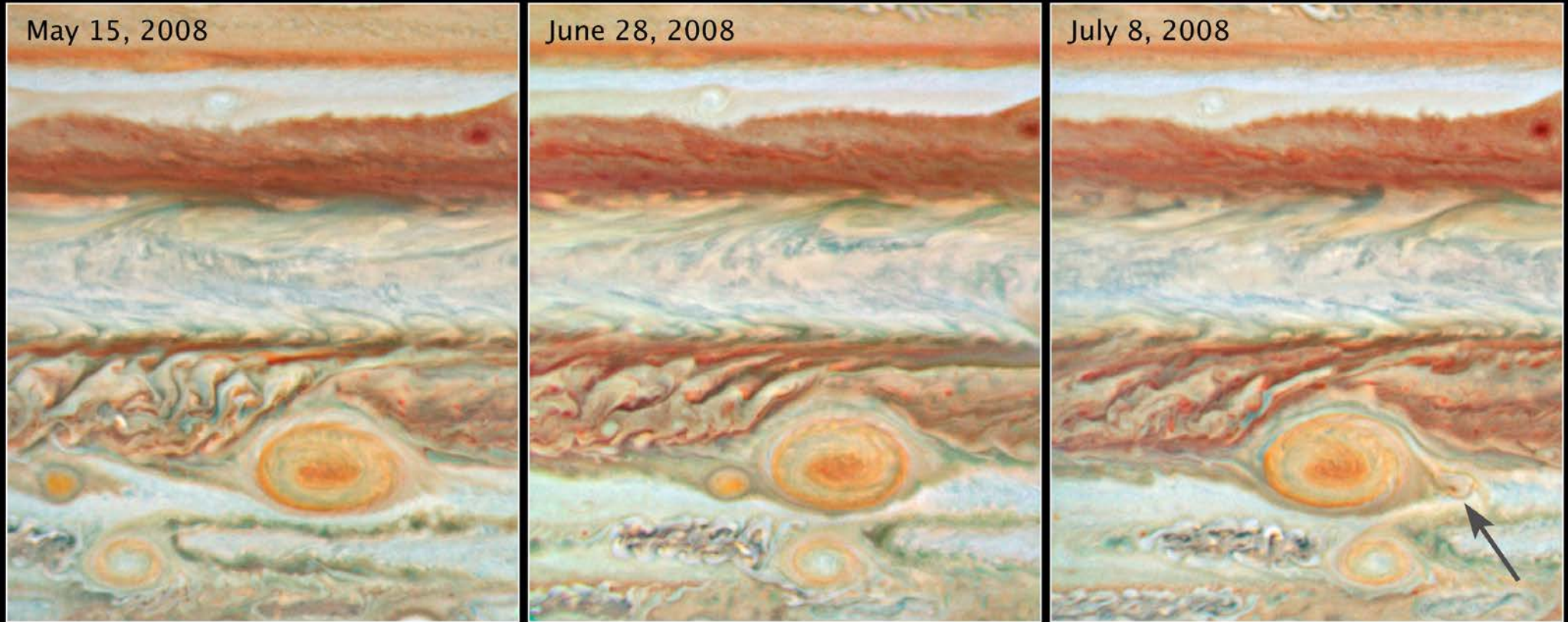


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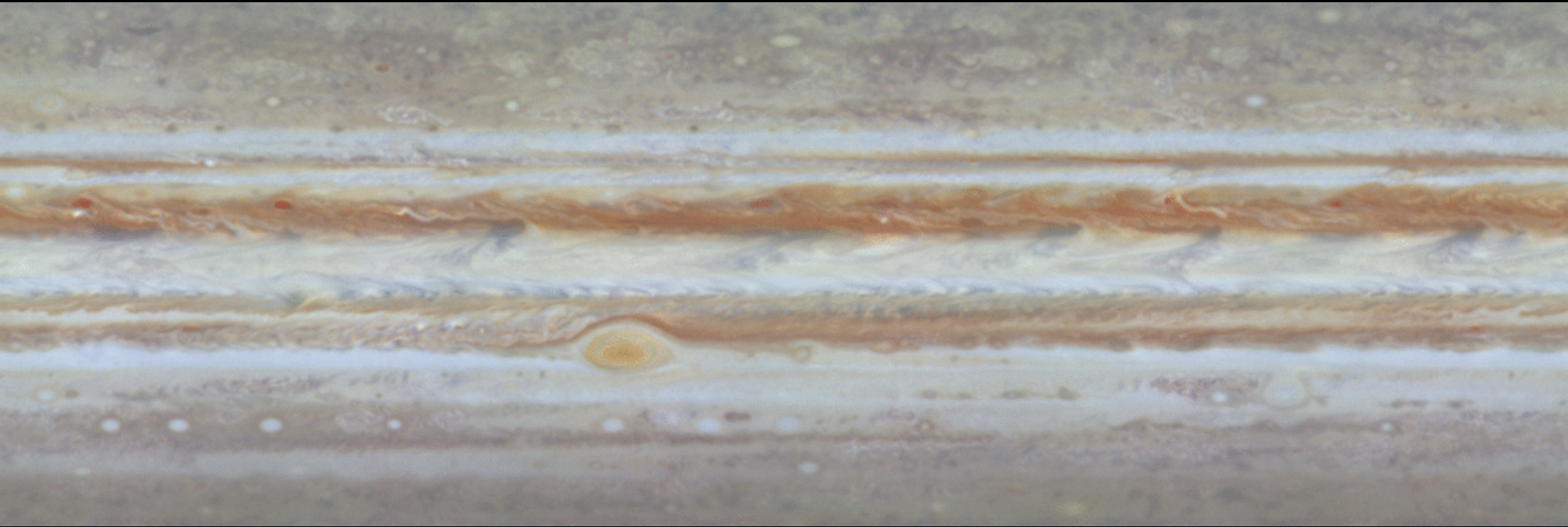
Jupiter's Great Red Spot



Jupiter's Red Spots
Hubble Space Telescope ■ WFPC2

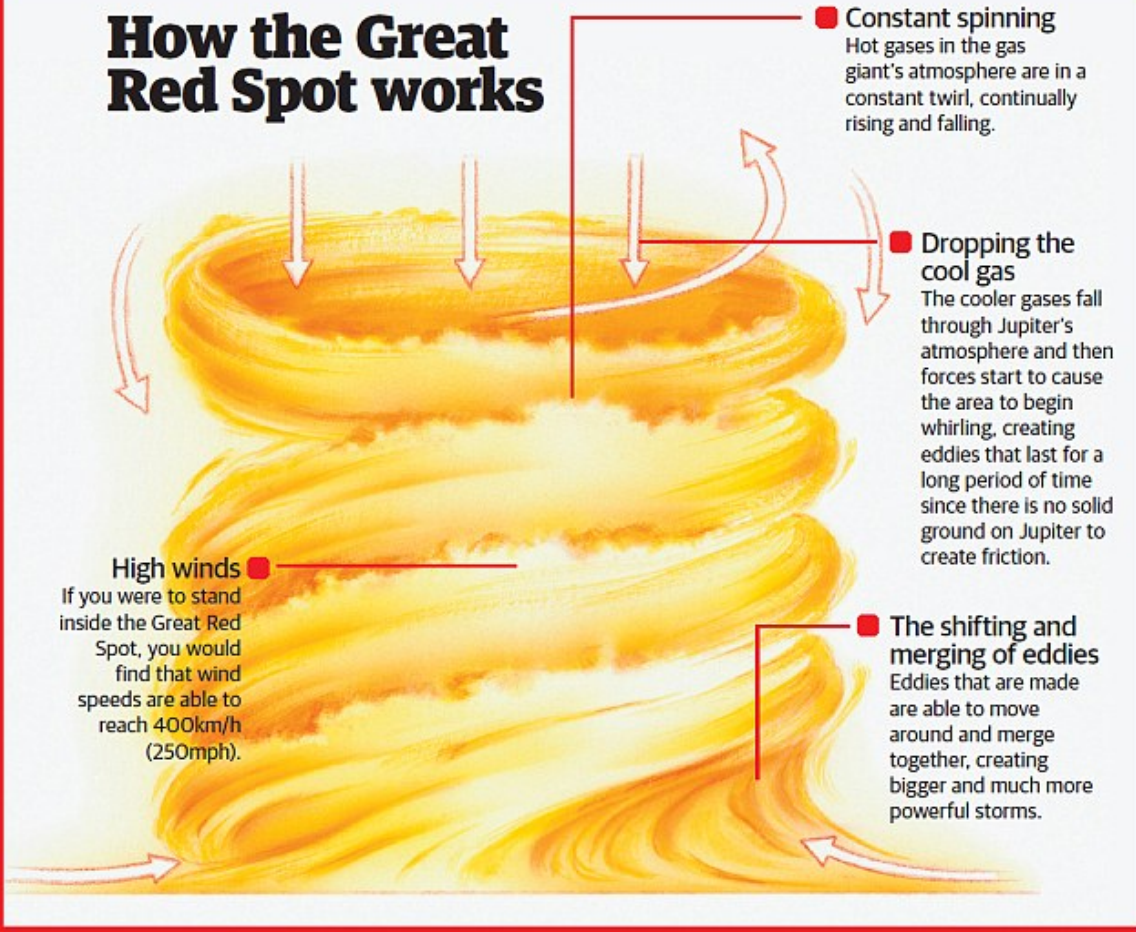
NASA, ESA, and A. Simon-Miller (NASA Goddard Space Flight Center) ■ STScI-PRC08-27

Jupiter's Great Red Spot



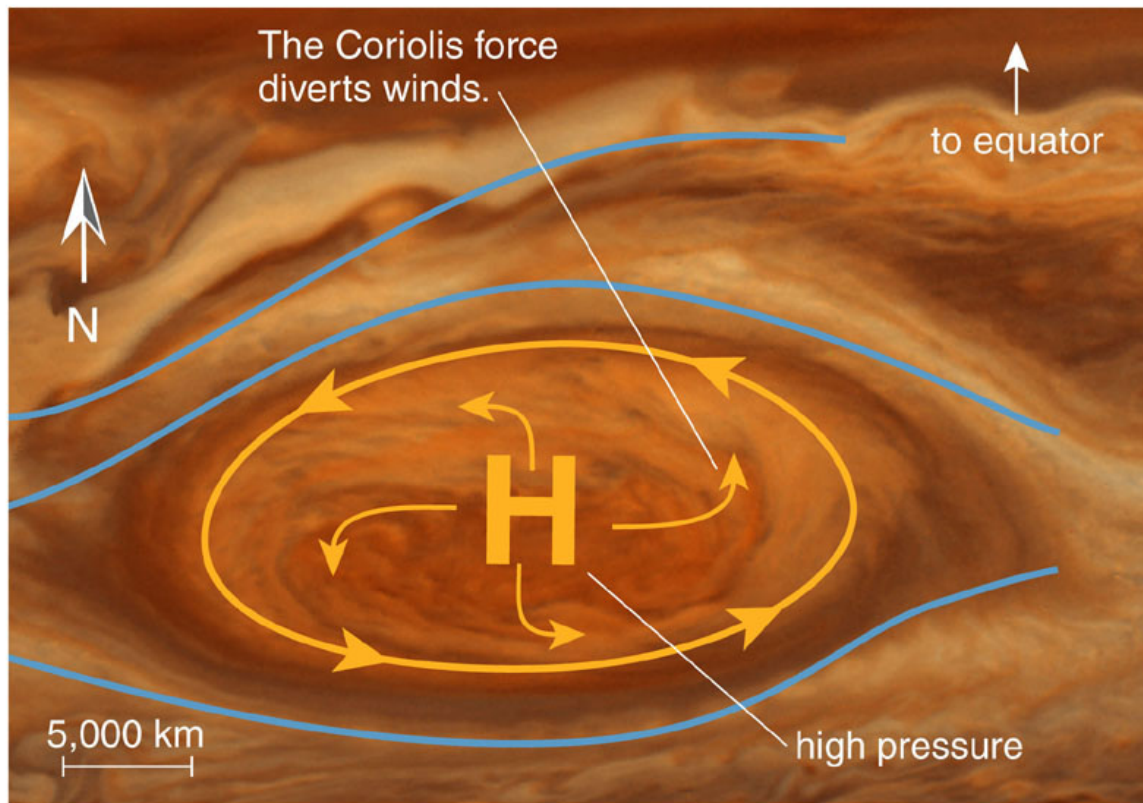
Jupiter's Great Red Spot

How the Great Red Spot works



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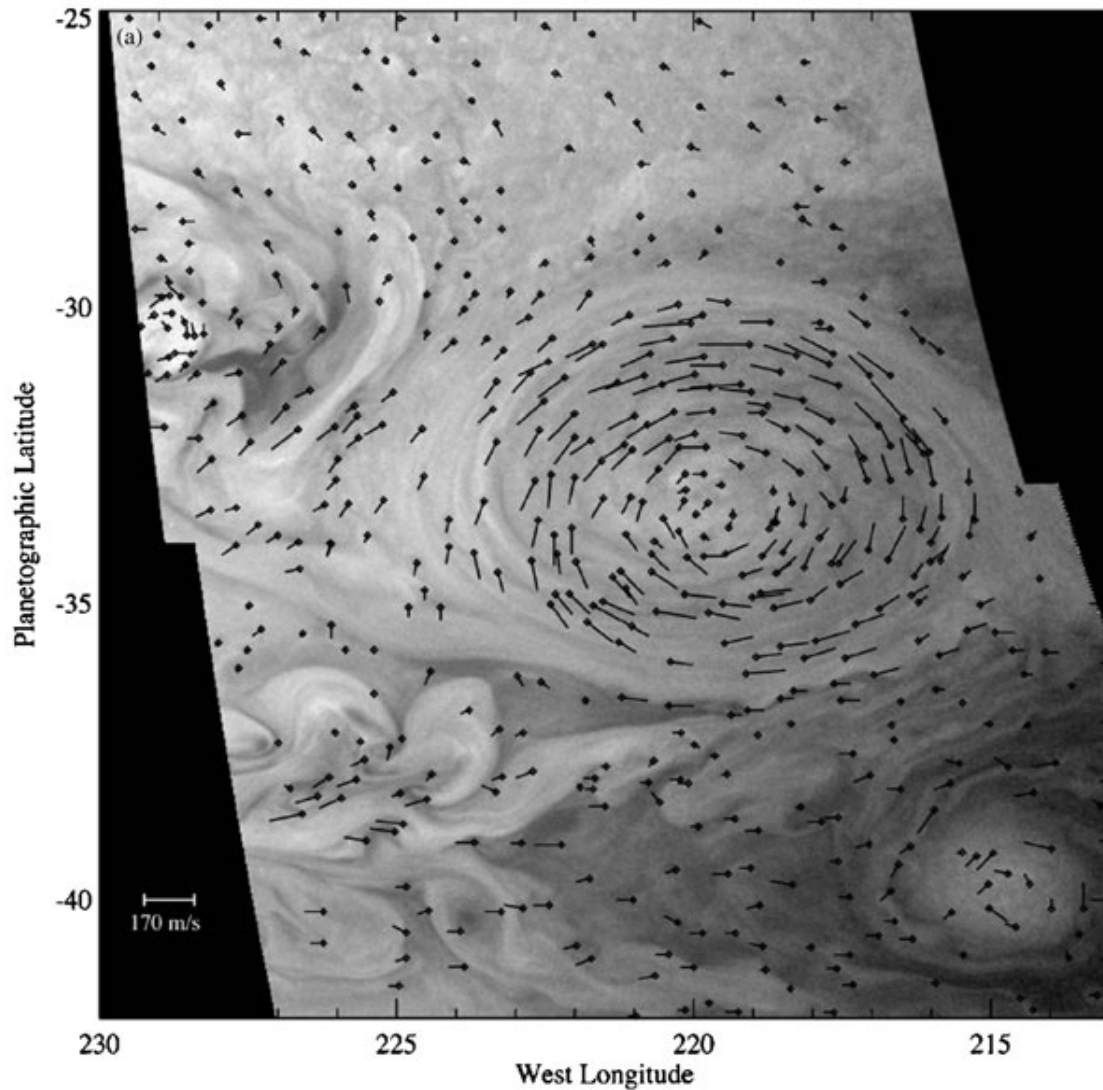
Jupiter's Great Red Spot



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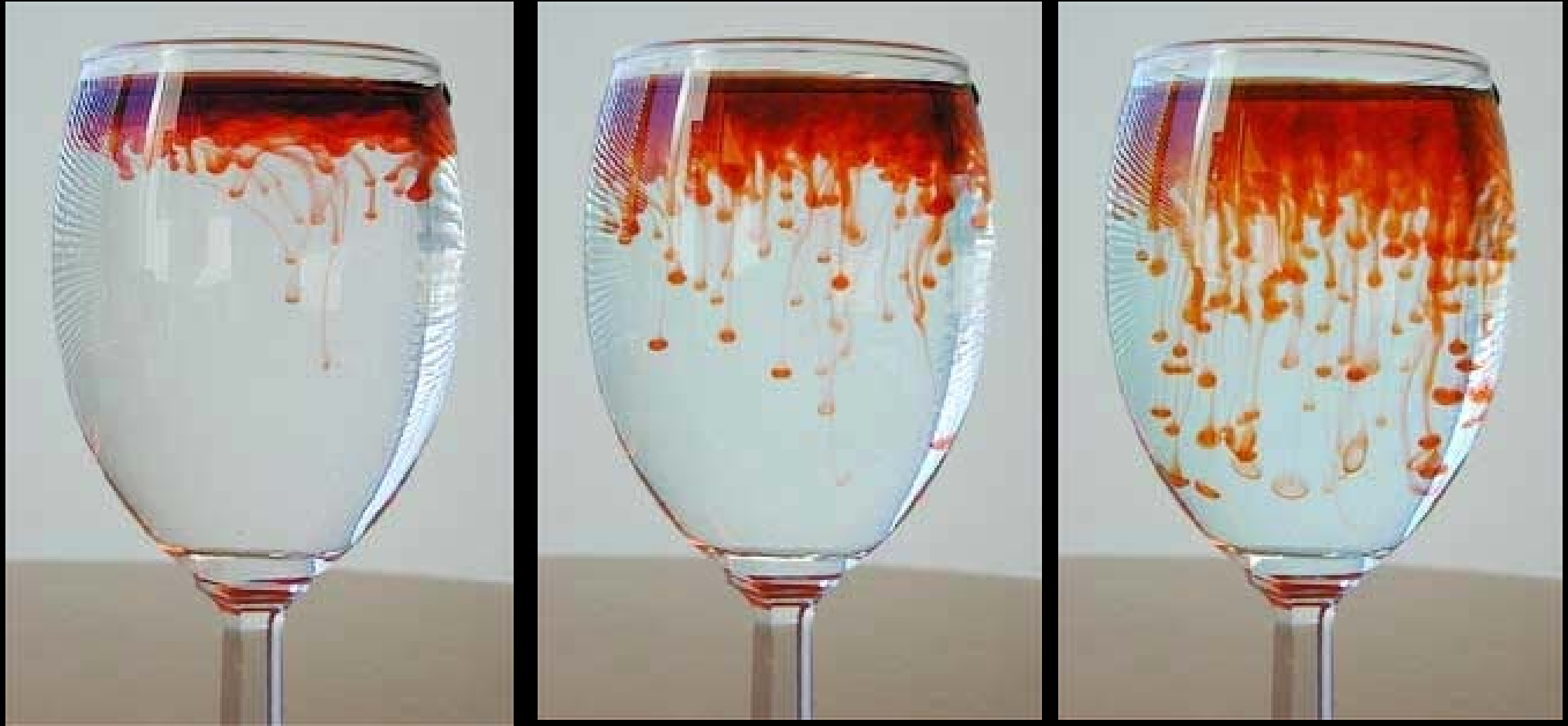
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Jupiter's Great Red Spot



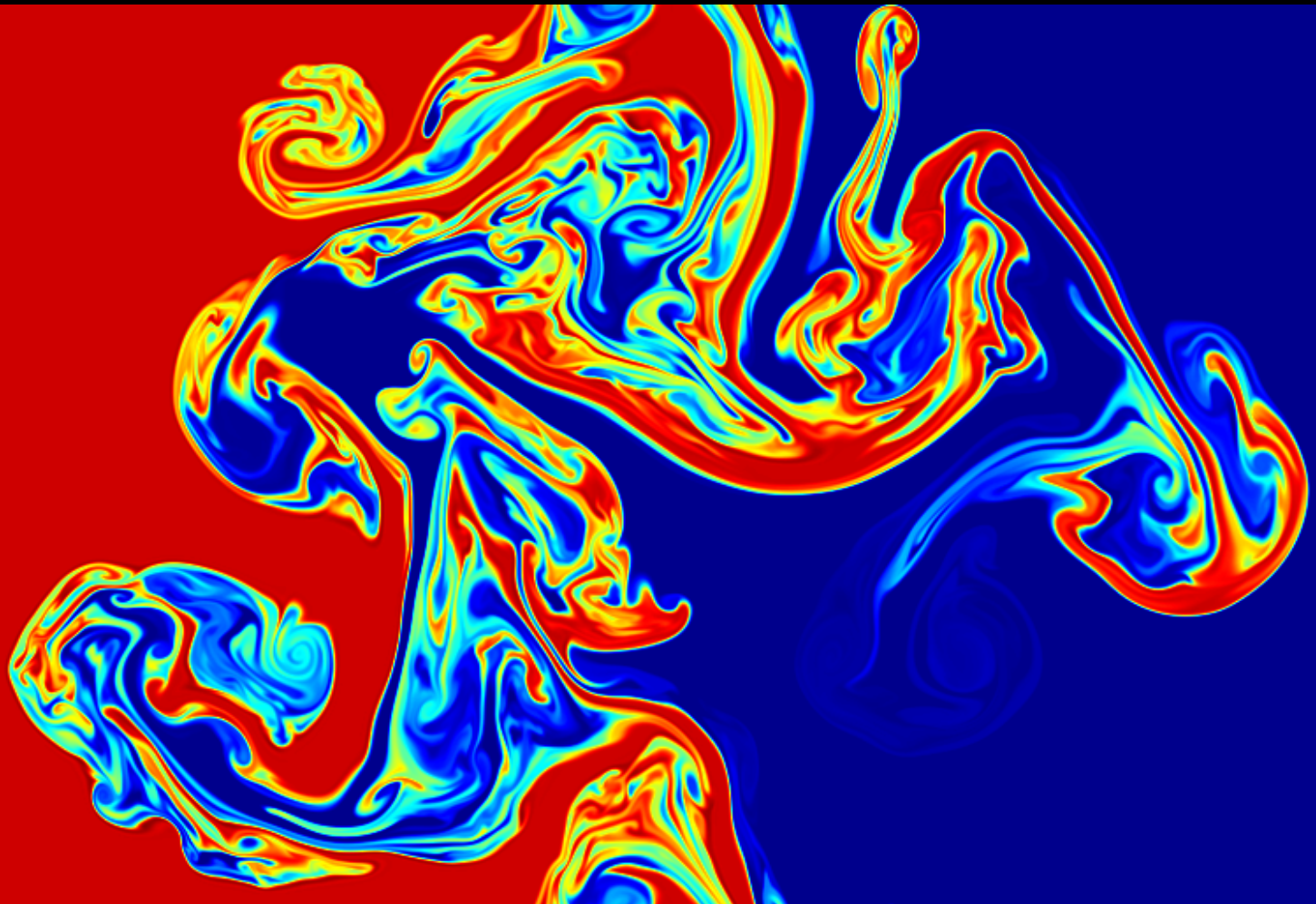
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Rayleigh-Taylor Instability



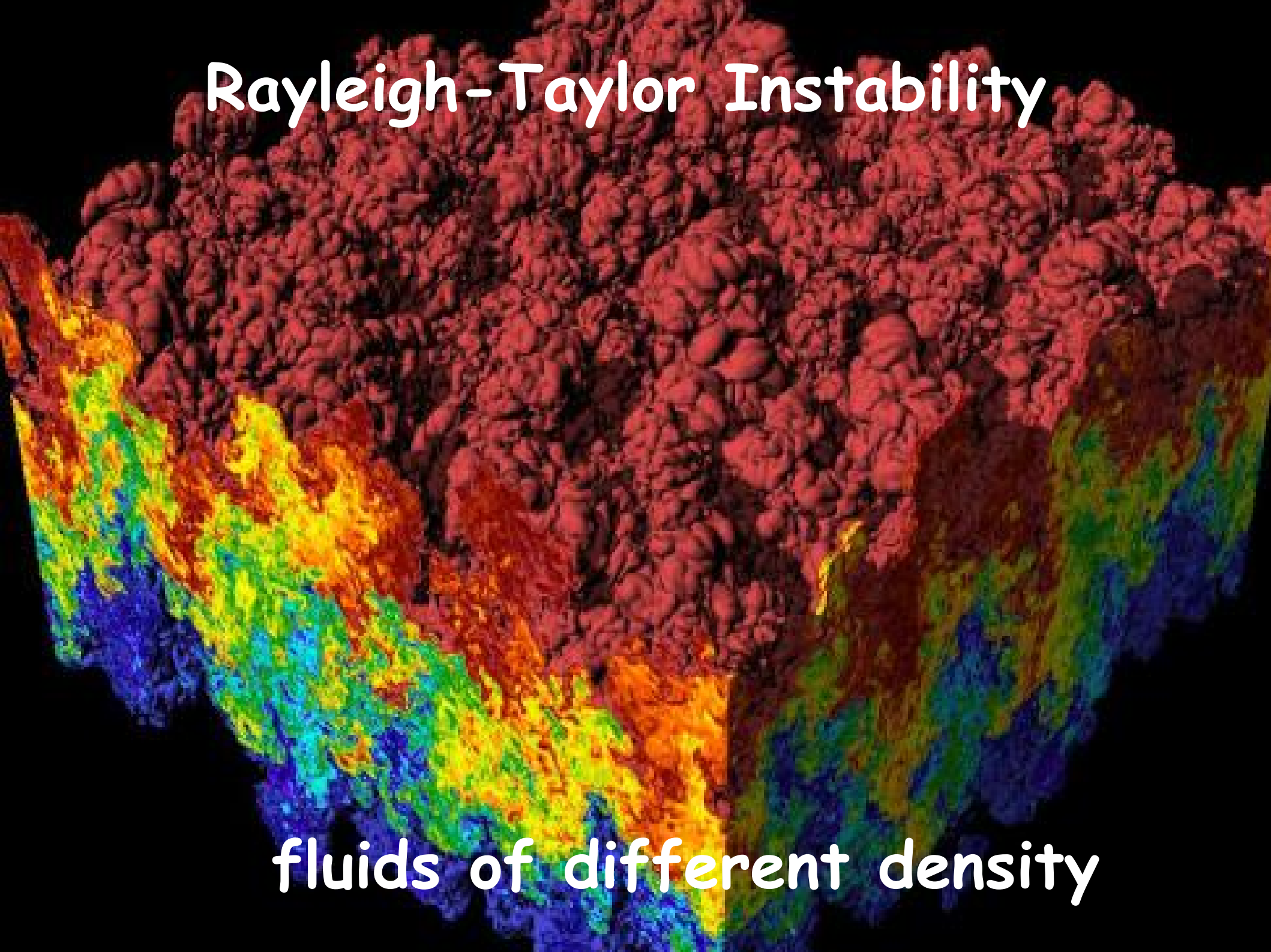
2 fluids of different density

Rayleigh-Taylor Instability



2 fluids of different density

Rayleigh-Taylor Instability



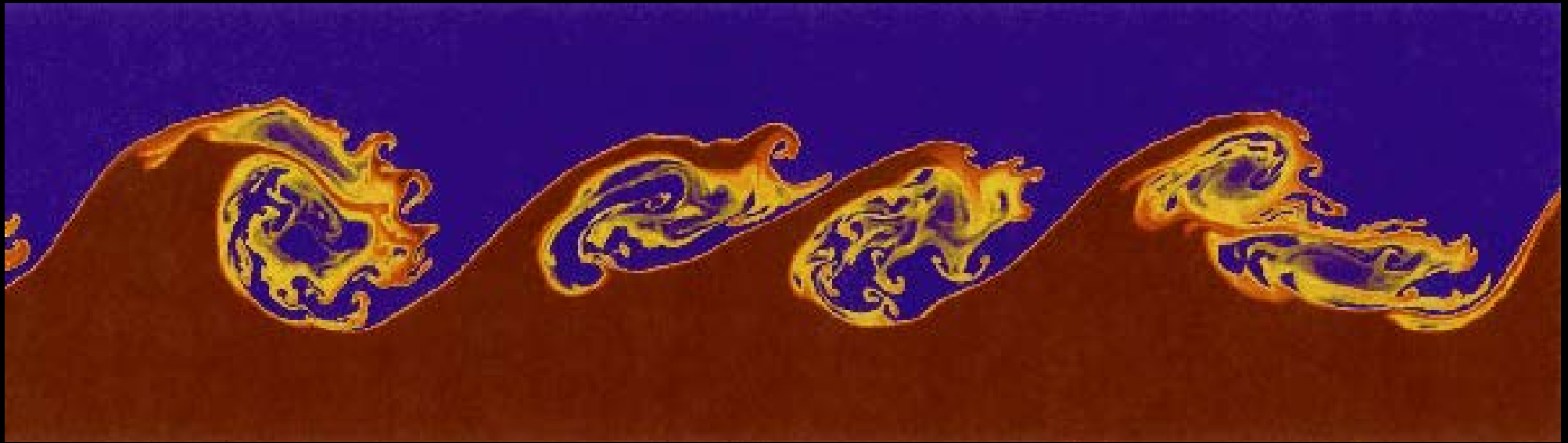
fluids of different density

Cosmic Rayleigh-Taylor Instability



Crab Supernova Remnant

Kelvin-Helmholtz Instability



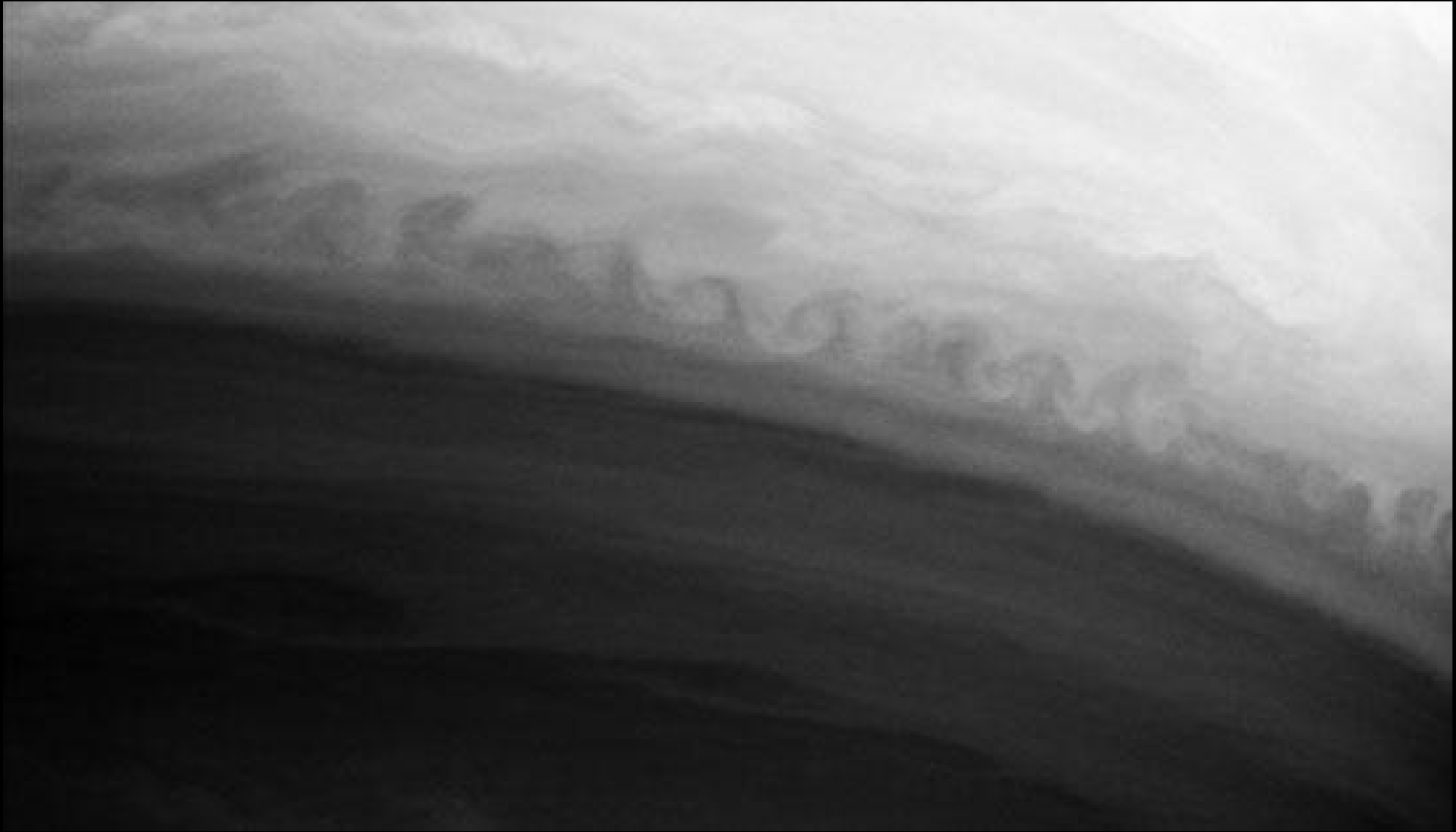
at the boundary of 2 shearing fluids

Kelvin-Helmholtz Instability



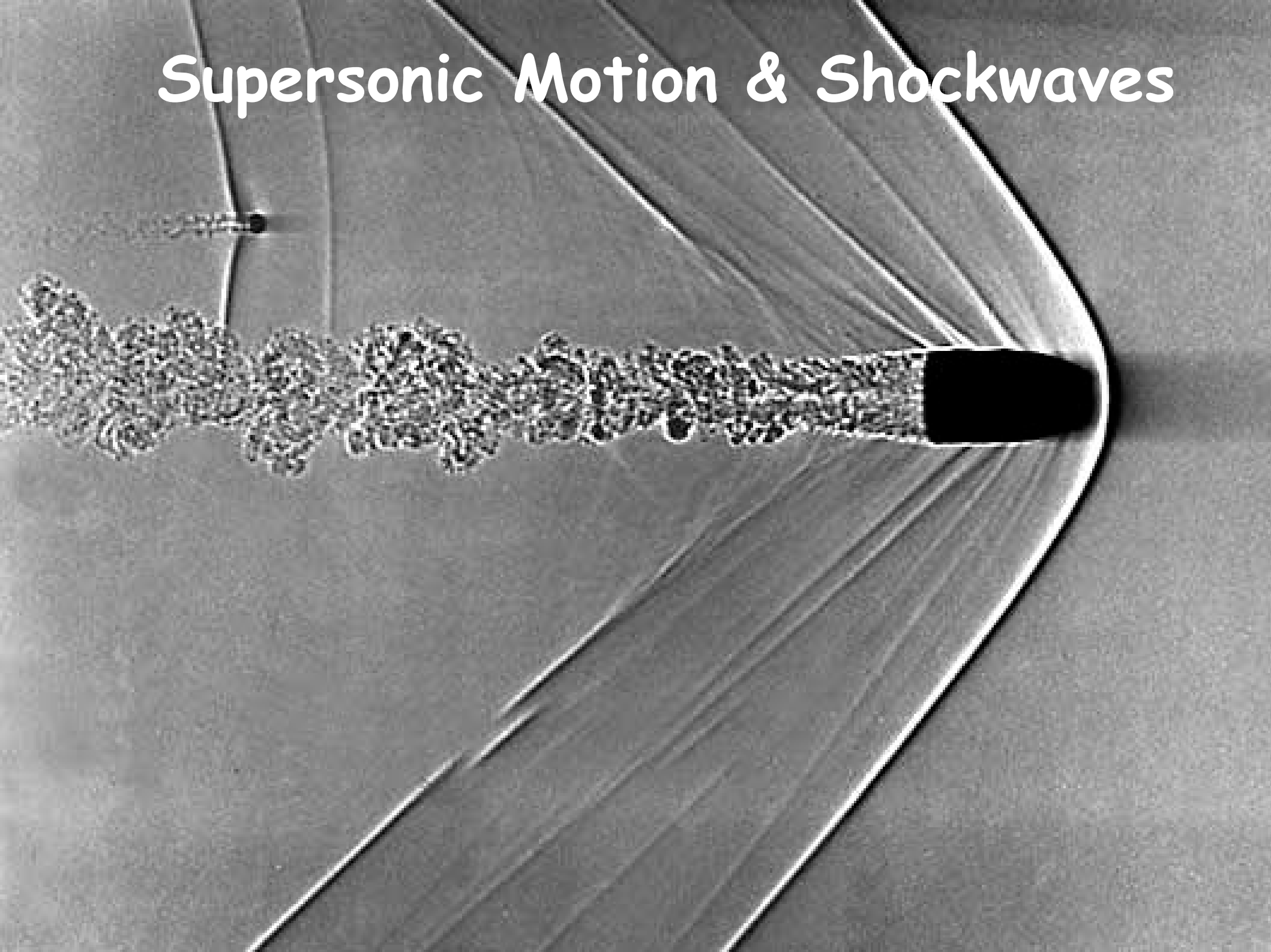
KH instability in cloud cover

Kelvin-Helmholtz Instability

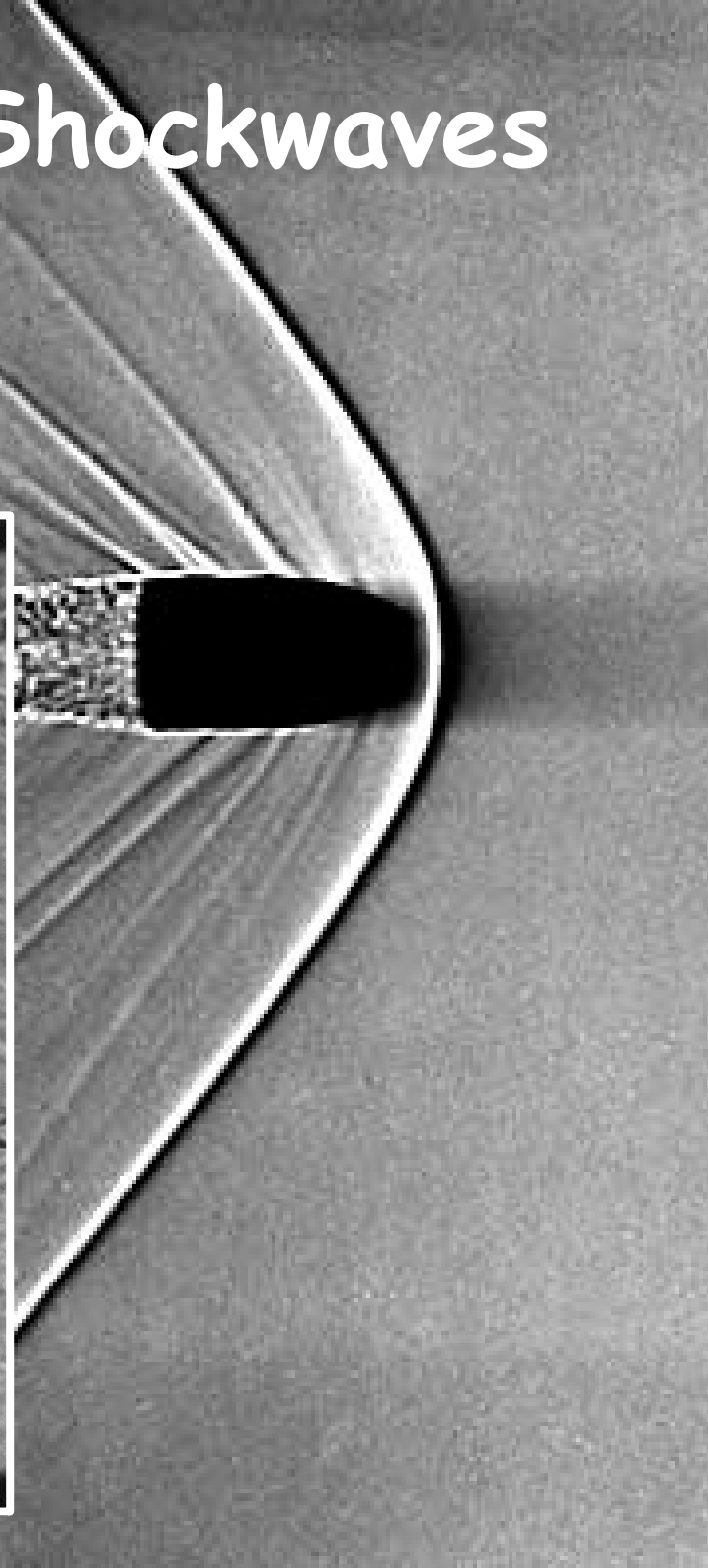
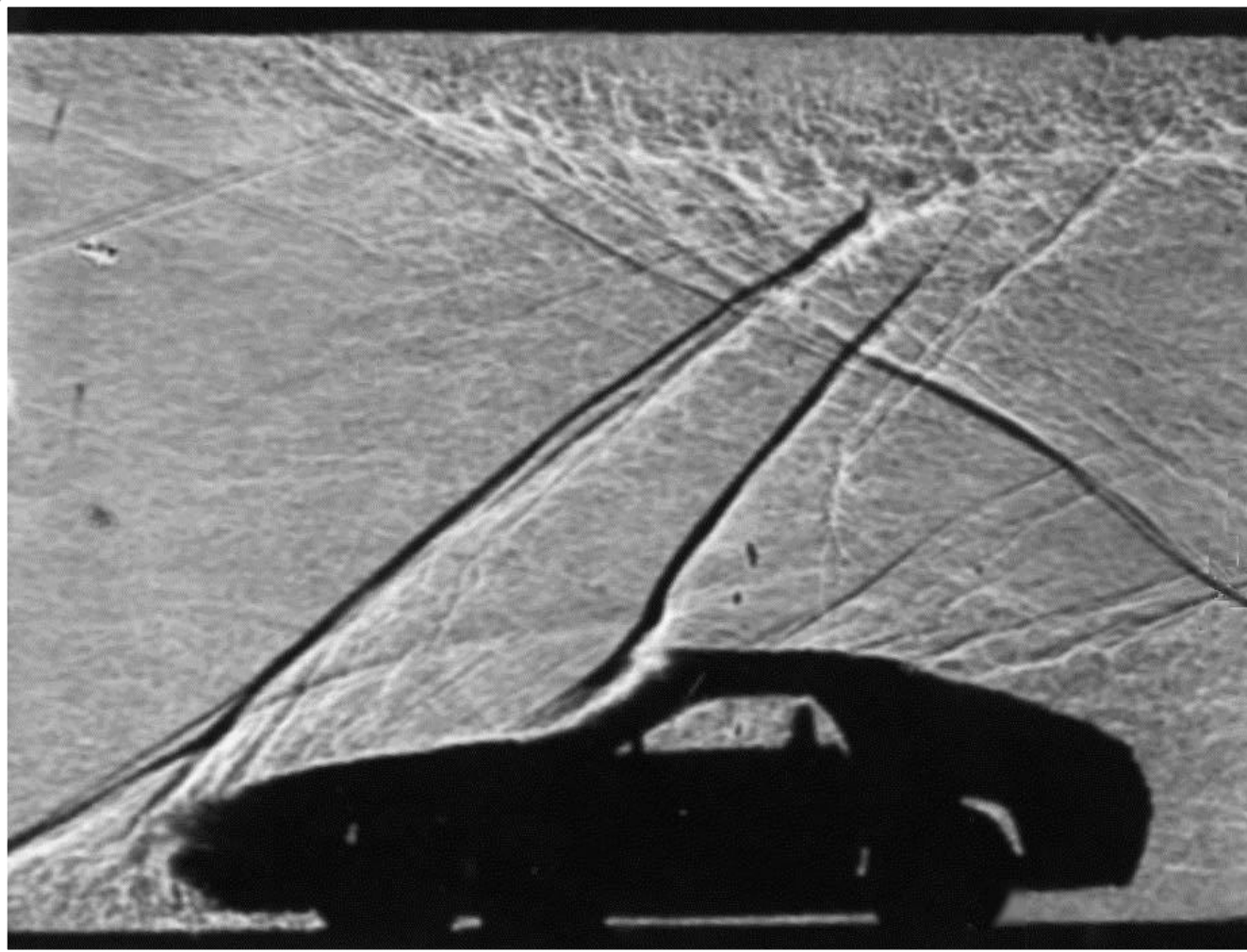


KH instability in Saturn's atmosphere

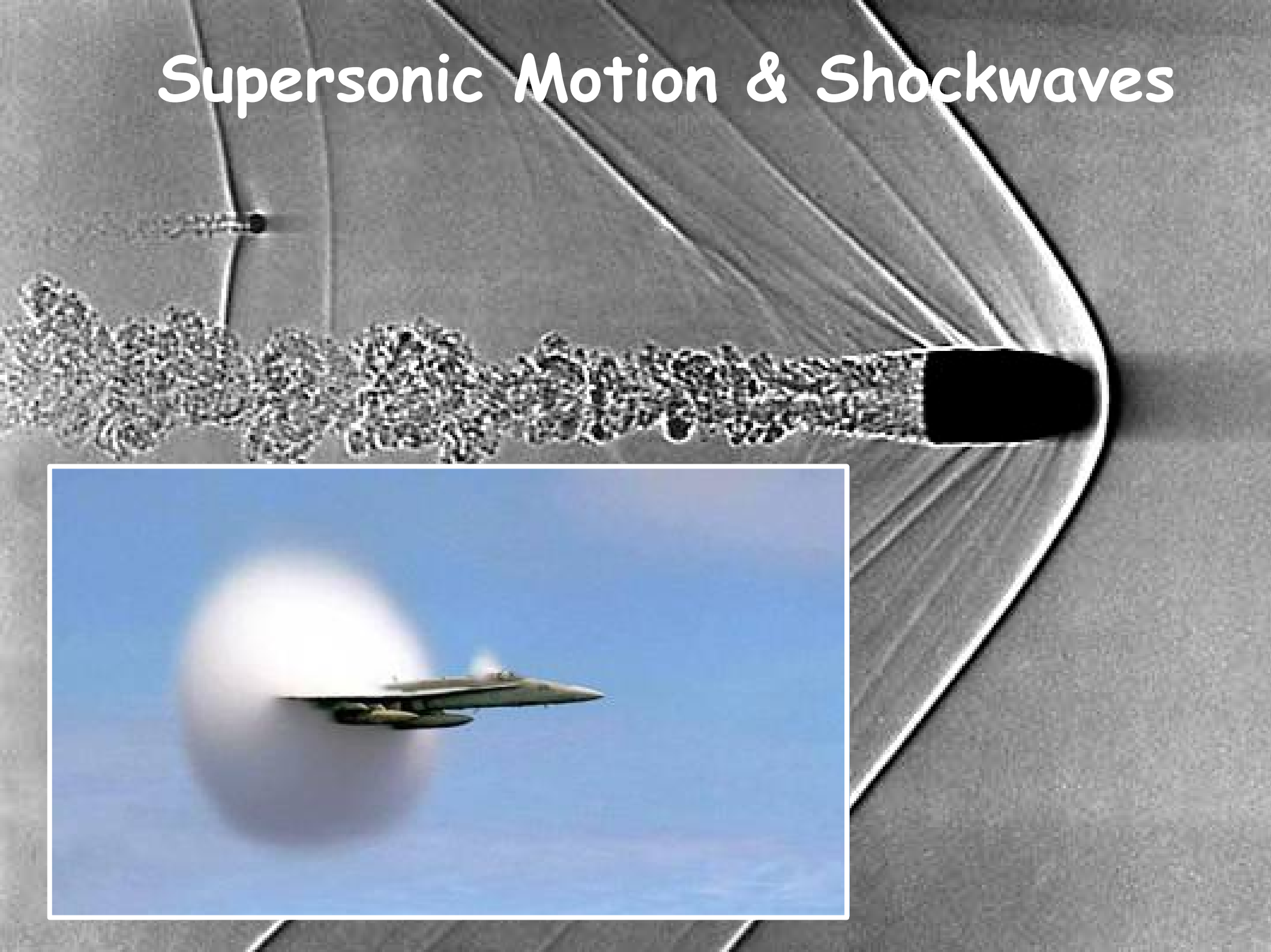
Supersonic Motion & Shockwaves



Supersonic Motion & Shockwaves



Supersonic Motion & Shockwaves



Cosmic Shockwave: Supernova remnant CasA



Gas streams
along magnetic field lines

Solar surface
TRACE

