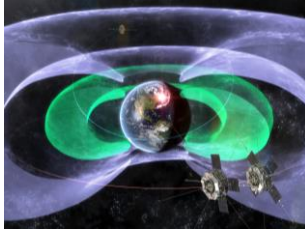


## Today's Class: Explorer 1 and Earth's Radiation Belts

- Reading: (1) Project Mercury at [https://en.wikipedia.org/wiki/Project\\_Mercury](https://en.wikipedia.org/wiki/Project_Mercury) and (2) Project Gemini at [https://en.wikipedia.org/wiki/Project\\_Gemini](https://en.wikipedia.org/wiki/Project_Gemini)
- Homework #2 is due next Wednesday, Sep. 16; Exam 1 on Sep. 21.
- **Complete Daily Health Form**



The NASA Van Allen Probes

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1

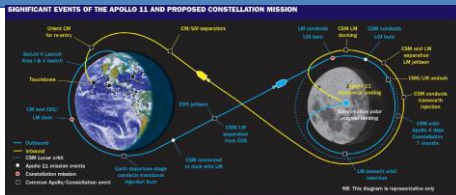
## Our Last Class

- **What are range of common Earth orbits?**
  - LEO, GEO, HEO
- **How do spacecraft travel from one orbit to another?**
  - Hohmann transfer: use elliptical orbit to transfer between 2 circular orbits
- **How can we use the gravitational energy of planets to assist in exploring the solar system?**
  - Gravitational assist (slingshot): tap gravity well and motion of planets around the Sun.

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2

## Around the Moon & Back



Lunar Visit and Return



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video

3

## Class Exercise: Unique experiments can be carried out in the Space Station because of its lack of gravity

- Yes, and the Space Station was built in order to escape gravity.
- This is not quite right – the Space Station still feels the effect of earth's gravity, but it is greatly diminished and the experiments are therefore referred to as being performed in "micro-gravity."
- No, the uniqueness of the experiments is not due to the lack of gravity but to weightlessness.
- No, similar experiments can be performed on earth's surface.
- No, similar experiments can be performed on the highest mountaintops on earth.

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4

## Unique experiments can be carried out in the Space Station because of its lack of gravity

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## Today's Class

- **Early history of satellite programs** – success for USSR, failures for US.
- **US Explorer 1 satellite** – technology & science!
- **The Van Allen Radiation Belts**
  - Driven by activity from the Sun, solar wind


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## USSR – First in Space



4 October 1957:  
Sputnik 1



7 November 1957  
Sputnik 2

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7

## Explorer 1 Team: Pickering, Van Allen, Von Braun



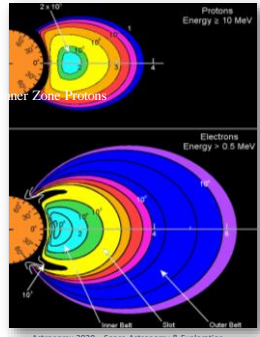
Launch: 1 February 1958, Jupiter C rocket



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## Van Allen Radiation Belts



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9

## Understanding Earth's Magnetosphere

10

## Observations of the Sun



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11

## Class Exercise: How does solar activity affect Earth?

- a) It can make beautiful aurora.
- b) It can cause geomagnetic storms.
- c) It can damage satellites.
- d) It can disrupt electrical power.
- e) all of the above

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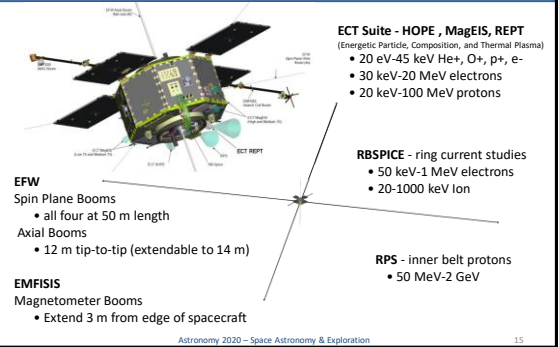
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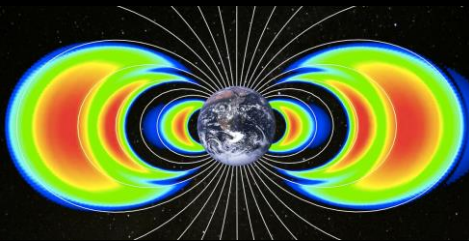
13

## Van Allen Probes Spacecraft – Launched Aug. 20, 2012



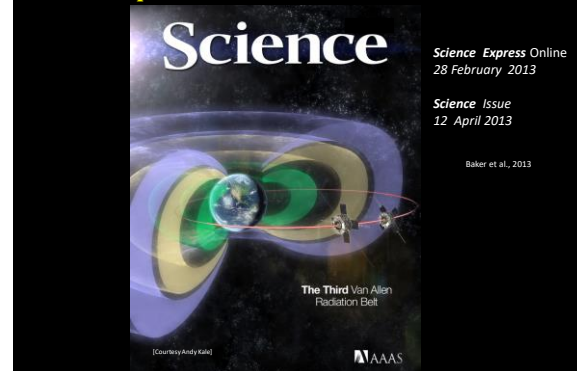
15

## Van Allen Probe Data Assimilation: Three Radiation Belts



17

## Unexpected Van Allen Belt Results



18

## What did we learn today?

- Early history of satellite programs – success for USSR, failures for US.
- US Explorer 1 satellite – technology & science!
- Discovery of Van Allen Radiation Belts
  - Driven by activity from the Sun, solar wind
- NASA's recent Van Allen Probes
  - Discovery of new radiation belt

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