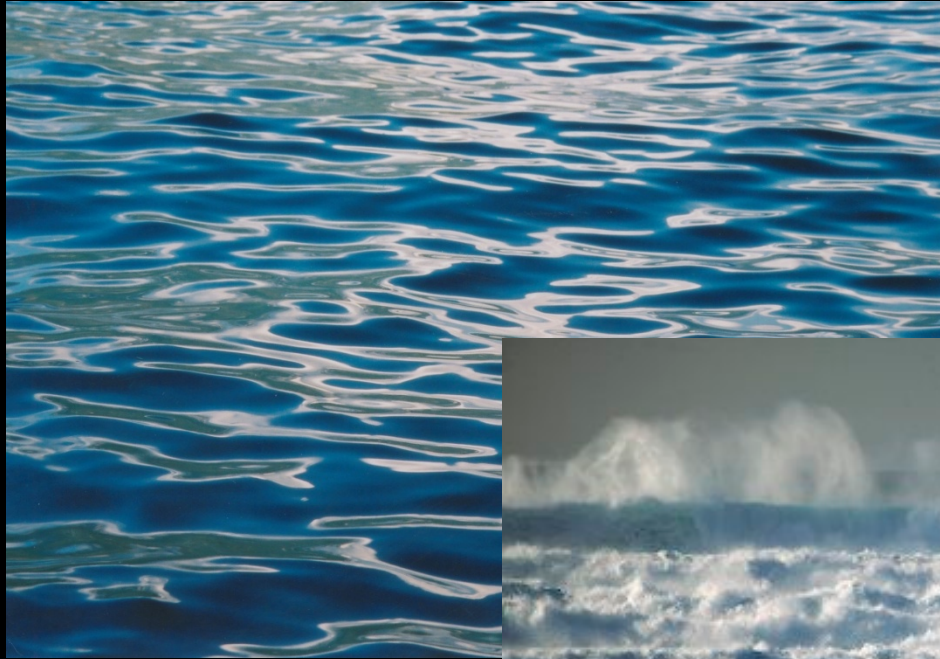




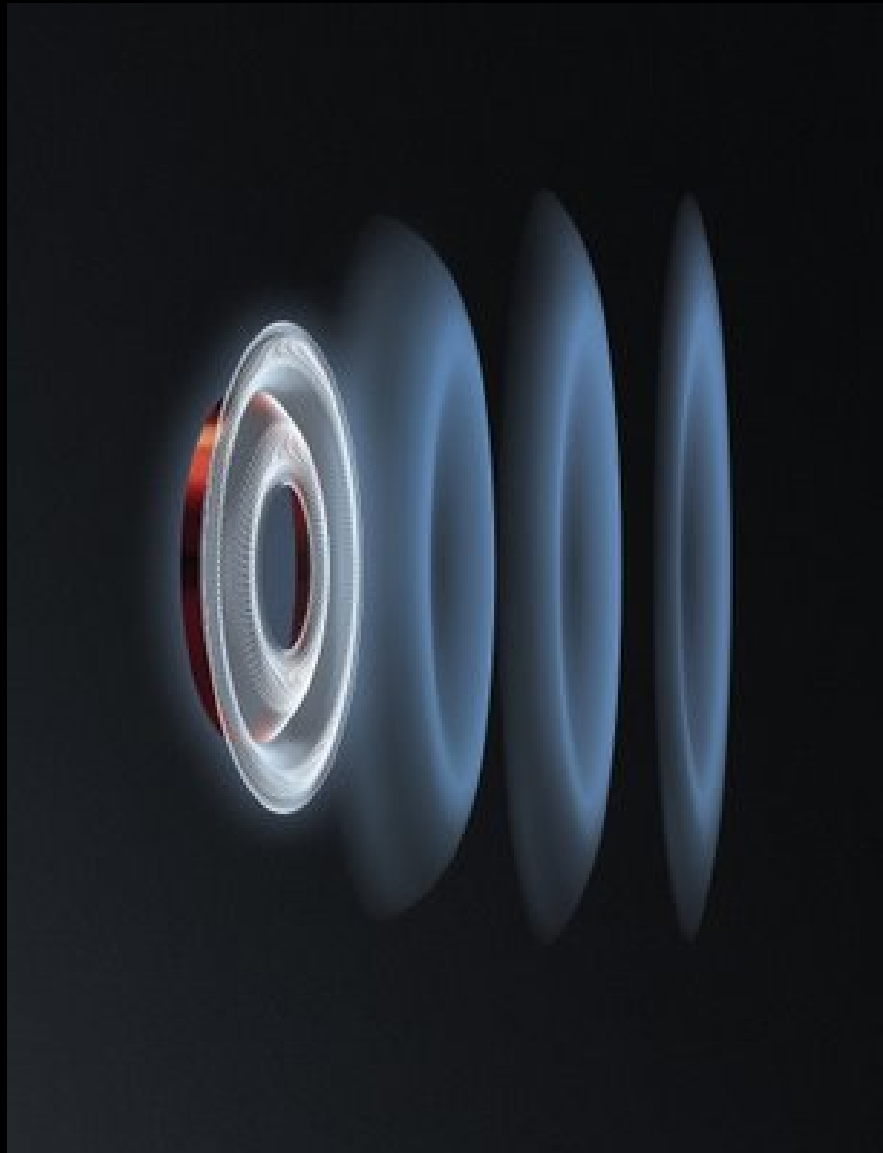
Astrophysical Fluid Dynamics

Fluid Picture Book

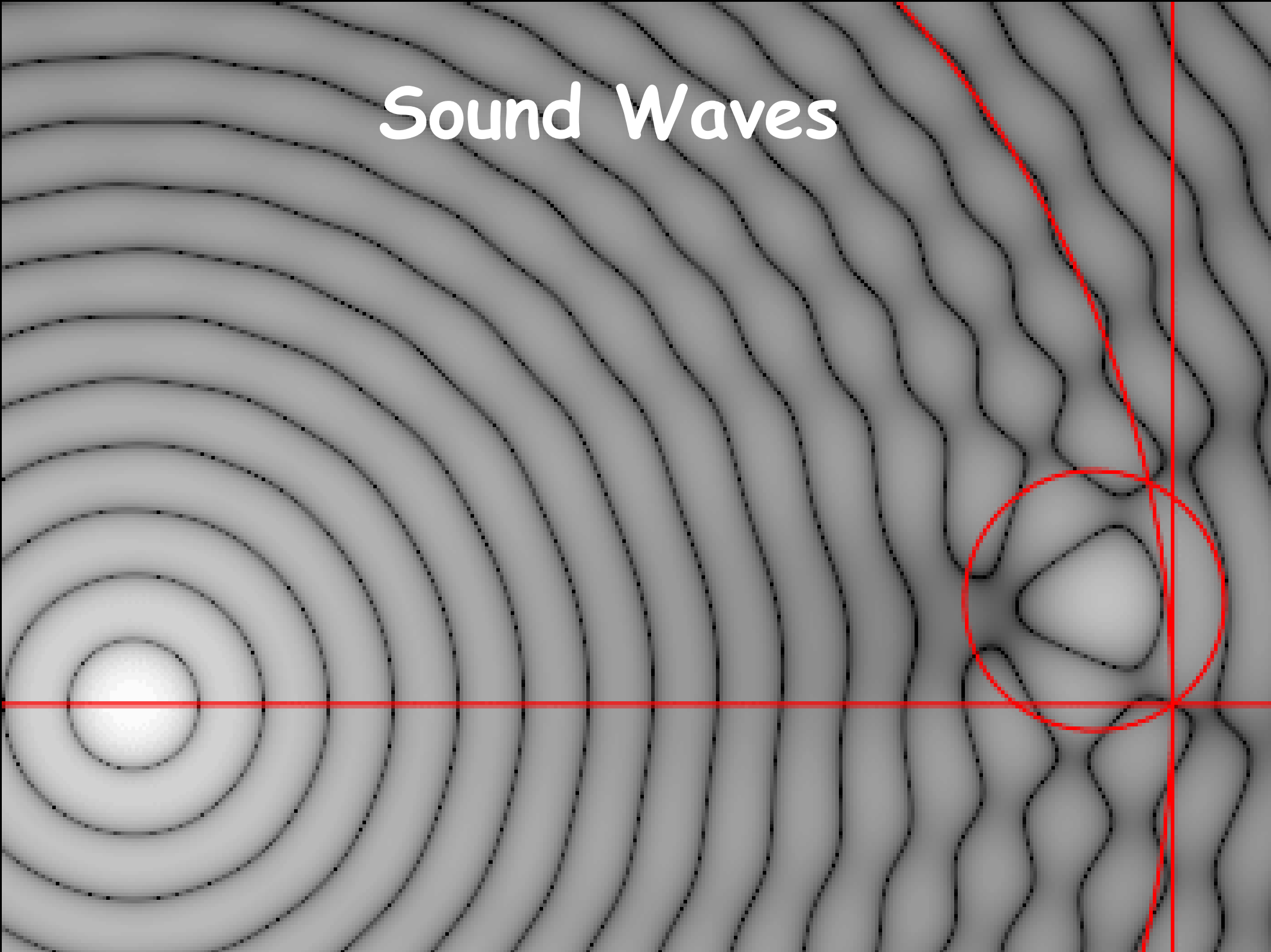
Waves: sea & ocean waves



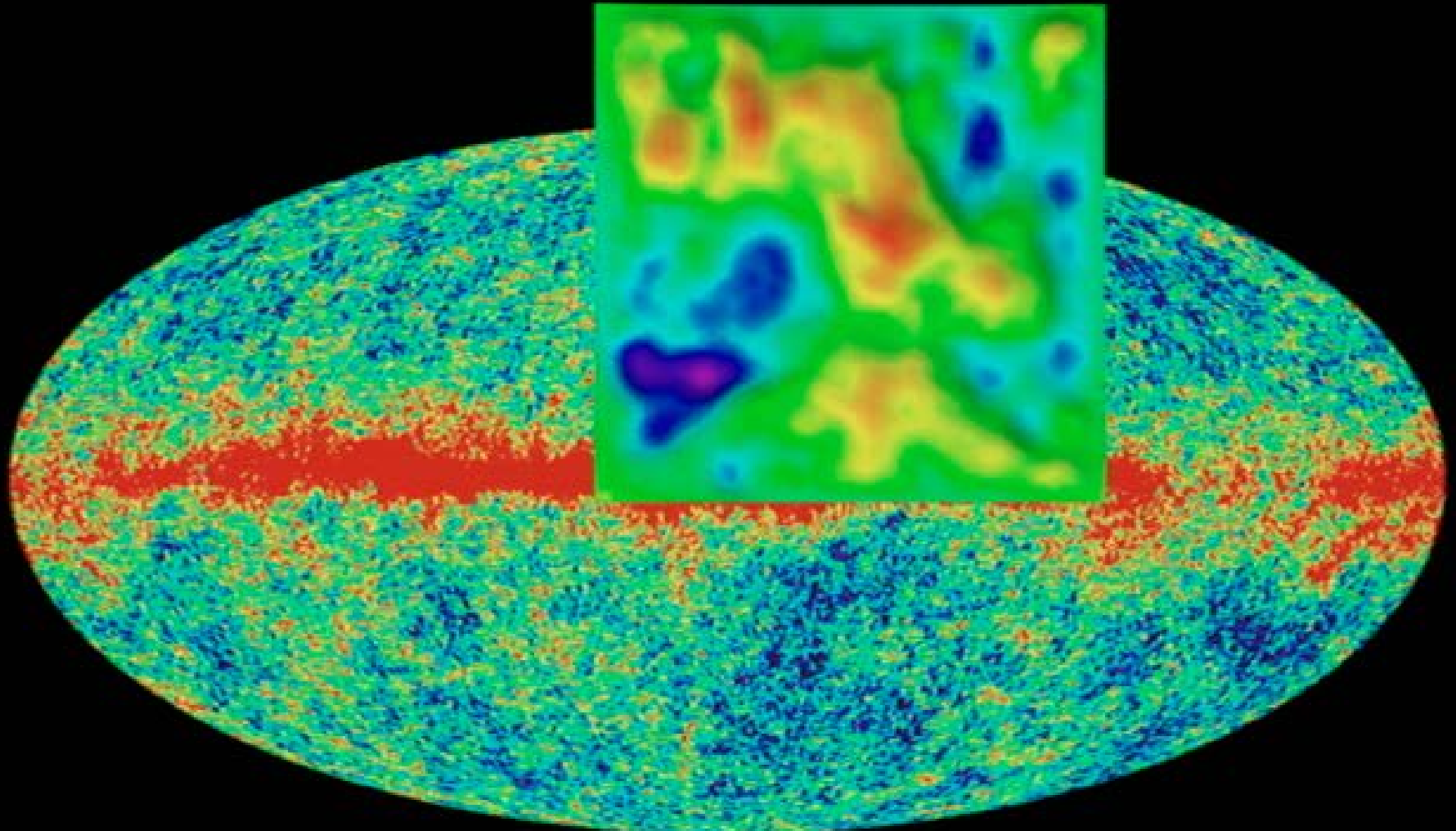
Sound Waves:



Sound Waves

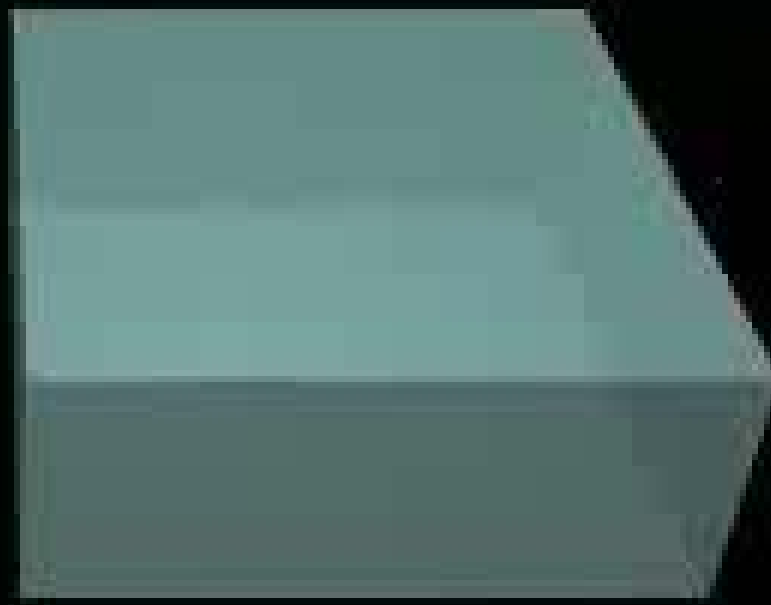


Cosmic Sound Waves

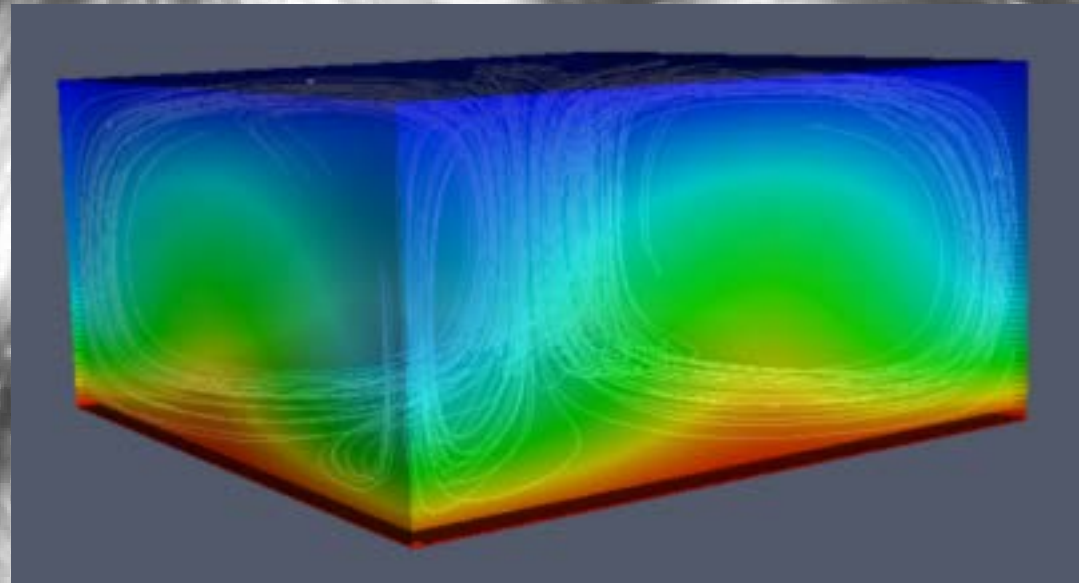


Primordial Sound Ripples seen in
WMAP Cosmic Microwave Background

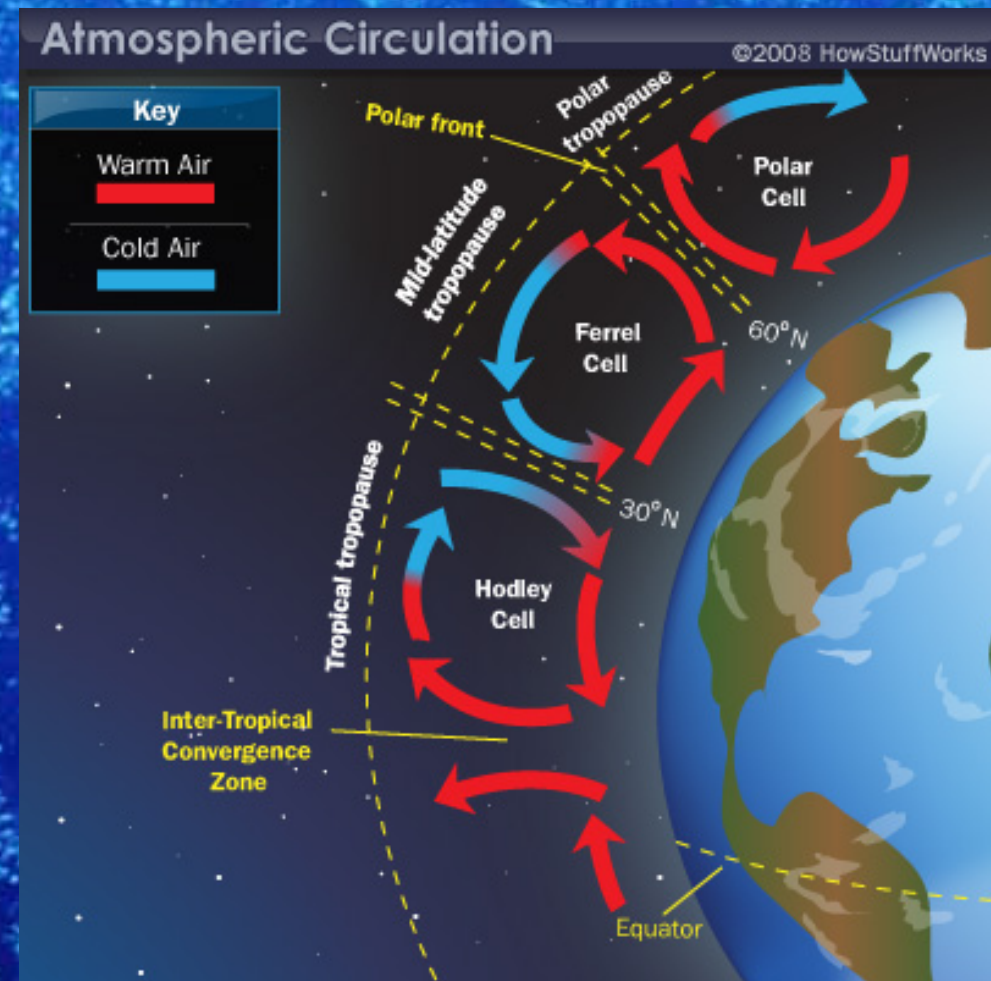
Cosmic Sound Waves

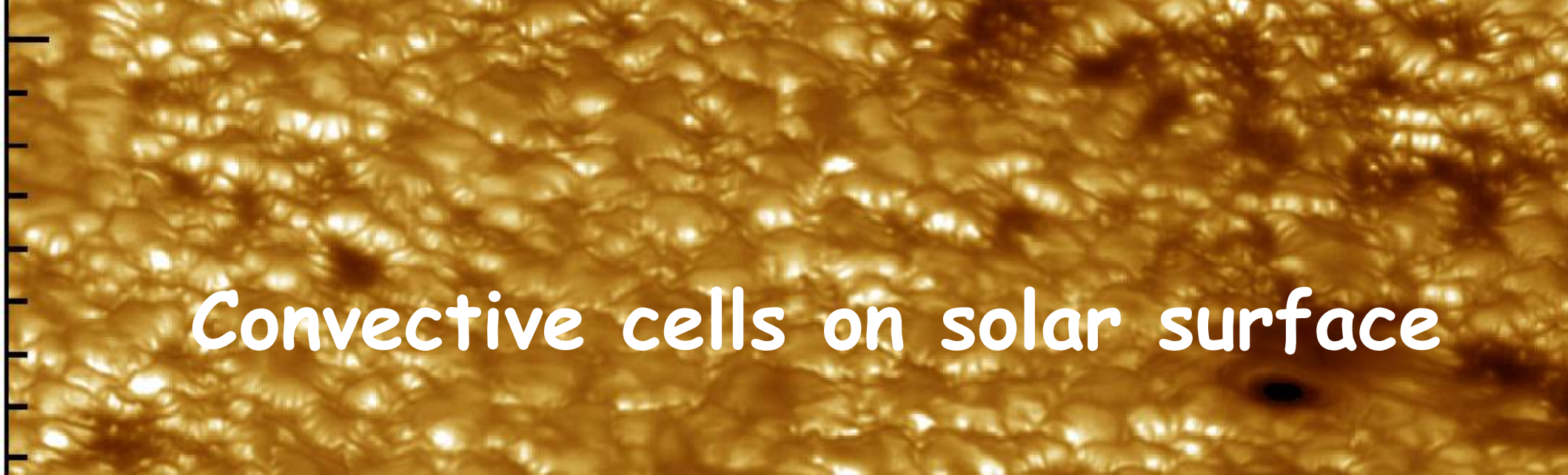
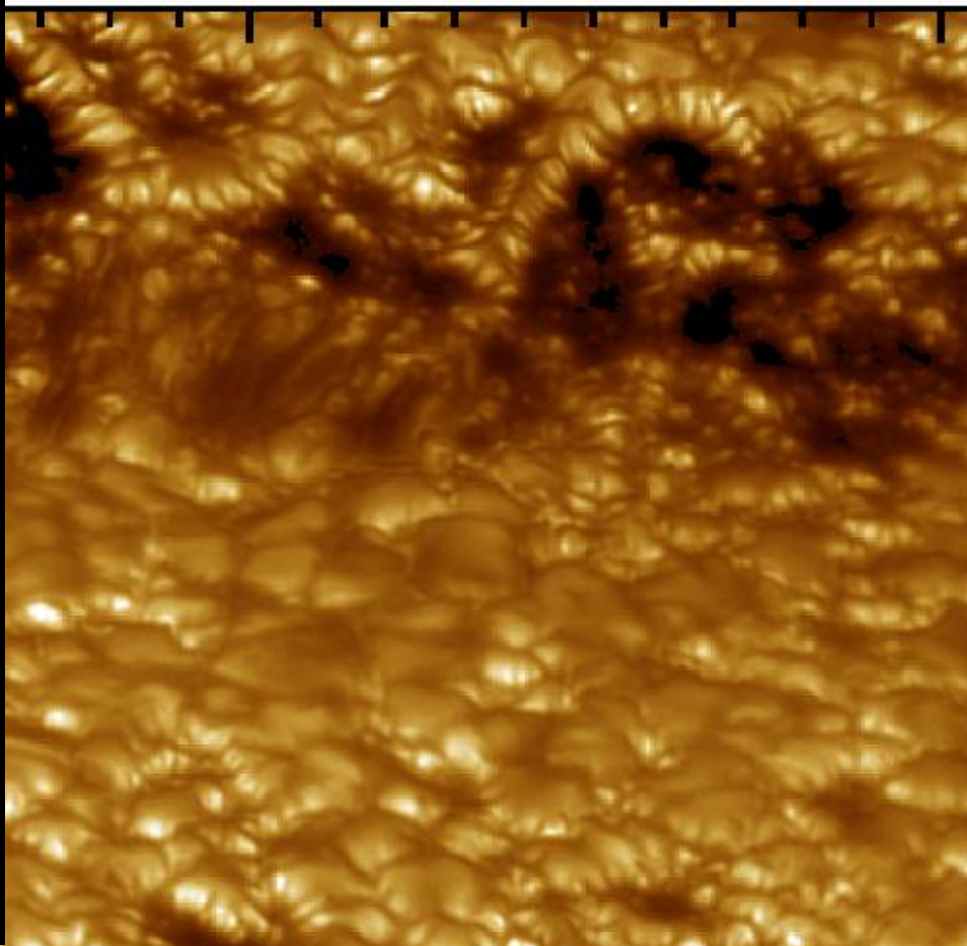
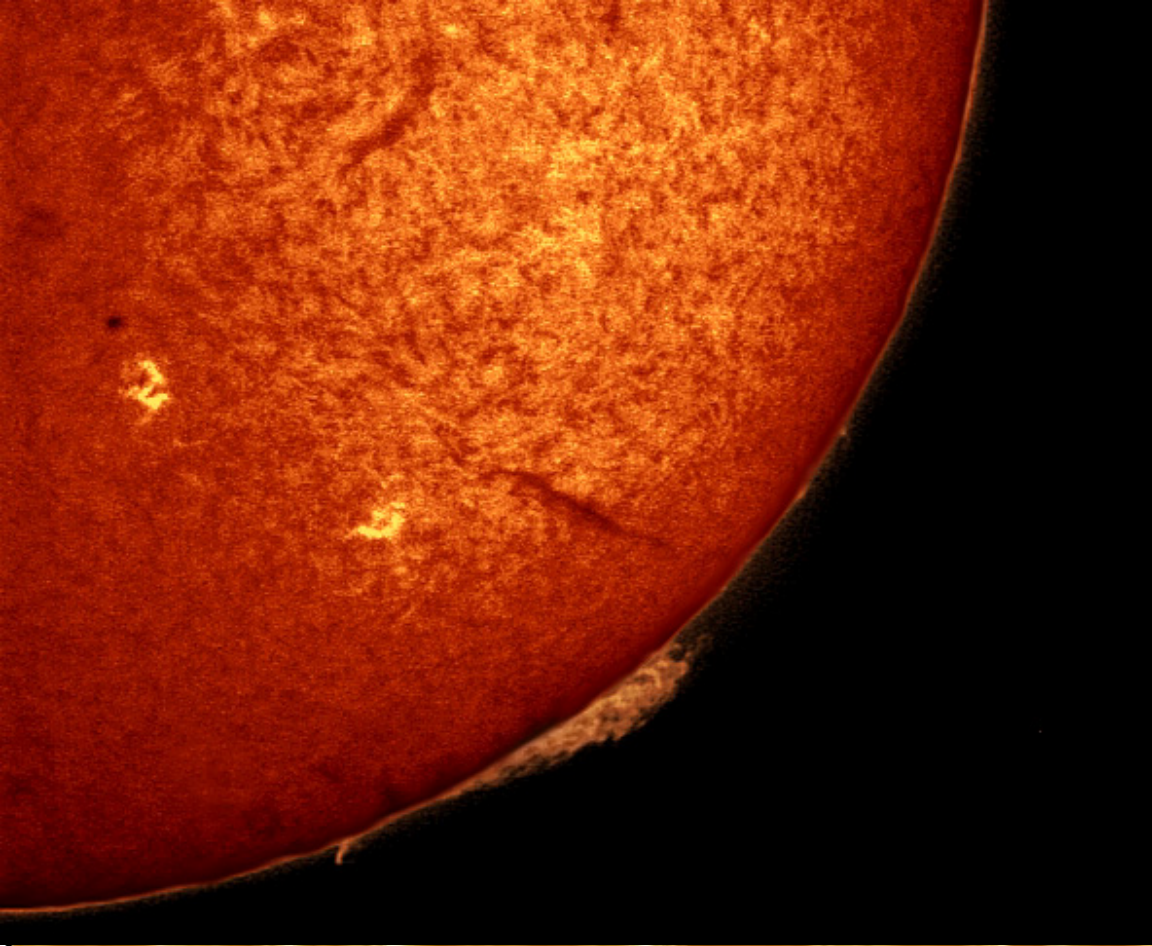


Convection: Benard cells



Convection: Earth Atmosphere





Convective cells on solar surface



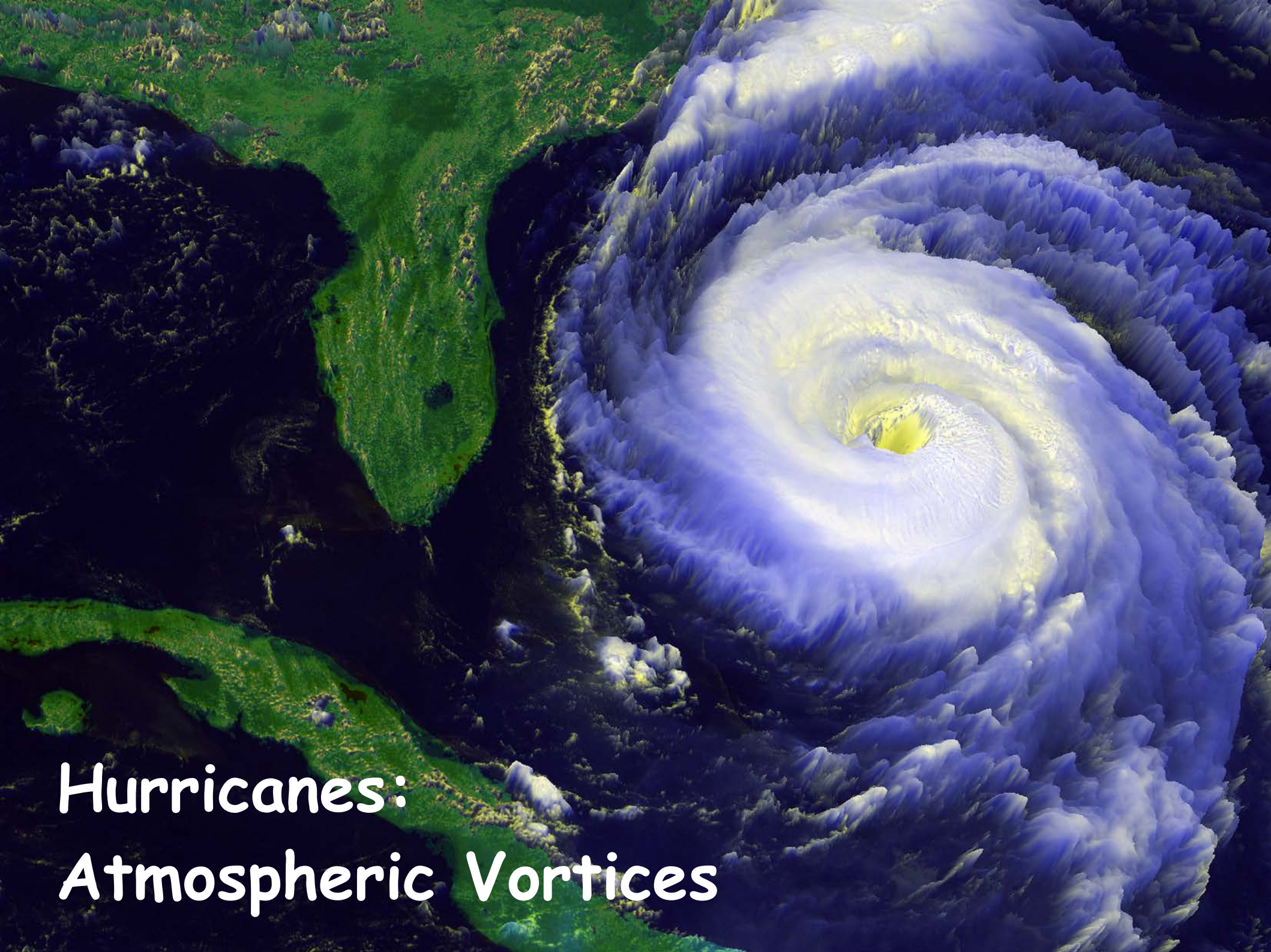
Vortex & Vorticity

Vortices in Shear Flow



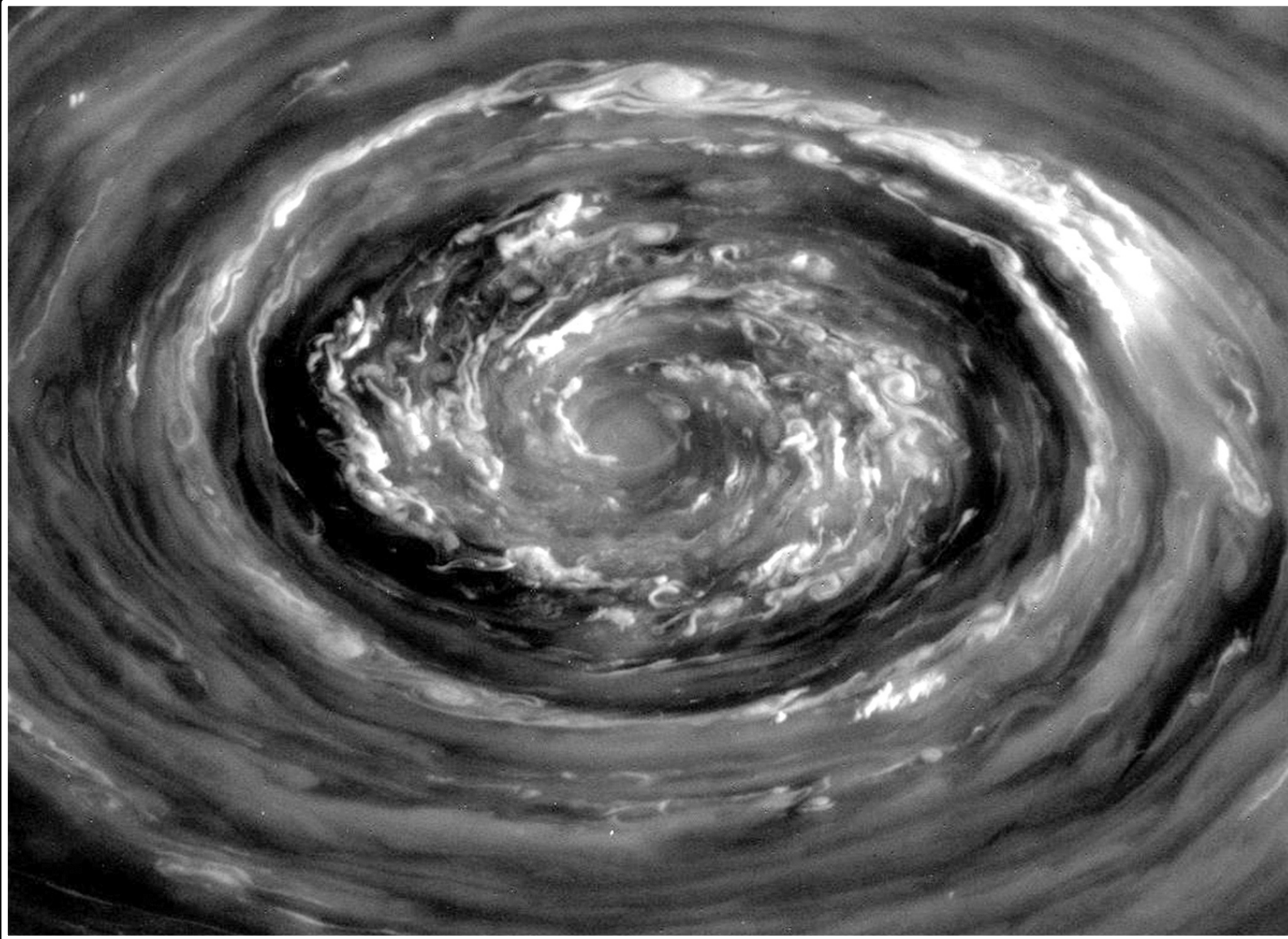


Tornados: Atmospheric Vortices



**Hurricanes:
Atmospheric Vortices**

Saturn's North Pole Vortex



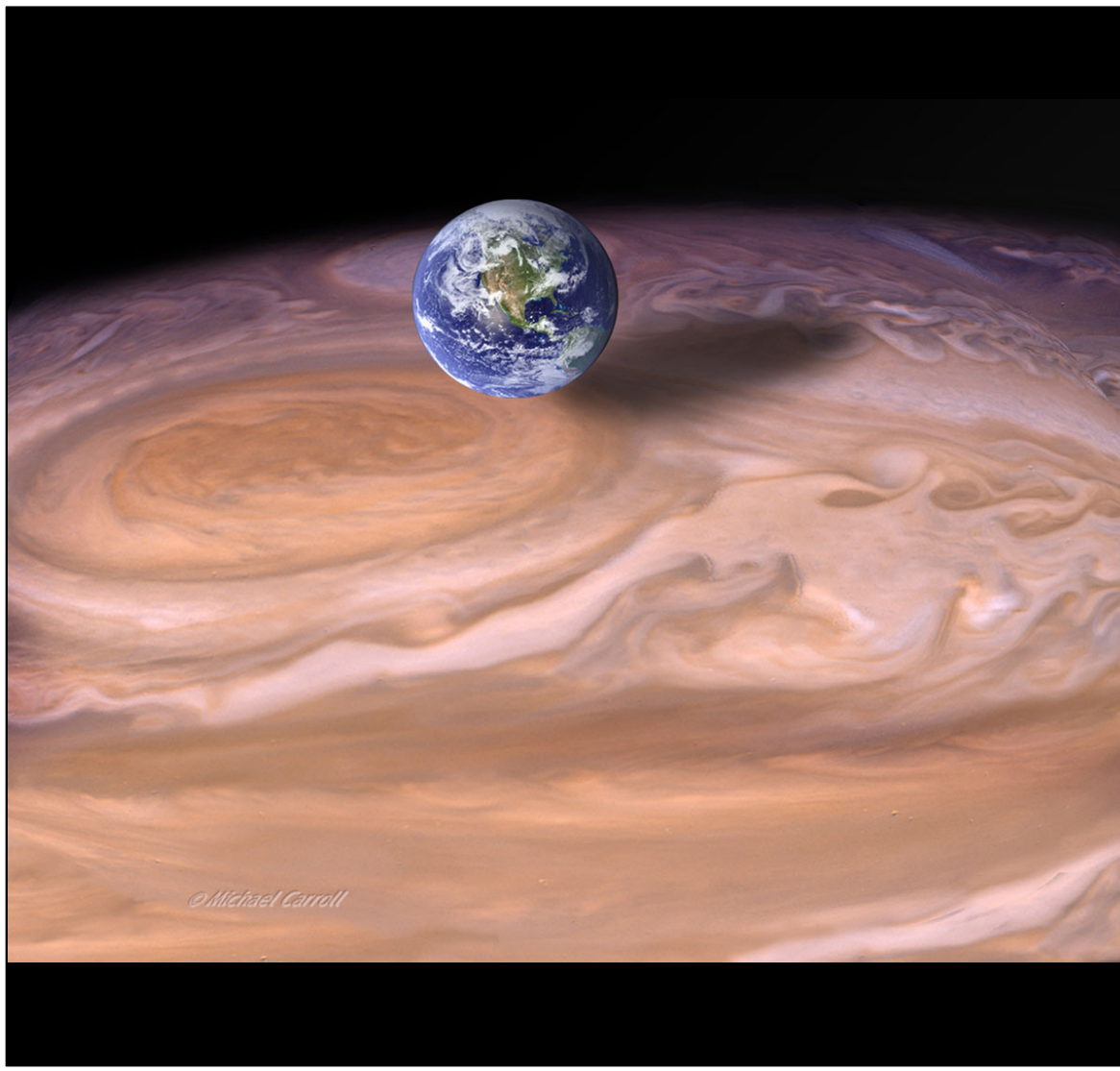
Cassini

400,048 km.



Vortices and Eddies:
Jupiter's turbulent atmosphere

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

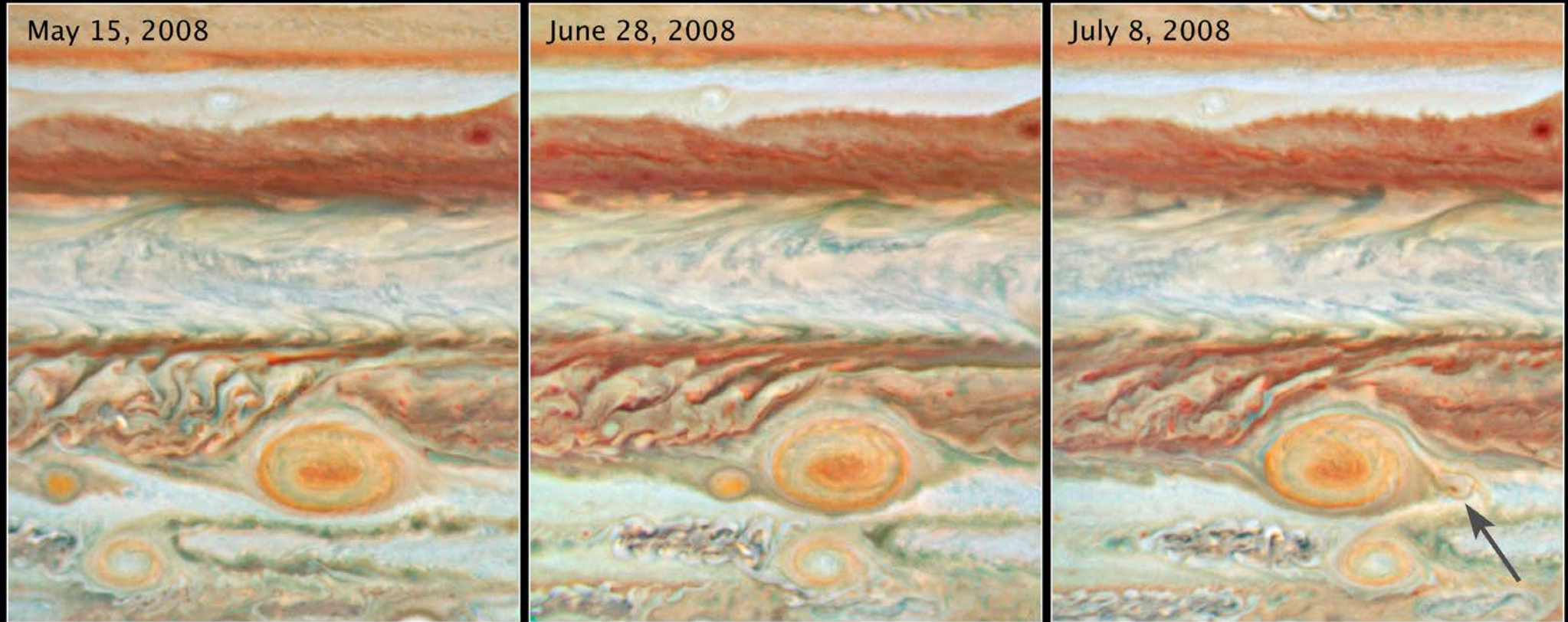


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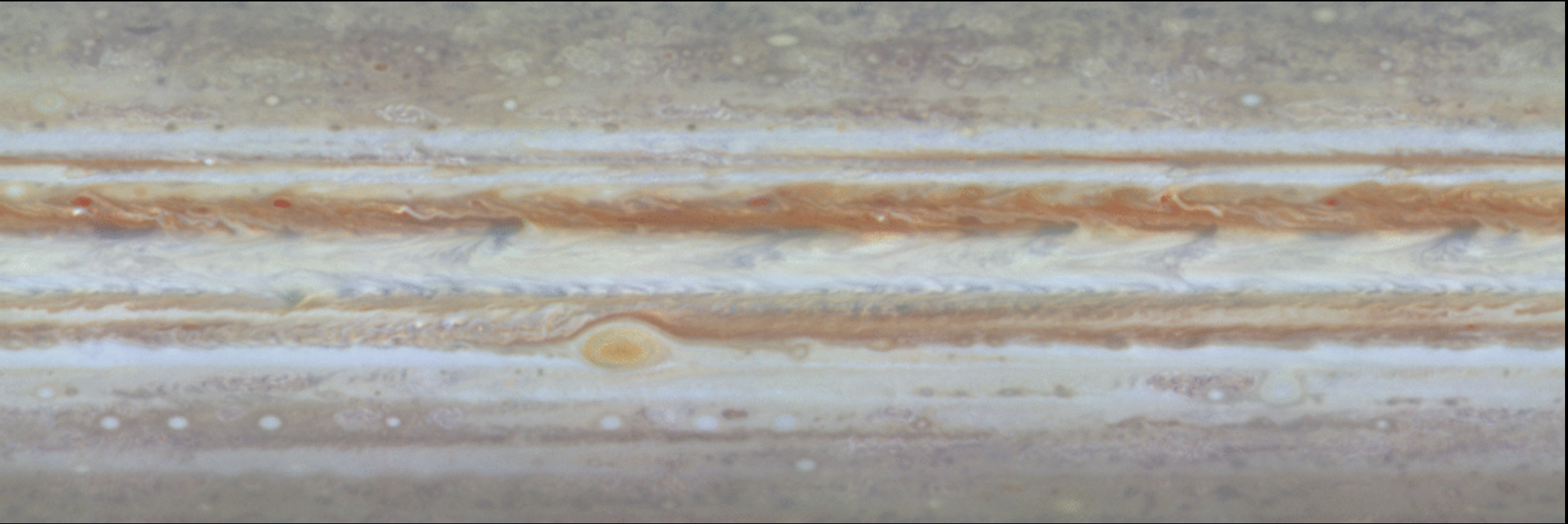
Jupiter's Great Red Spot



Jupiter's Red Spots
Hubble Space Telescope ■ WFPC2

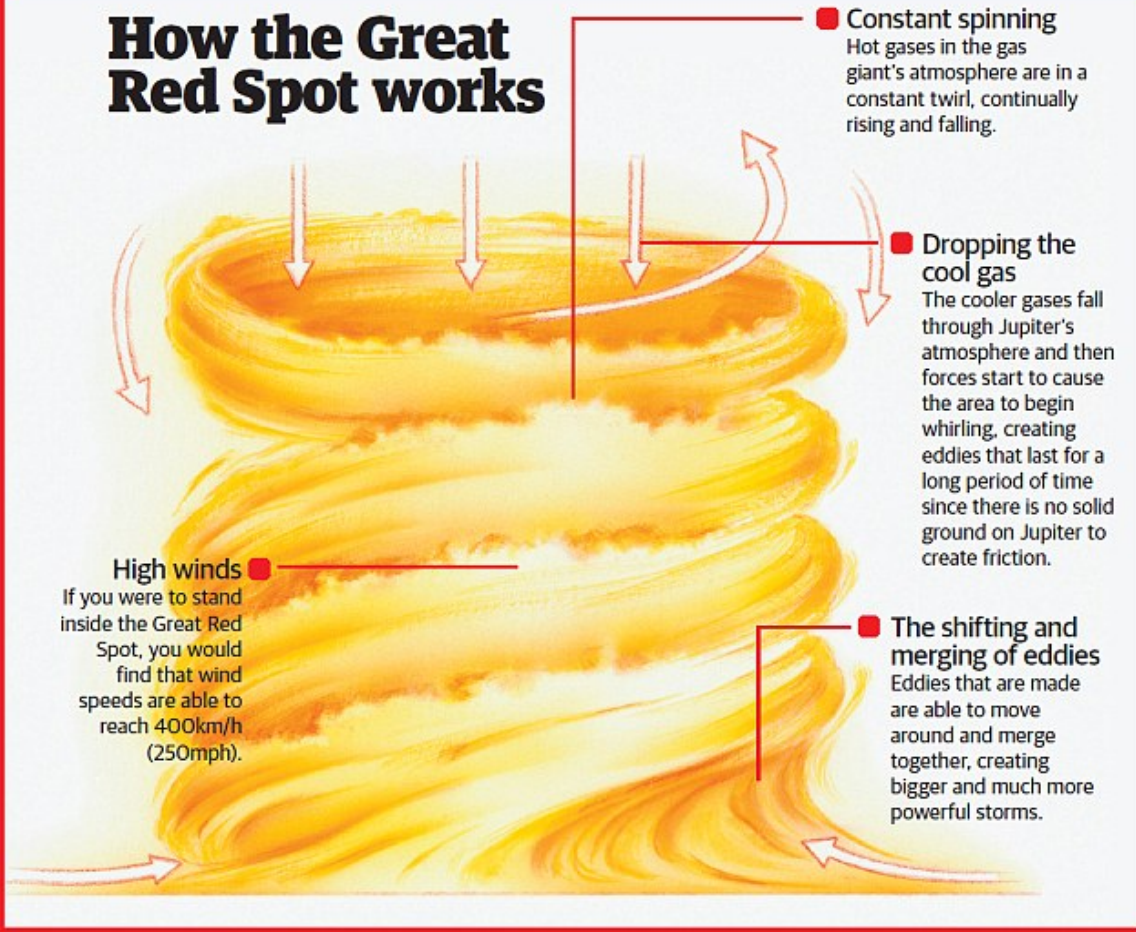
NASA, ESA, and A. Simon-Miller (NASA Goddard Space Flight Center) ■ STScI-PRC08-27

Jupiter's Great Red Spot



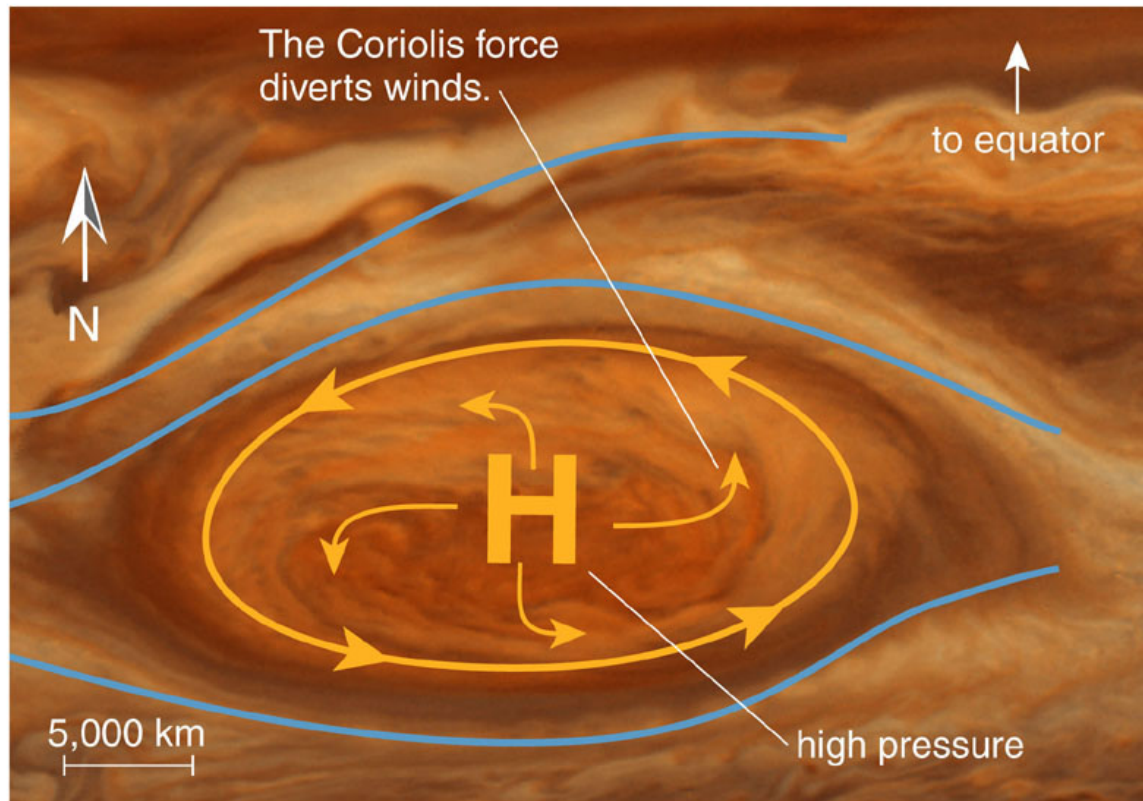
Jupiter's Great Red Spot

How the Great Red Spot works



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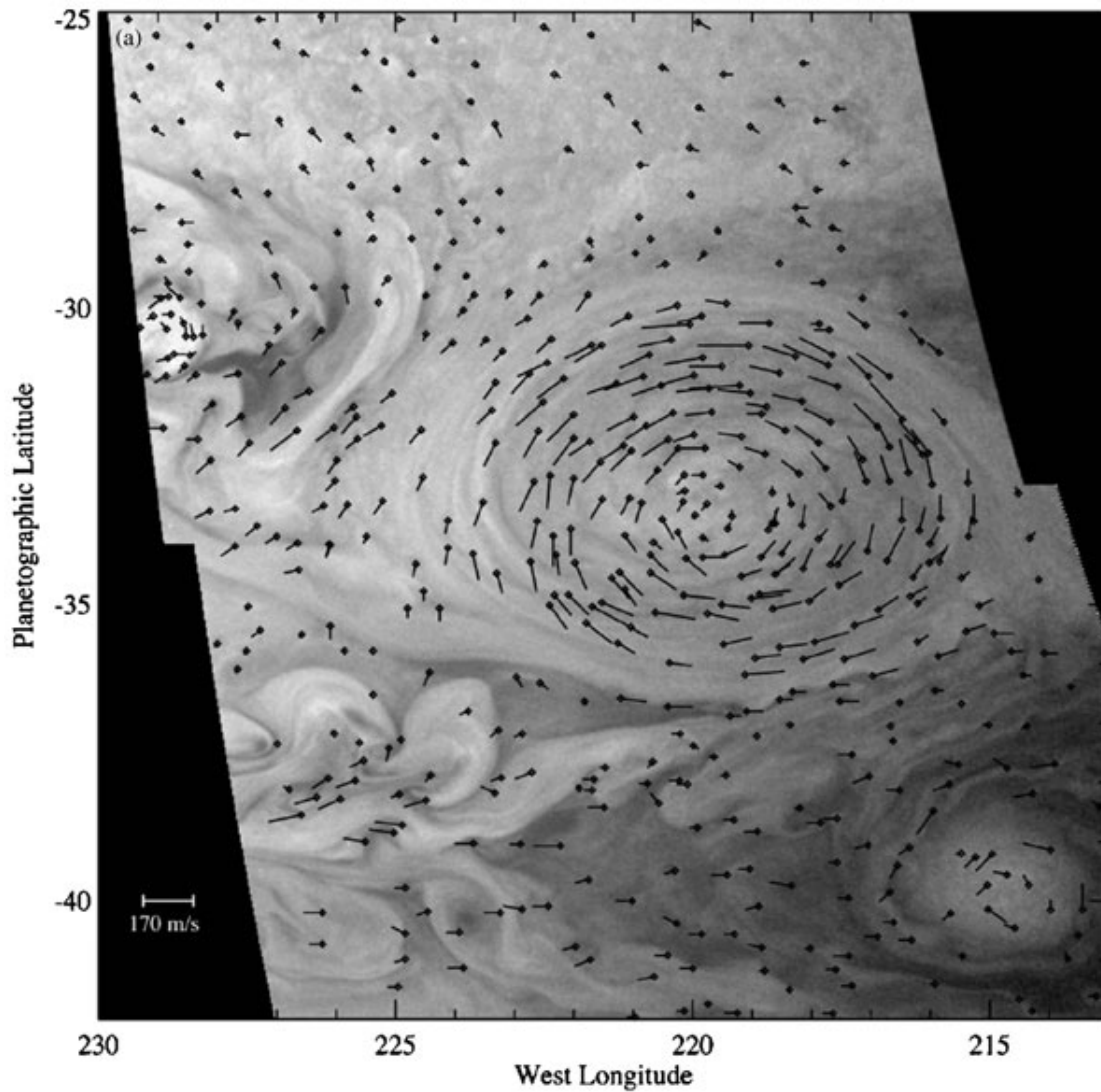
Jupiter's Great Red Spot



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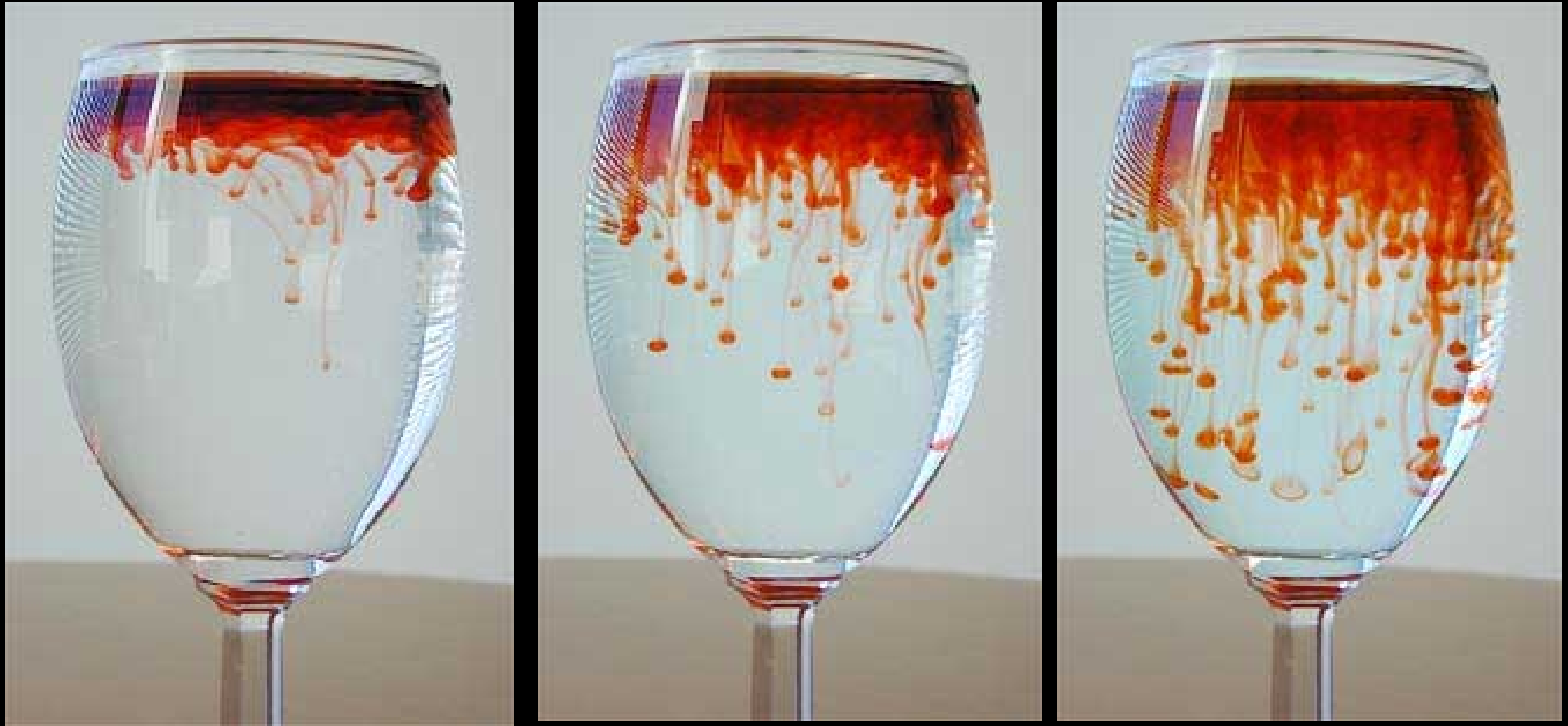
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Jupiter's Great Red Spot



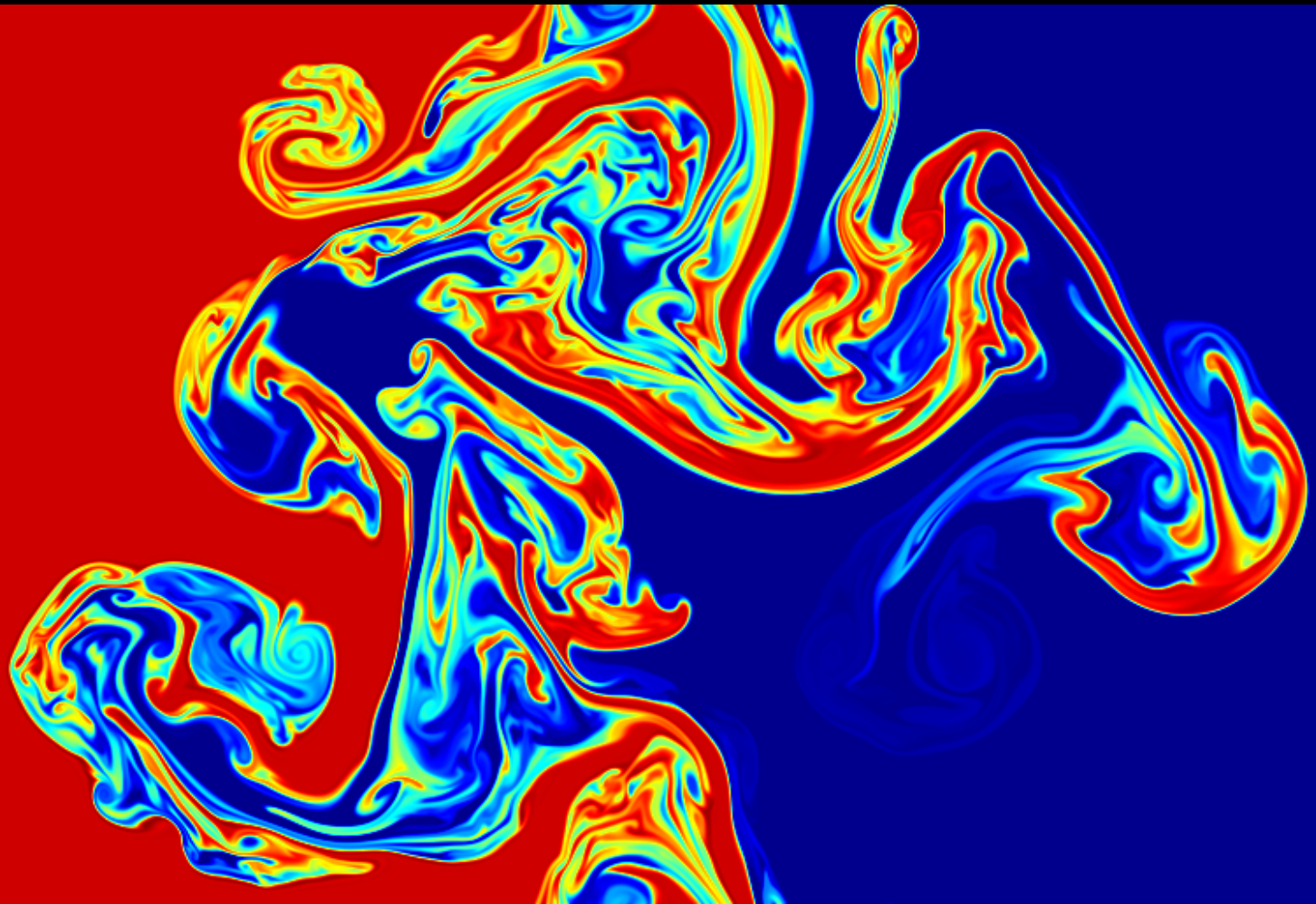
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Rayleigh-Taylor Instability



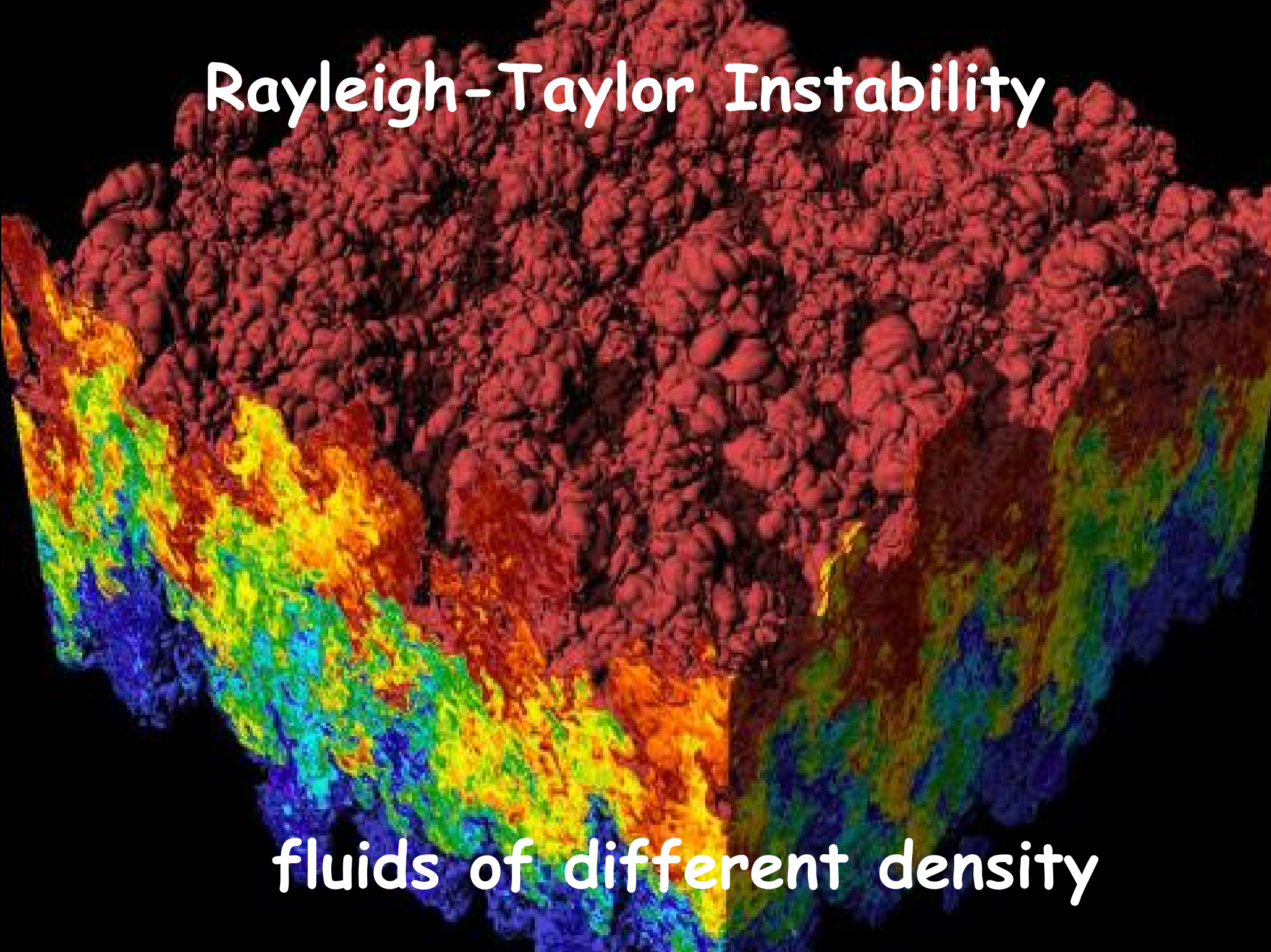
2 fluids of different density

Rayleigh-Taylor Instability



2 fluids of different density

Rayleigh-Taylor Instability



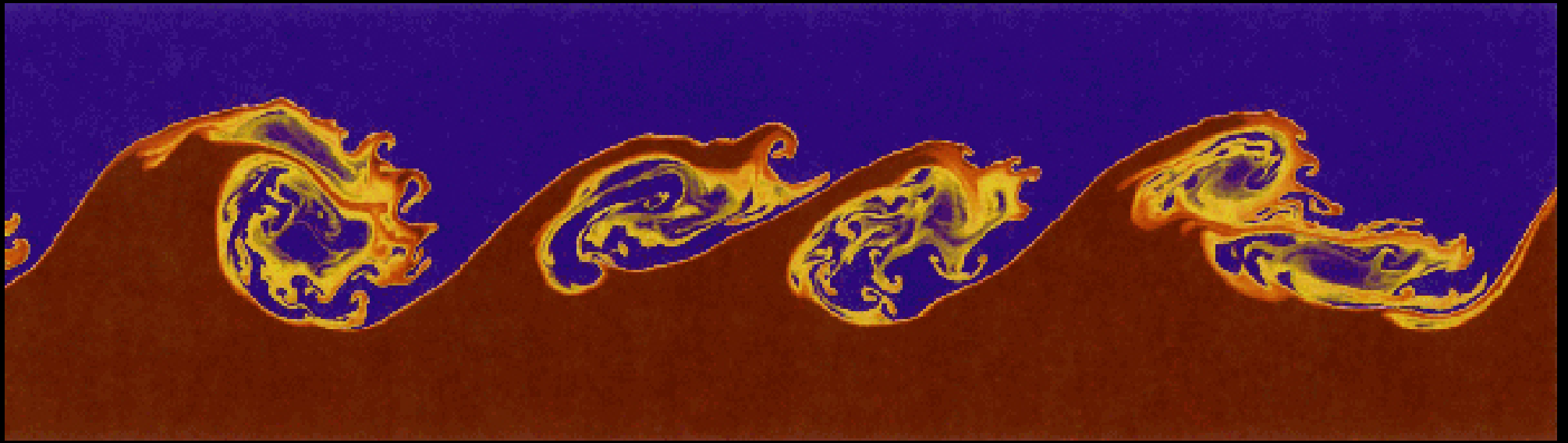
fluids of different density

Cosmic Rayleigh-Taylor Instability



Crab Supernova Remnant

Kelvin-Helmholtz Instability



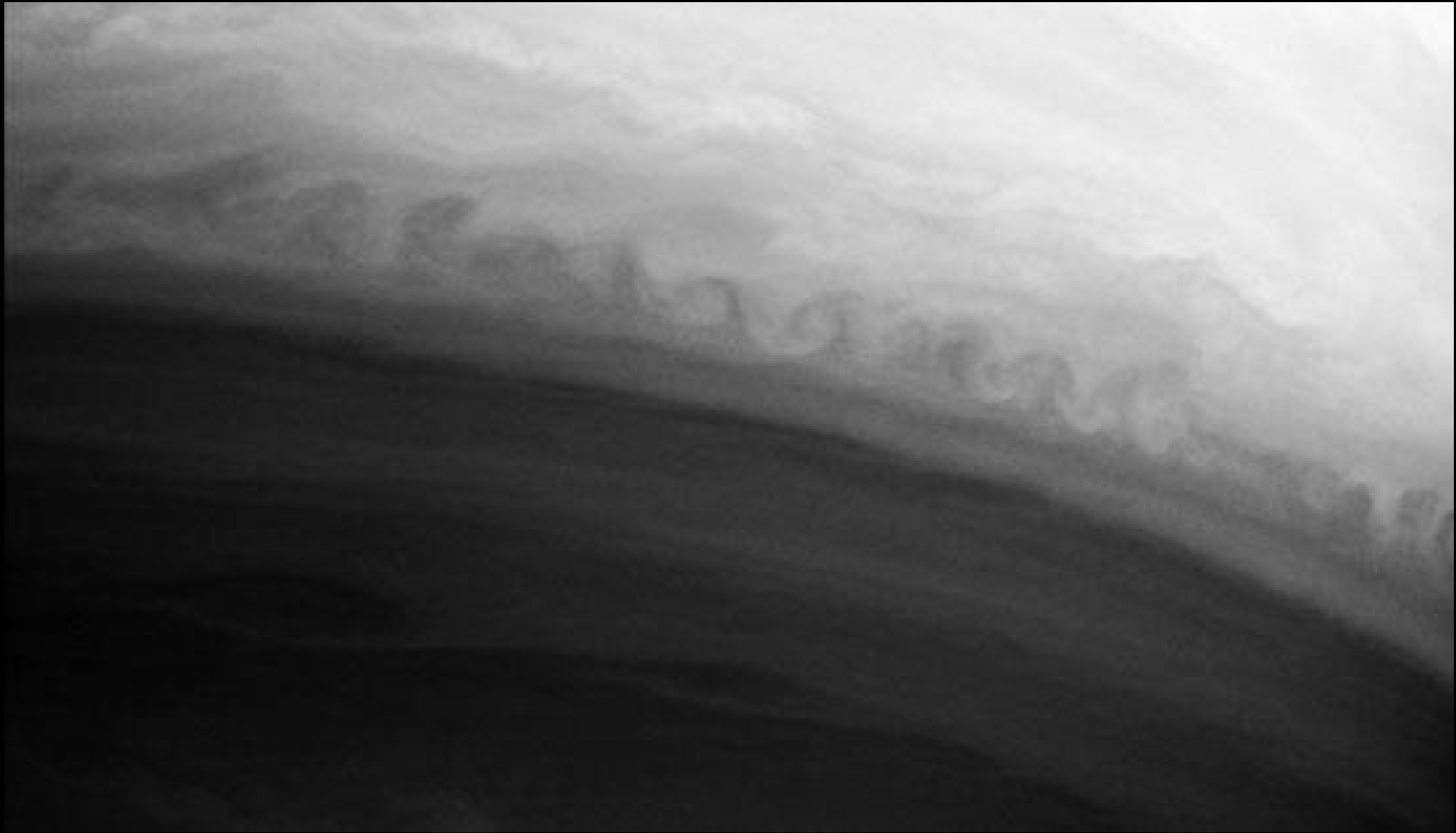
at the boundary of 2 shearing fluids

Kelvin-Helmholtz Instability



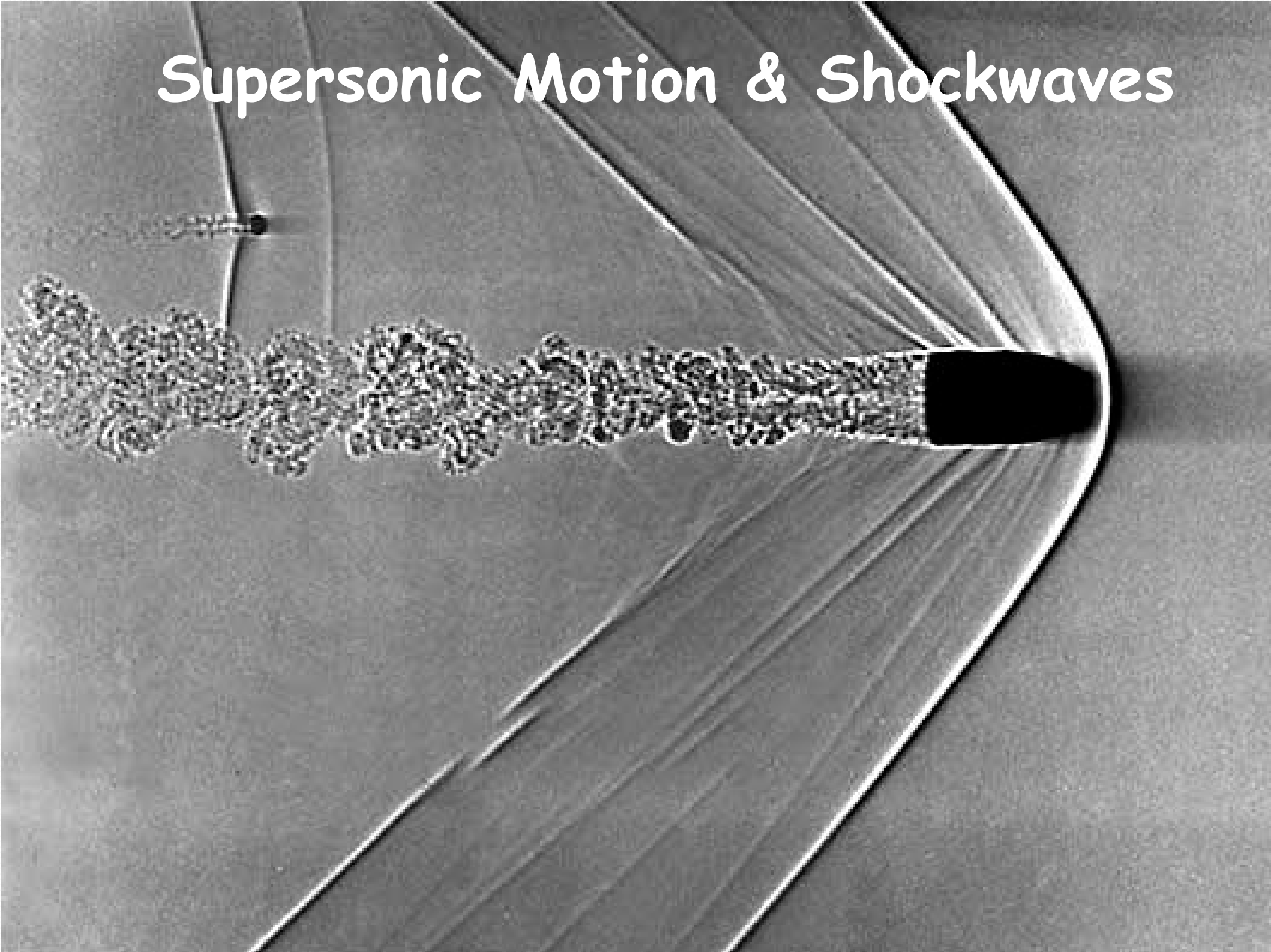
KH instability in cloud cover

Kelvin-Helmholtz Instability

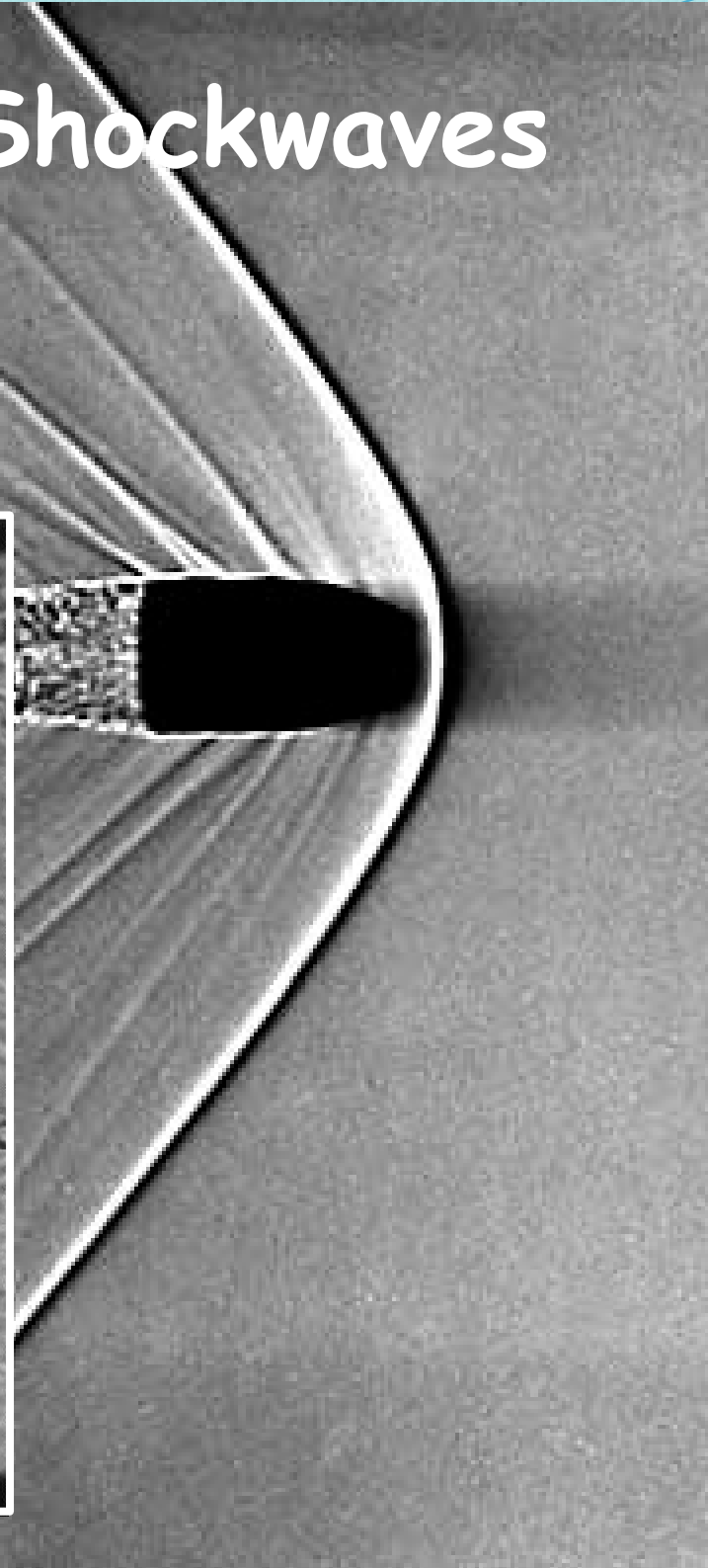
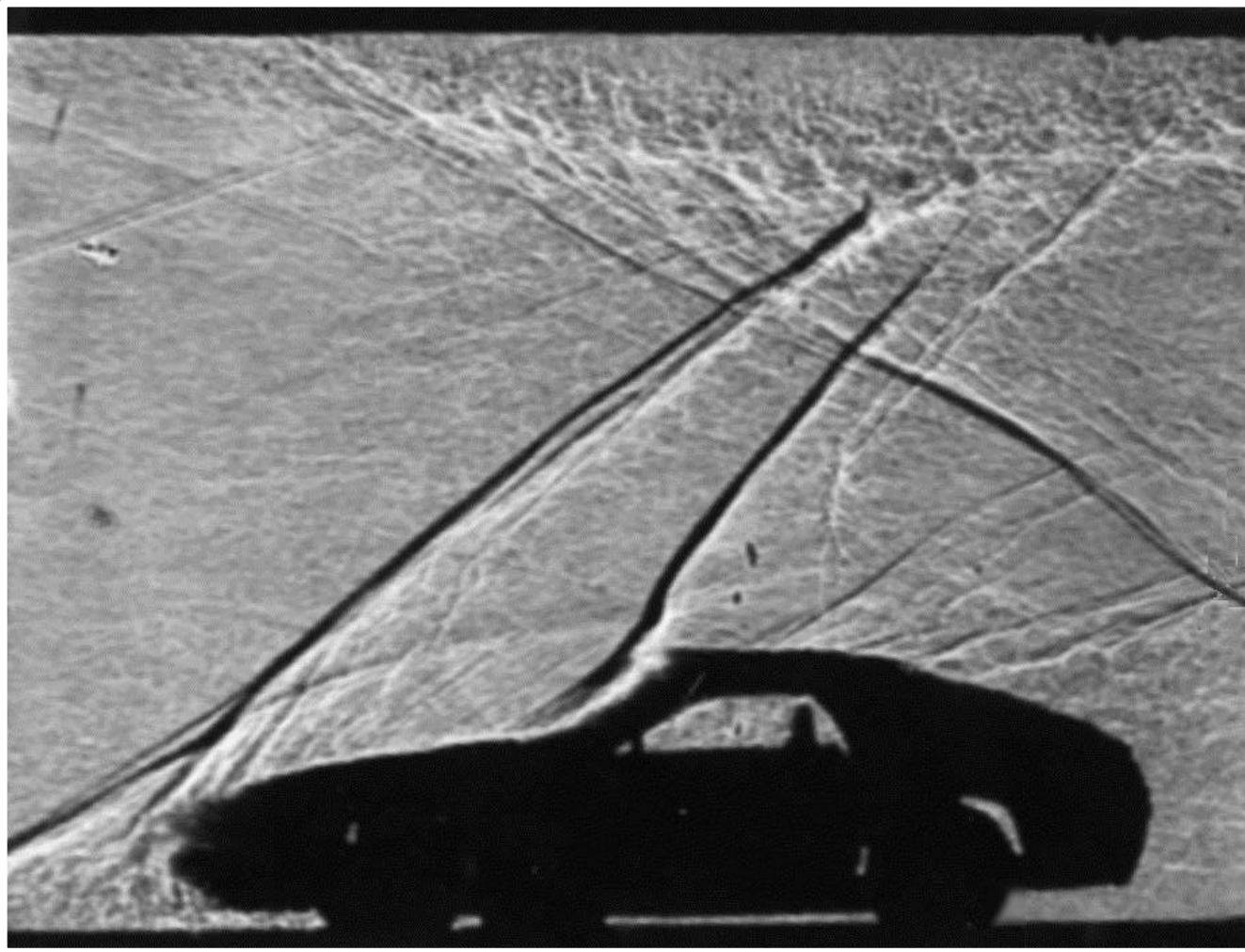


KH instability in Saturn's atmosphere

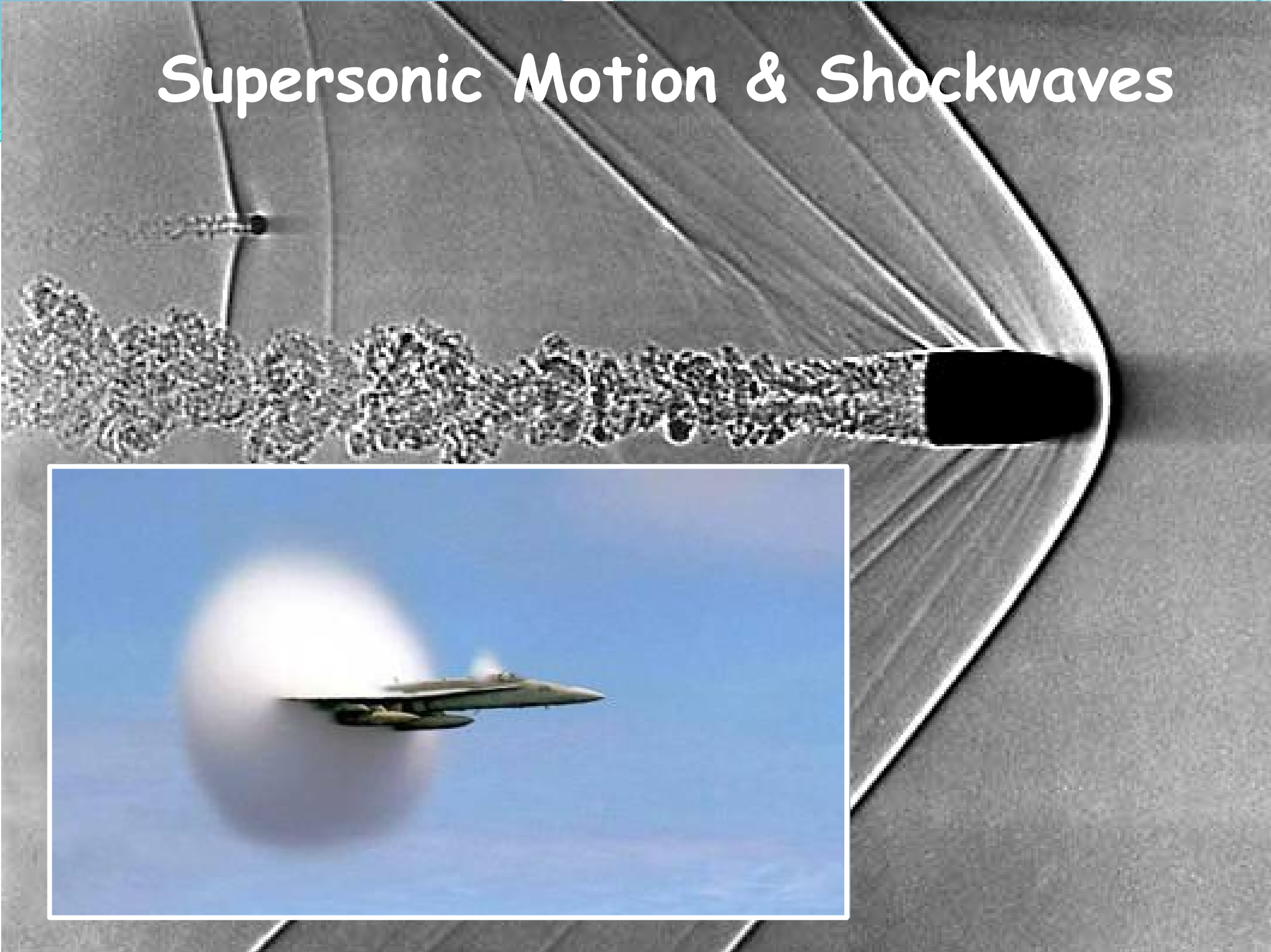
Supersonic Motion & Shockwaves



Supersonic Motion & Shockwaves



Supersonic Motion & Shockwaves



Cosmic Shockwave: Supernova remnant CasA



Gas streams
along magnetic field lines

Solar surface
TRACE

