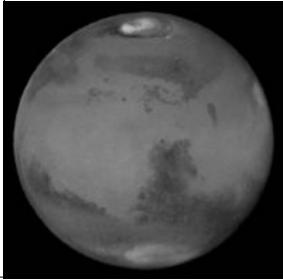


# Mars

The most Earth-like planet?



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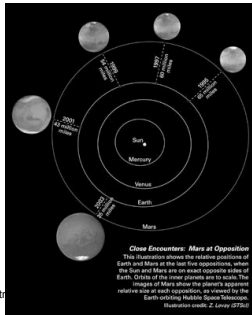
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Mars

## Observation from Earth

- ❖ large brightness variation
- ❖ closest at opposition
- ❖ opposition to opposition = 26 months
- ❖ closest oppositions every 15 years



Astr

Close Encounters: Mars at Opposition  
This illustration shows the relative positions of Earth and Mars at the last four oppositions, when the Sun and Mars are on exact opposite sides of Earth. Only the two inner planets are shown. The images of Mars show the greatest apparent relative size at each opposition, as well as the Earth's varying relative orbital distance. Illustration credit: Z. Leary (2012)

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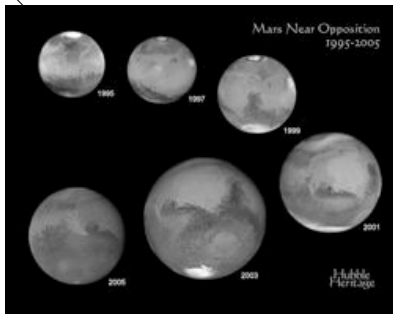
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Mars

## Mars Oppositions



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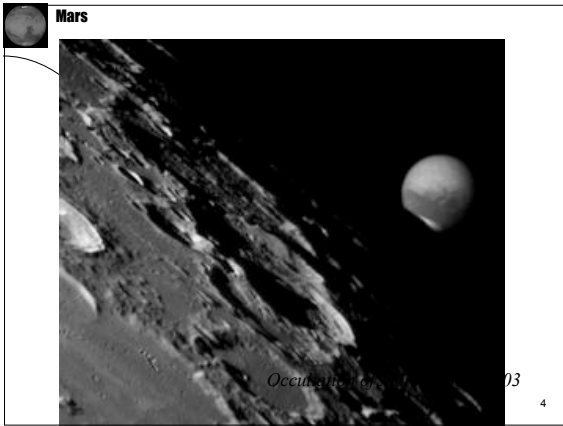
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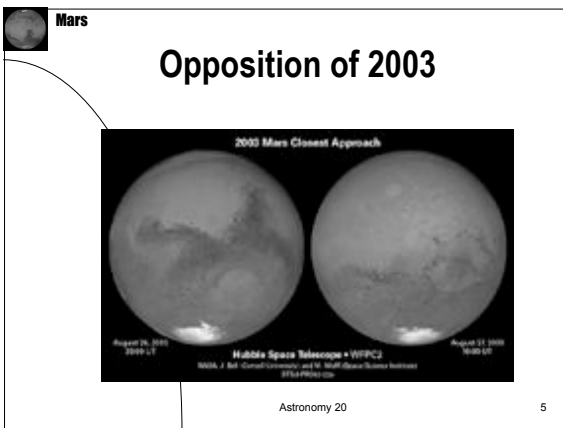
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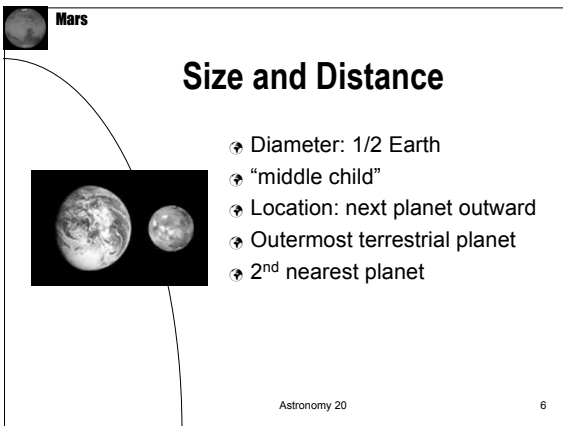
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**Mars**

## 2 Moonlets

- ♣ Phobos
- ♣ Deimos

Deimos

Phobos

*Phobos entering Mars's shadow.*

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**Mars**

## Atmosphere

- ♣ CO<sub>2</sub> 95%
- ♣ N<sub>2</sub> 5%
- ♣ Pressure 7 millibars
- ♣ Below *triple point* of water
- ♣ *No liquid water on surface today.*

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**Mars**

## Global Dust Storms

June 26, 2001

September 4, 2001

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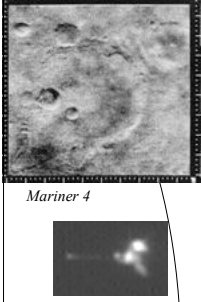
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**Mars**


## Mars Spacecraft



- ✦ Mariner 4 (1965)
- ✦ Mariner 9 (1971)
- ✦ Vikings 1 & 2 (1976)
- ✦ Pathfinder (1997)
- ✦ Mars Global Surveyor (1997- )
- ✦ Mars Odyssey (2001-)
- ✦ Mars Express (2003-)
- ✦ Mars Exploration Rovers (2004)
- ✦ Mars Reconnaissance Orbiter (2006)

*Mariner 4*

*Mars Odyssey from Mars Global surveyor*



*Astronomy 20* *Pathfinder*

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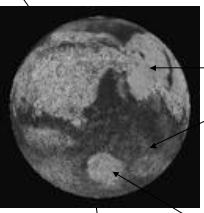
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**Mars**

## Surface Geology



- ✦ Northern plains
- ✦ Southern Highlands
- ✦ Large elevation range – 30,000 m

*Hellas*

*Astronomy 20*

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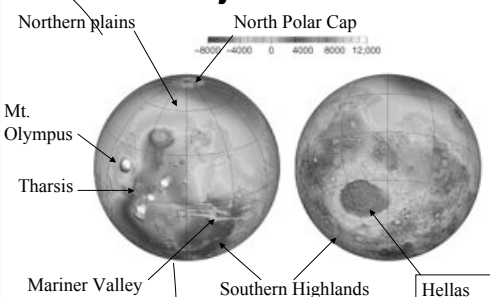
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**Mars**

## Major Features



Northern plains

North Polar Cap

Mt. Olympus

Tharsis

Mariner Valley

Southern Highlands

Hellas

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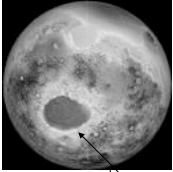
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**Mars**

## Southern Highlands



- ⦿ Heavily cratered
- ⦿ 4 billion years old.
- ⦿ 2 large impact basins
  - Hellas
  - Argyre

*Hellas*

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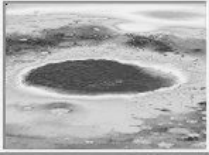
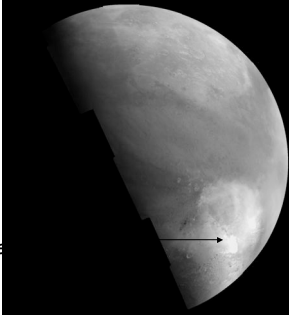
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**Mars**

## Hellas

*Hellas covered*

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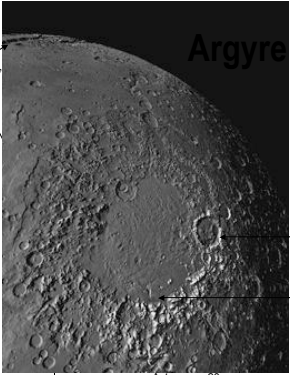
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**Mars**



*Mariner Valley*

**Argyre**

*Galle*

*Dry river*

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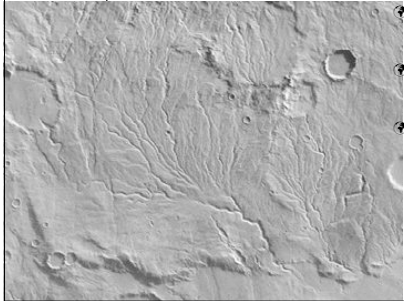
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Mars

## Dry Riverbeds



- ⌚ Rainfall or springs?
- ⌚ Not found on plains.
- ⌚ 4 billion yrs old

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Mars

## Flood Channels



- ⌚ 10s km wide
- ⌚ 100s km long
- ⌚ younger than plains
- ⌚ 3.5 billion yrs

Astronomy 20

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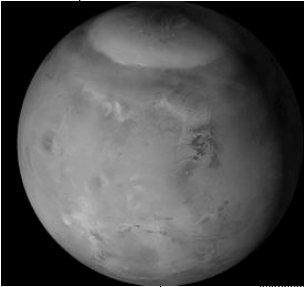
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Mars

## Northern Hemisphere



Plains  
Volcanic plateaus

- Tharsis
- Elysium

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**Mars**

## Tharsis and USA



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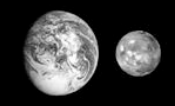
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**Mars**

## Mars & Earth

- ☛ Length of day: 24 h 39 m
- ☛ Temperature: Antarctic-like
- ☛ Polar Ice Cap
- ☛ Seasons
- ☛ Surface gravity: 3/8 gee



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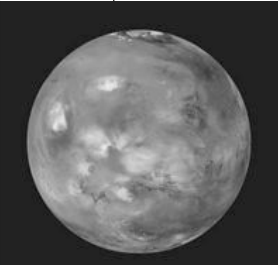
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**Mars**

## Three Mysteries



- ☛ Was there life on Mars in the past?
- ☛ What happened to the water?
- ☛ Why did Mars start with such a thin atmosphere?

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