Asteroid Deflection

School Code - 05

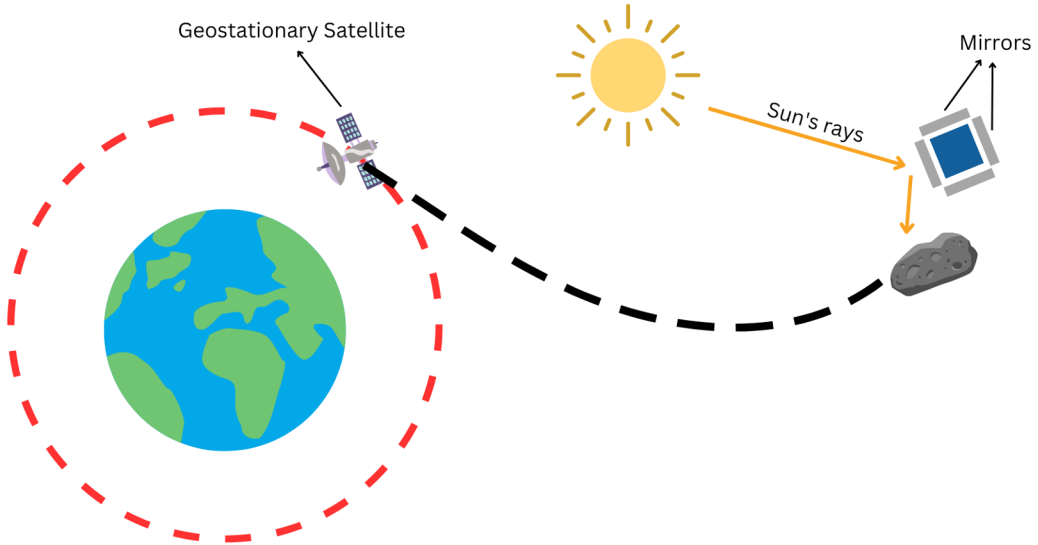
Prompt 3: Asteroid Deflection

> 300 m
wide

~80 mn kg
mass

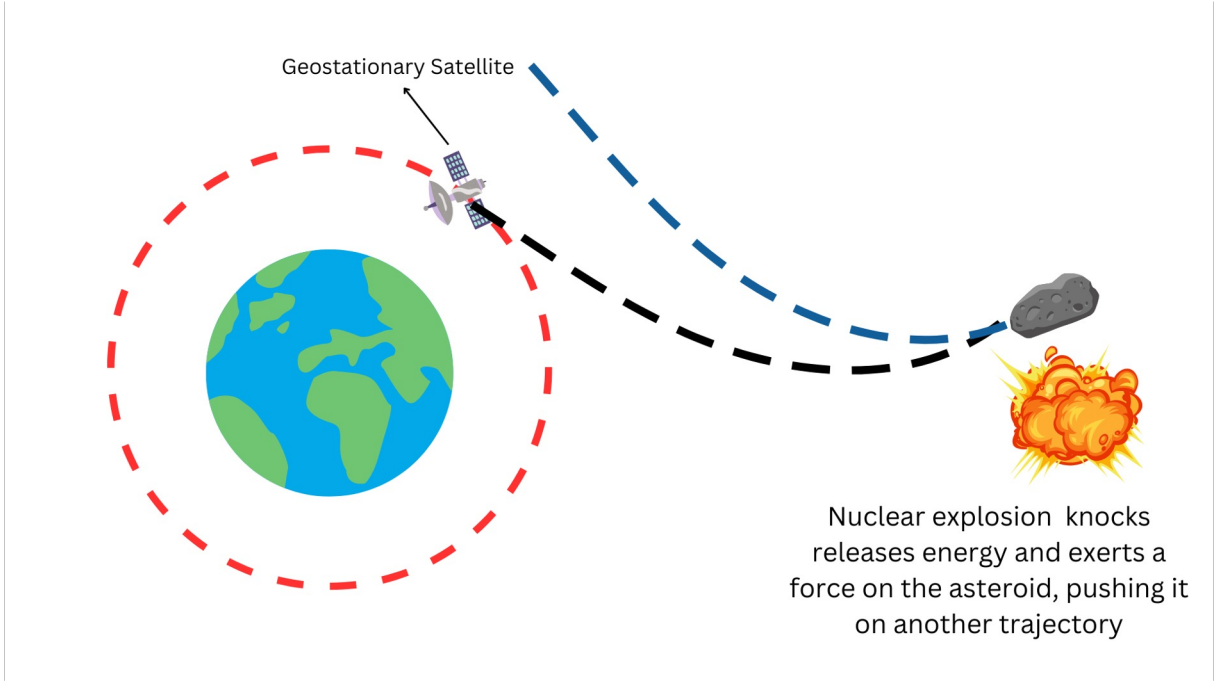
Possible Solutions considered

Spacecraft with Reflecting Mirrors



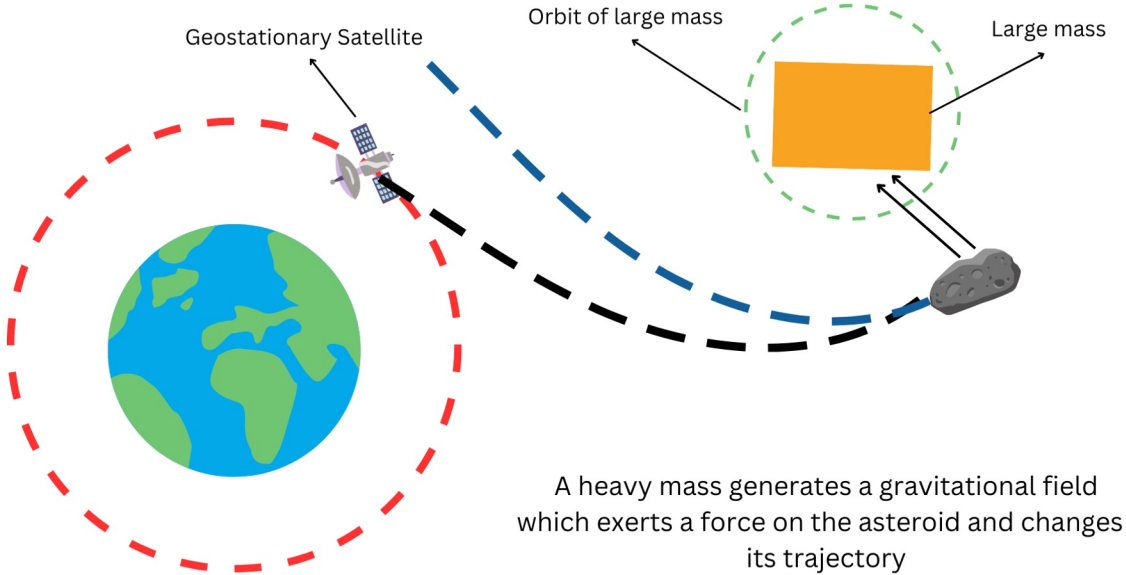
- Could have lots of random reflection
- Vapourisation requires more time and could break the asteroid

Nuclear Detonation near Asteroid



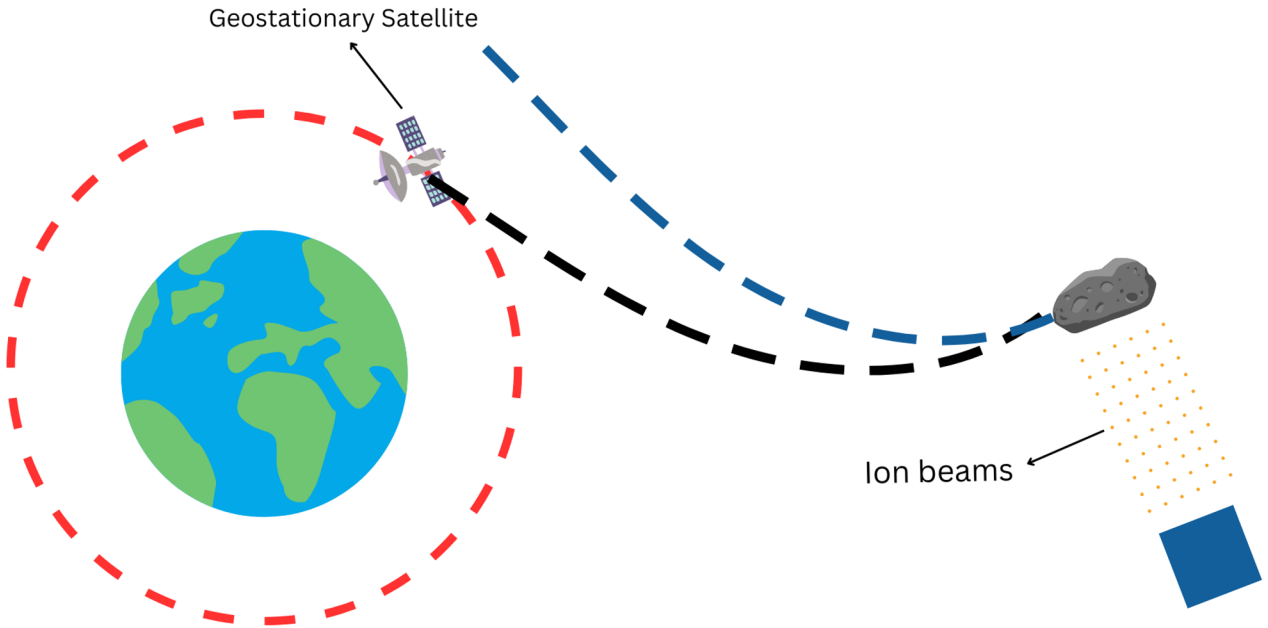
- Detonation is hard to control and again very high risk because it might break the asteroid
- Nuclear radiation can interfere with communication with spacecraft

Gravitational Deflection



- Need to launch a very large object (max payload mass so far is 144,000 kg) which is infeasible

Using Ion Beams

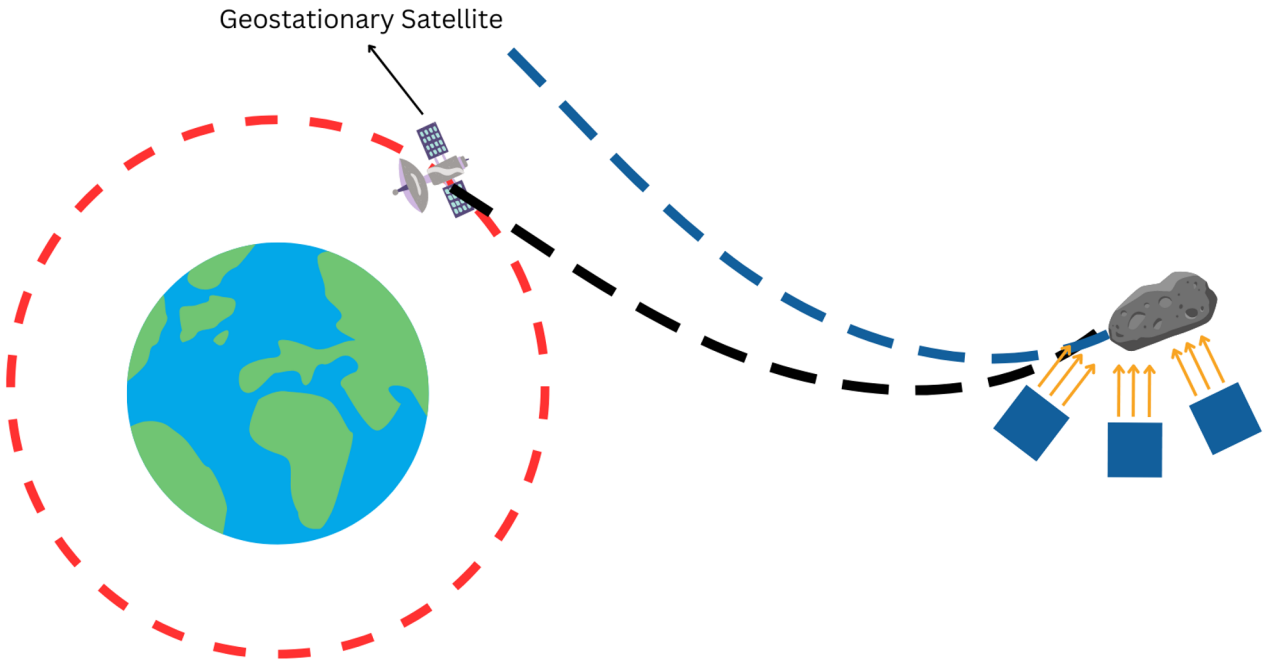


What we picked

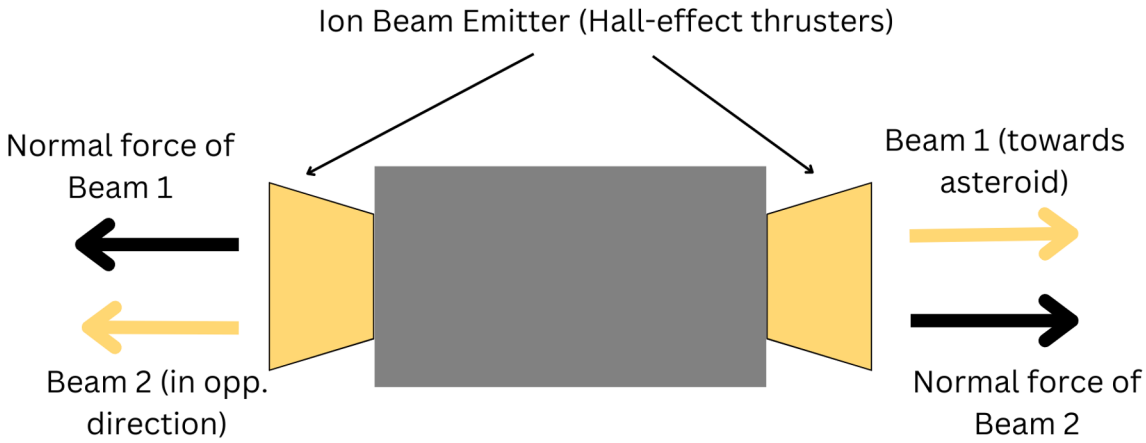
	Feasibility	Does not break asteroid	Chance of Success
Reflecting Mirrors	✓✓	✗	✓
Nuclear Detonation	✓	✗	✓
Gravitational Deflection	✗	✓	✓✓
Ion Beams	✓✓✓	✓	✓✓✓

Our solution: Ion Beam Deflection

The Concept - A swarm of ion beam emitters

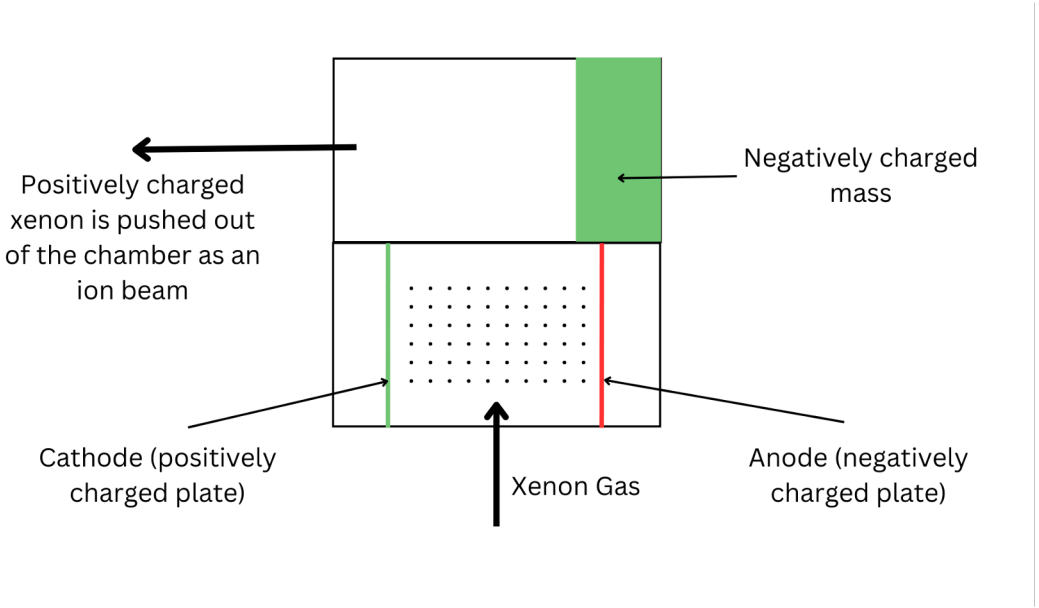


Emitting Ion Beams



- Emitting a beam of ions with force causes an equal and opposite force (Newton's 3rd law)
- Therefore a beam of ions needs to be shot out from both sides to ensure the spacecraft stays in place and doesn't move backwards

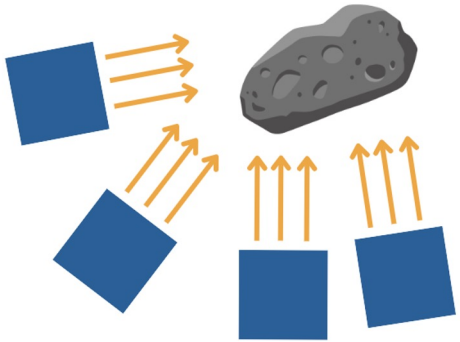
Hall-effect thrusters



- Xenon gas gets hit by electrons moving between the cathode and anode
- It forms positive ions and moves towards the second chamber
- It is repelled by a negatively charged mass which shoots out a beam of xenon ions
- To strengthen ion beams and push them in the correct direction we use ion beam prisms

Using Swarm Technology

- Inspired by the social structures which exist in nature like bee colonies
- Individual spacecrafts work in coordination with one another
- Using collective intelligence they are able to bombard the asteroid with a beam of ions that can push it off it's original trajectory
- Since multiple units are working in collaboration the impact of the ion beams is maximised and time required to deflect the asteroid reduce
- Since the individual units have processing, sensing and communication capabilities, they are able to interact with each other and react autonomously to the environment.



Pros and Cons

Pros

- Risk of fragmenting the asteroid is low
- Scalable to asteroids of any sizes
- Xenon is relatively inexpensive
- The effect of the ion beam is amplified by the emitter swarm
- Renewable Solar Energy

Cons:

- Xenon fuel needs to be replenished
- Investment into controlling system for the swarm

Factors that have to be configured

Momentum

Asteroid velocity

Precise Dimensions of the Asteroid

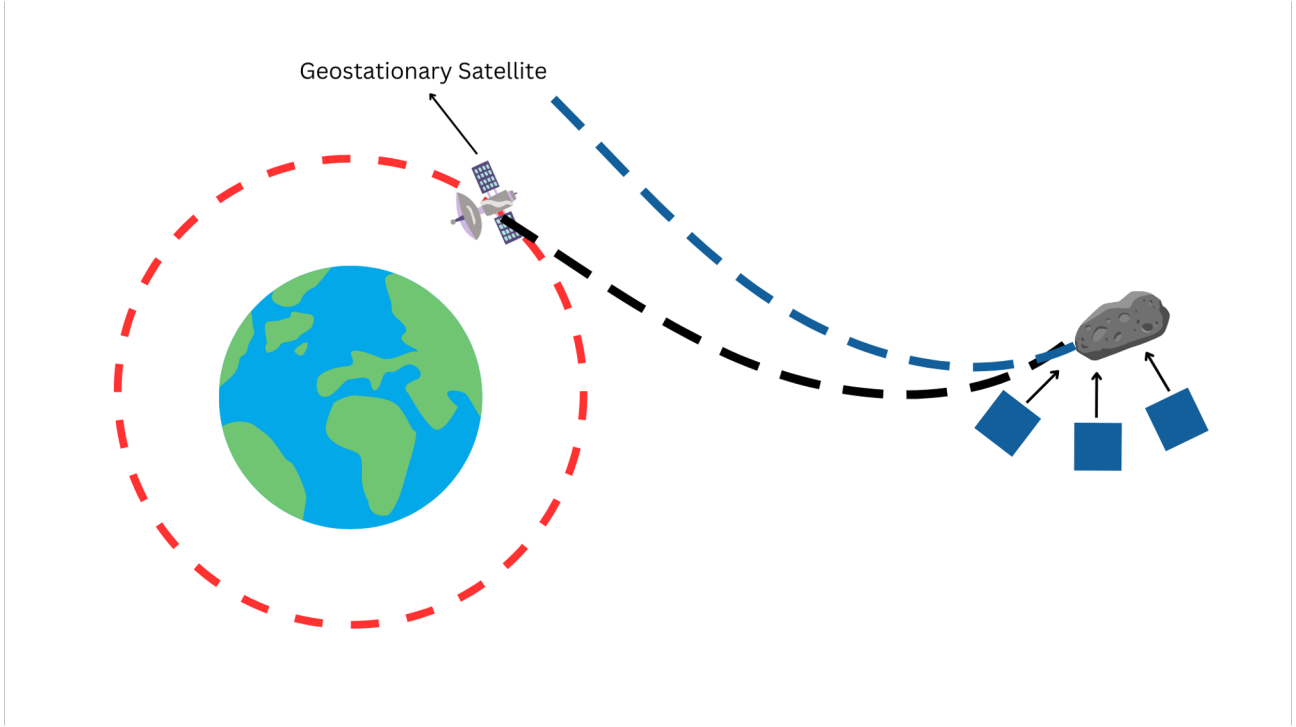
Mass of the asteroid

Asteroid Orbital Period

Asteroid Orbital Trajectory

Backup plan

Kinetic Impact



Thank you!