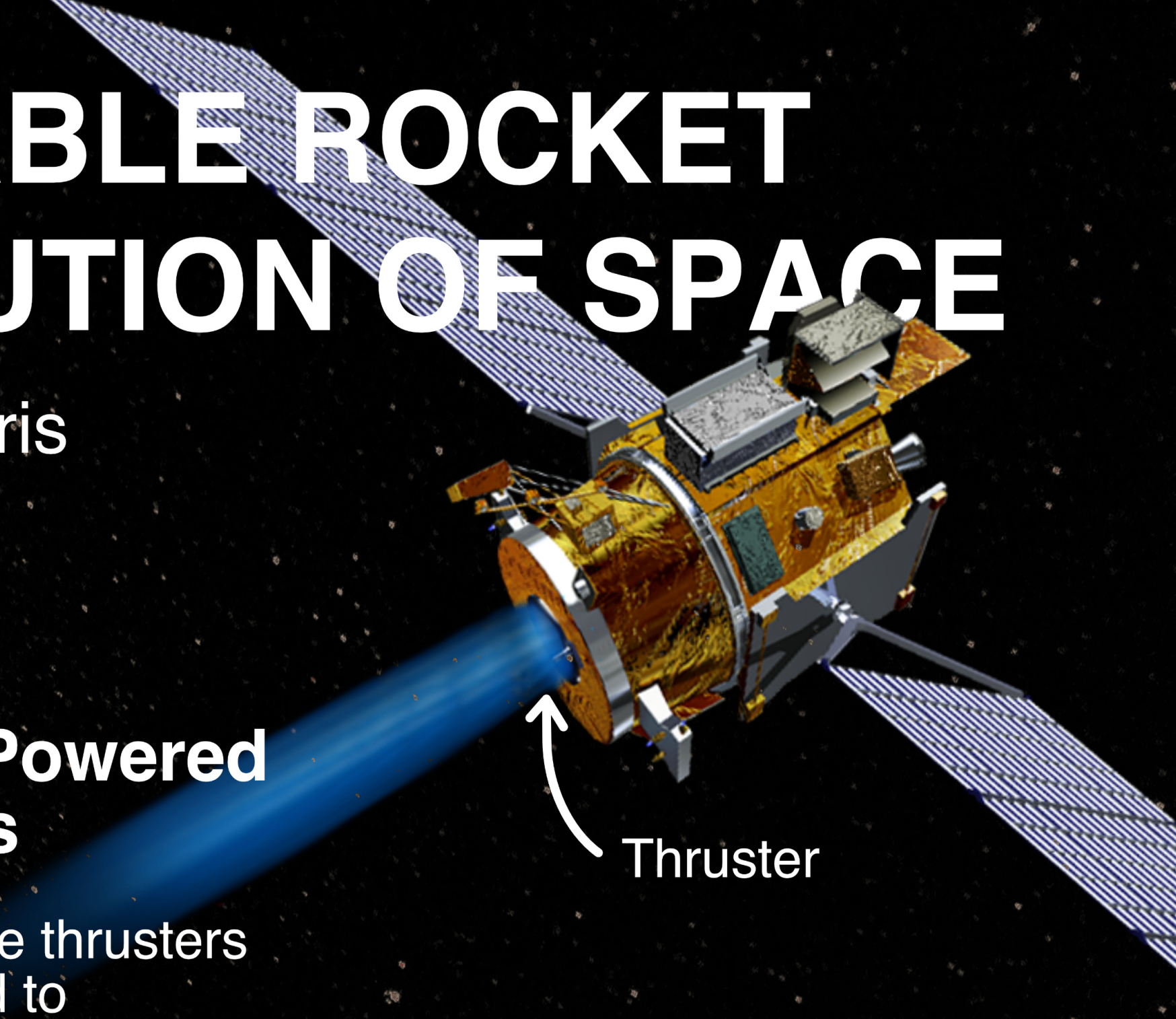


DEVELOPMENT OF A SUSTAINABLE ROCKET THRUSTER TO REDUCE THE POLLUTION OF SPACE

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Why do Satellites Need Thrusters?

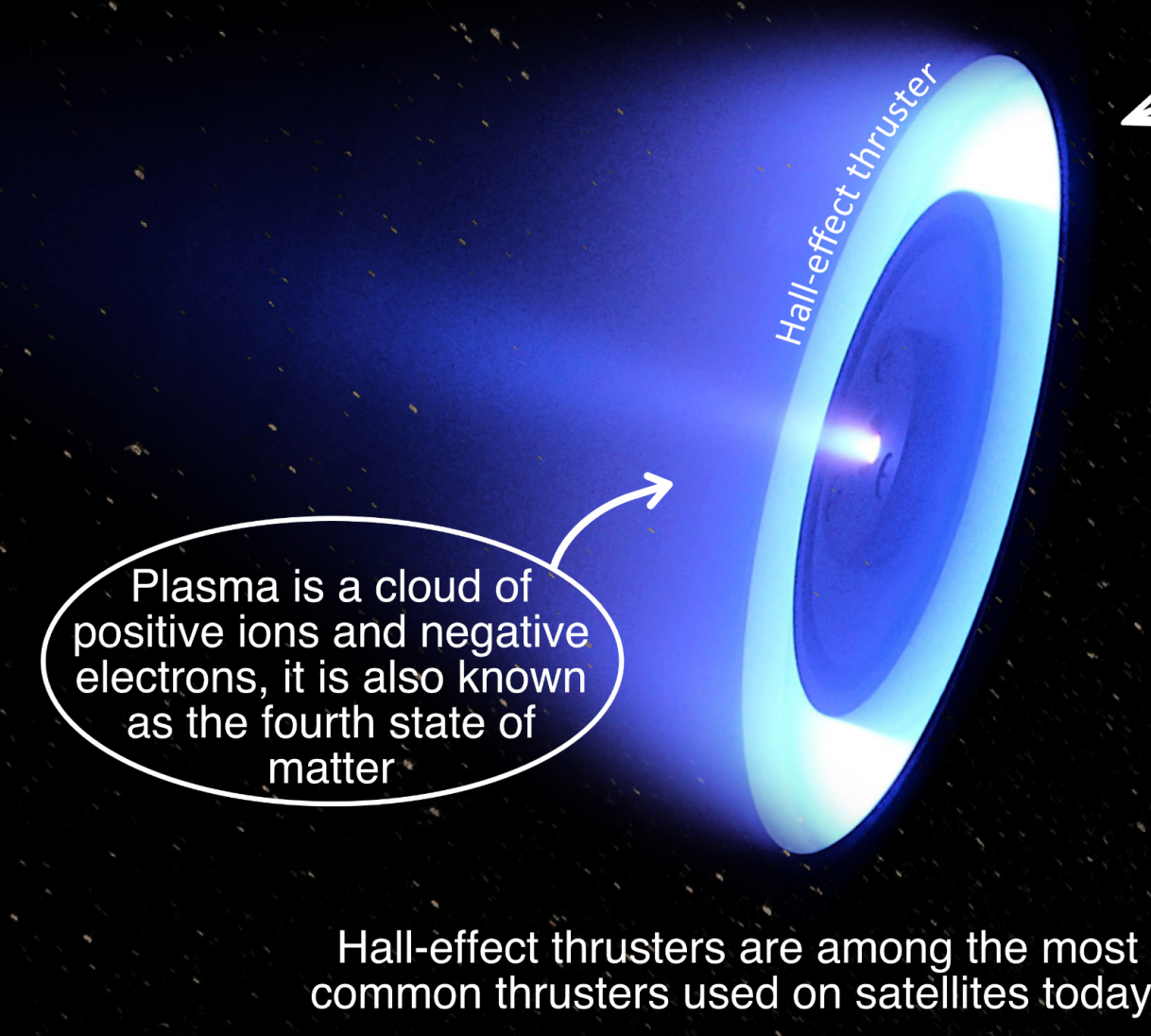
- To get to their desired orbit, the Moon or Mars.
- To avoid hitting other satellites and creating space debris.
- To de-orbit after use so they don't pollute space.

Why we need Microwave Powered Magnetic Nozzle Thrusters

- Microwave powered magnetic nozzle thrusters have many benefits when compared to conventional thrusters.

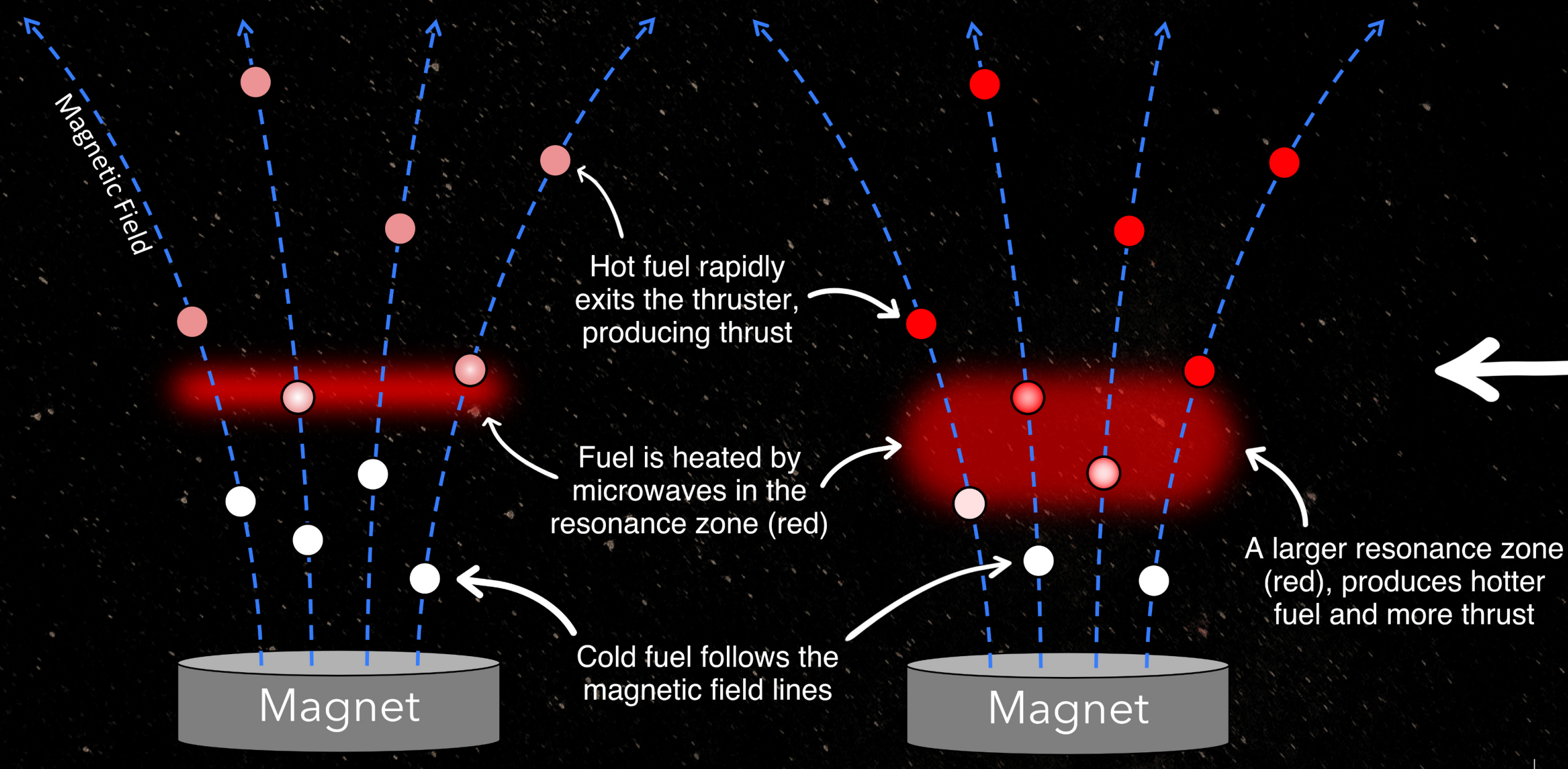
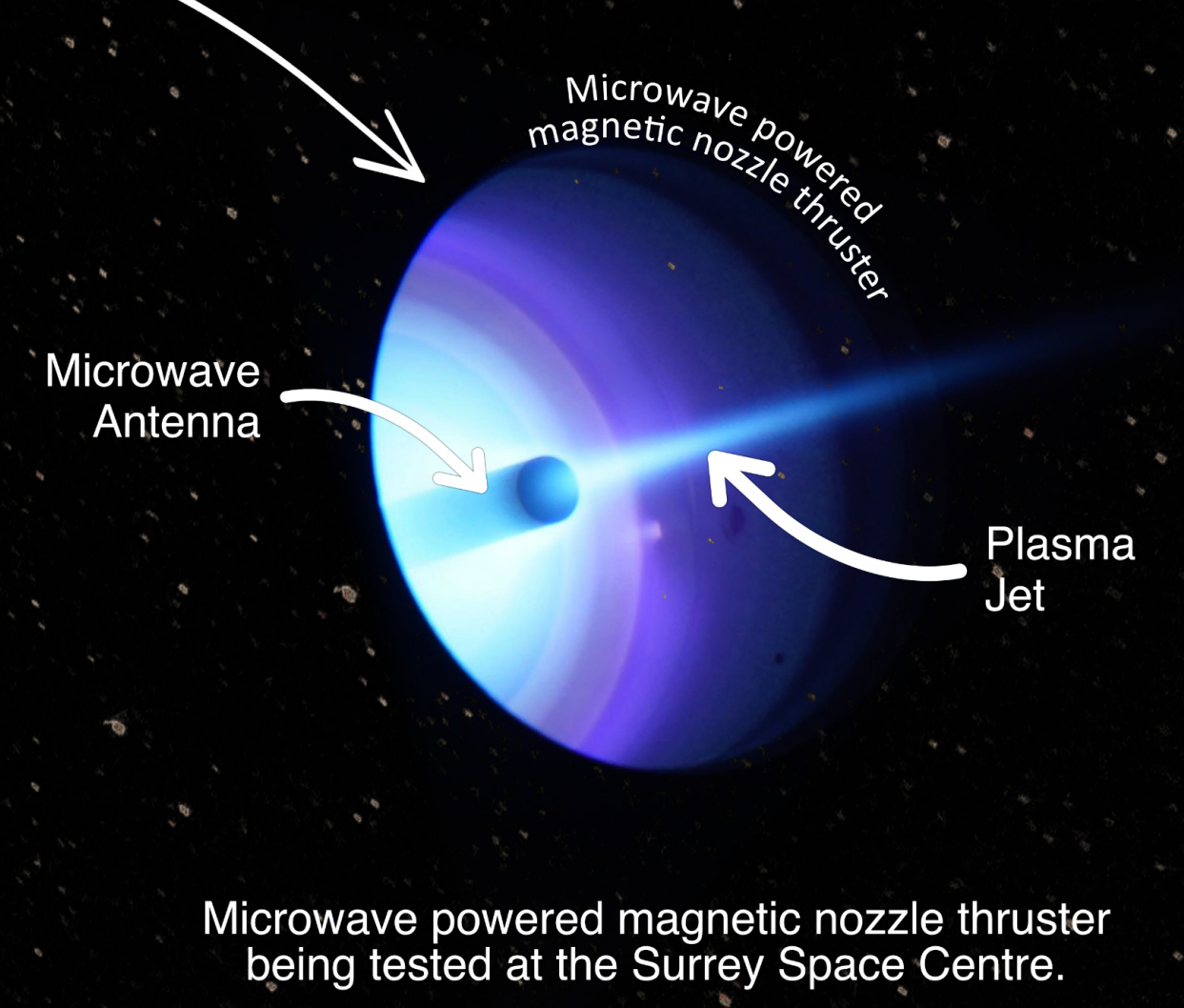
From disaster relief to environmental monitoring, satellites provide an abundance of real time data that is used to inform critical decisions across both government and industry.

Microwave powered magnetic nozzle thrusters use microwaves to heat their fuel and magnets to accelerate it.



- High Performance
- Simple Design
- Reliable Components
- Low Erosion
- Can Run On Water

Conventional Thruster	Microwave Powered Magnetic Nozzle Thruster
✓ (used by many satellites)	✗ (never flown in space)
✗ (high cost)	✓ (low cost)
✗ (can fail unpredictably)	✓ (unlikely to fail)
✗ (can break prematurely)	✓ (long lifetime)
✗ (will run out of fuel)	✓ (could be refuelled in space using water found on asteroids or the Moon)

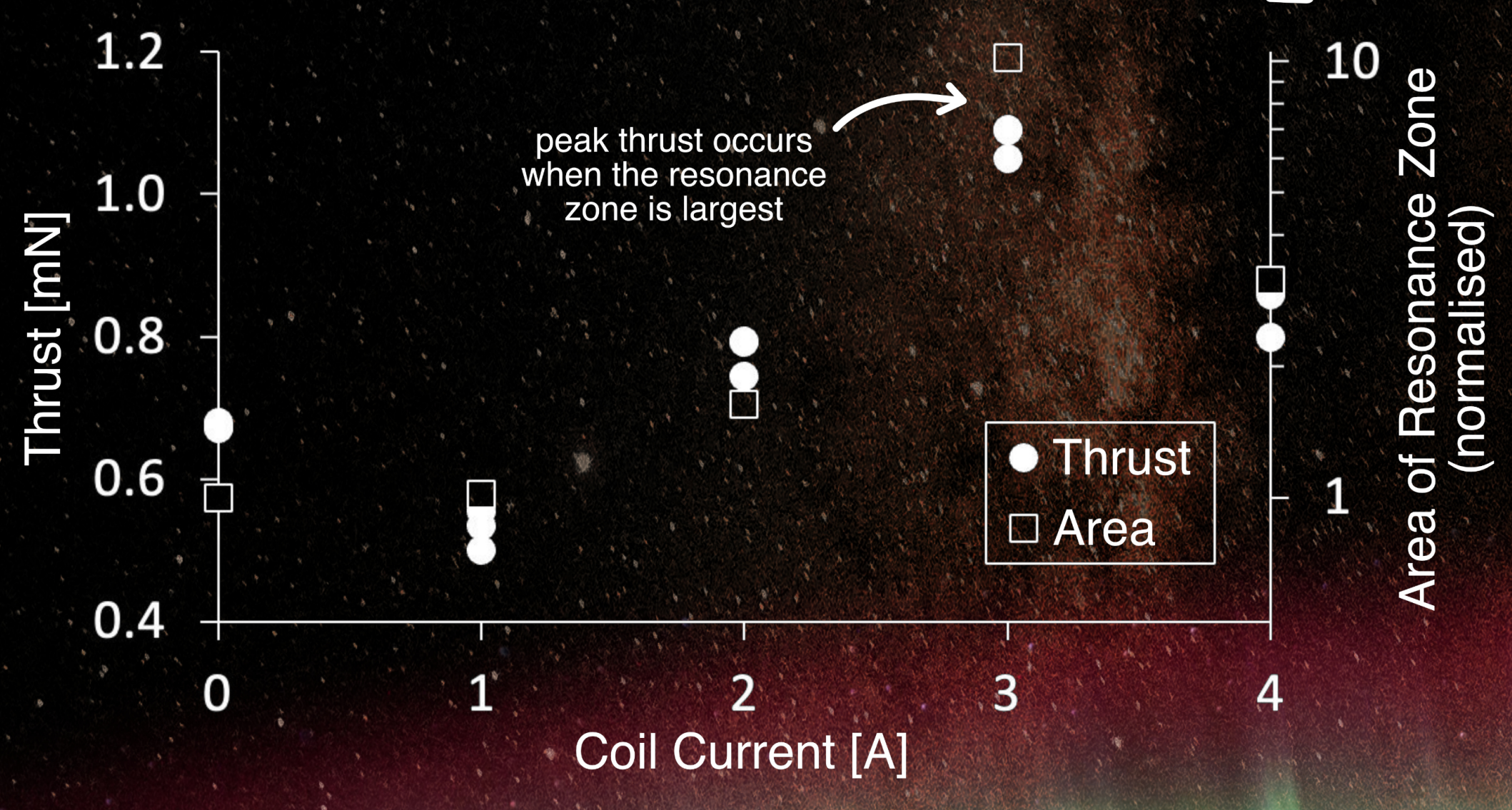
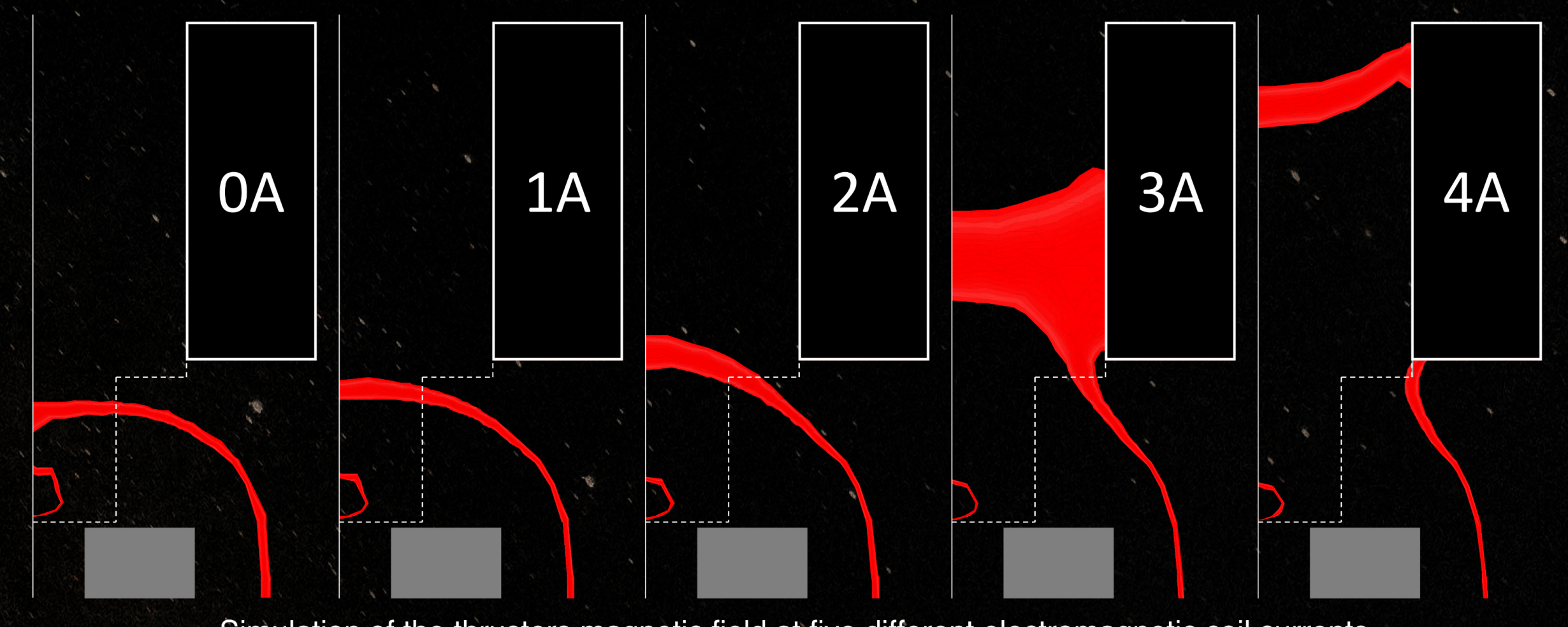


A Novel Way to Increase Performance

- A lack of performance means that microwave powered magnetic nozzle thrusters have never been flown in space.
- By magnetically stretching the resonance zone (red), more energy is able to be absorbed by the fuel.
- This thicker resonance zone increases thrust, enabling the use of microwave powered magnetic nozzle thrusters on spacecraft.

Experimental Results

- Magnetic field simulations identified the magnetic field at which the resonance zone was largest.
- The thruster was placed under vacuum where thrust measurements were taken in different magnetic fields.
- A correlation is observed between the thickness (area) of the resonance zone and the thrust produced.



Research Outcomes

- Thickening the resonance zone significantly increases thruster performance.
- This promotes the adoption of microwave powered magnetic nozzle thrusters by satellite manufacturers.
- These reliable, low cost, long lifetime thrusters will reduce the number of satellites required, reducing the pollution of space.
- The ability to run on water opens up the possibility of in-space refuelling from asteroids or the moon, making the thruster highly sustainable.