UNIVERSITY OF TARTU
1632

ESTCube-1: Stepping Stone for Fast Interplanetary Travel

ESTCube-1 team*

Presented by Mart Noorma

Tartu Observatory

Estonia

1st Interplanetary CubeSat Workshop, MIT, May 30, 2012

UNIVERSITY OF TARTU
1632

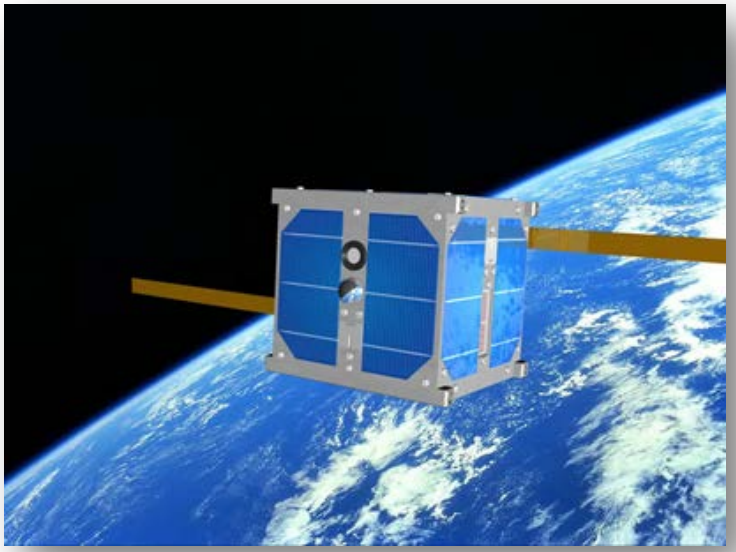
*ESTCube-1 team

- ✓ Finnish Meteorological Institute
- ✓ University of Tartu, Estonia
- ✓ Tartu Observatory, Estonia
- ✓ Stud. of Tallinn University of Technology
- ✓ Stud. of Estonian Aviation Academy
- ✓ Stud. of Estonian University of Life Sciences
- ✓ Helsinki Univerisity, Finland
- ✓ Jyväskylä University, Finland
- ✓ German Aerospace Center (DLR)

www.estcube.eu; facebook.com/estcube

Outline

- ✓ Electric Solar Wind Sail (E-sail) concept
- ✓ Technological challanges
- ✓ ESTCube-1 CubeSat mission at LEO
- ✓ Next steps



The Electric Solar Wind Sail (E-sail)

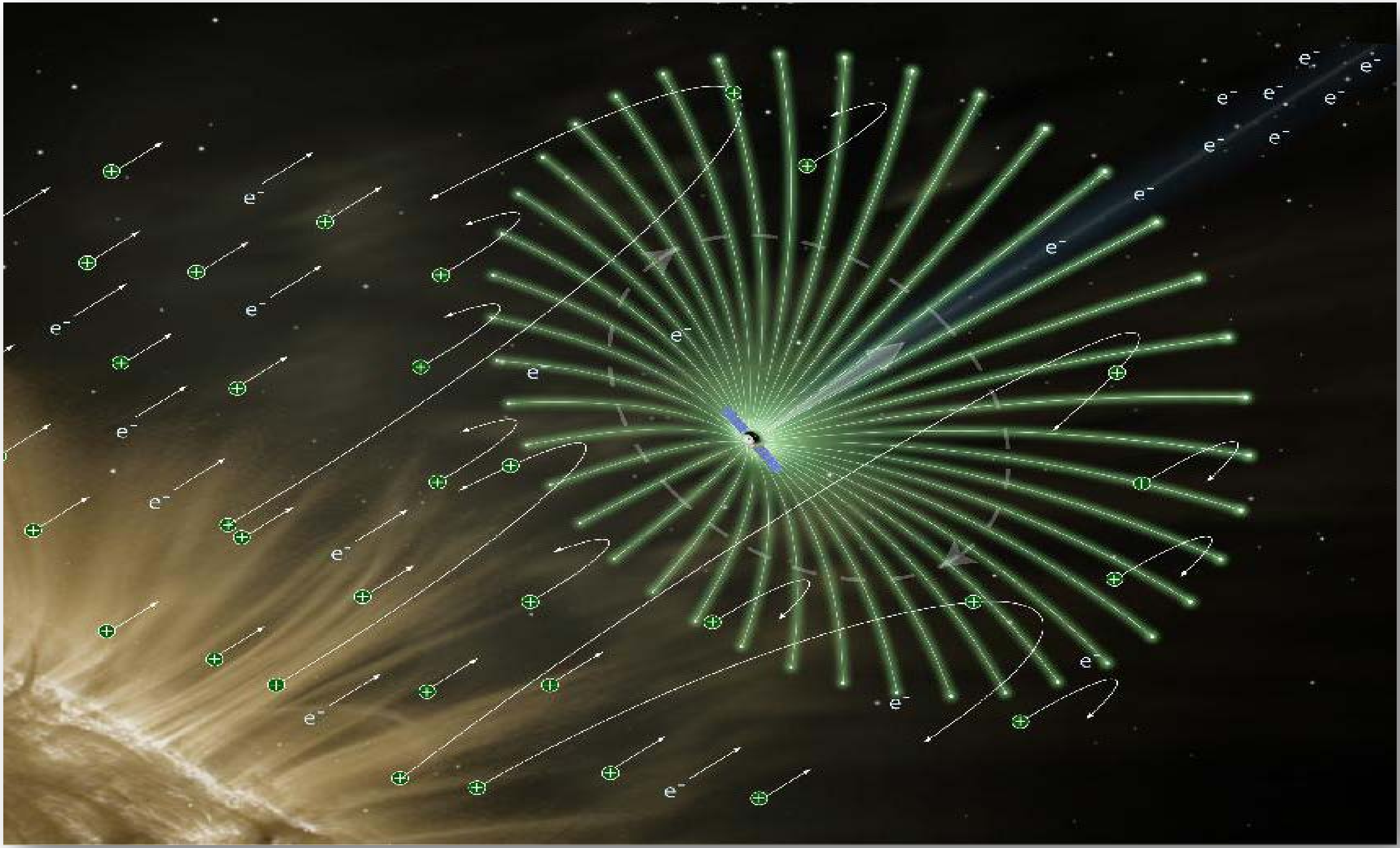
- ✓ Invented by Pekka Janhunen, Finnish Meteorological Institute

  Janhunen, P., Electric sail for spacecraft propulsion, AIAA Journal of Propulsion and Power, 20, 4, 763-764, 2004
- ✓ Uses solar wind momentum for producing thrust
- ✓ Consists of a number of long thin conducting tethers
- ✓ An electron gun is used to keep the wires at high positive potential
- ✓ The electric field of the wires extends tens of meters into the surrounding solar wind plasma

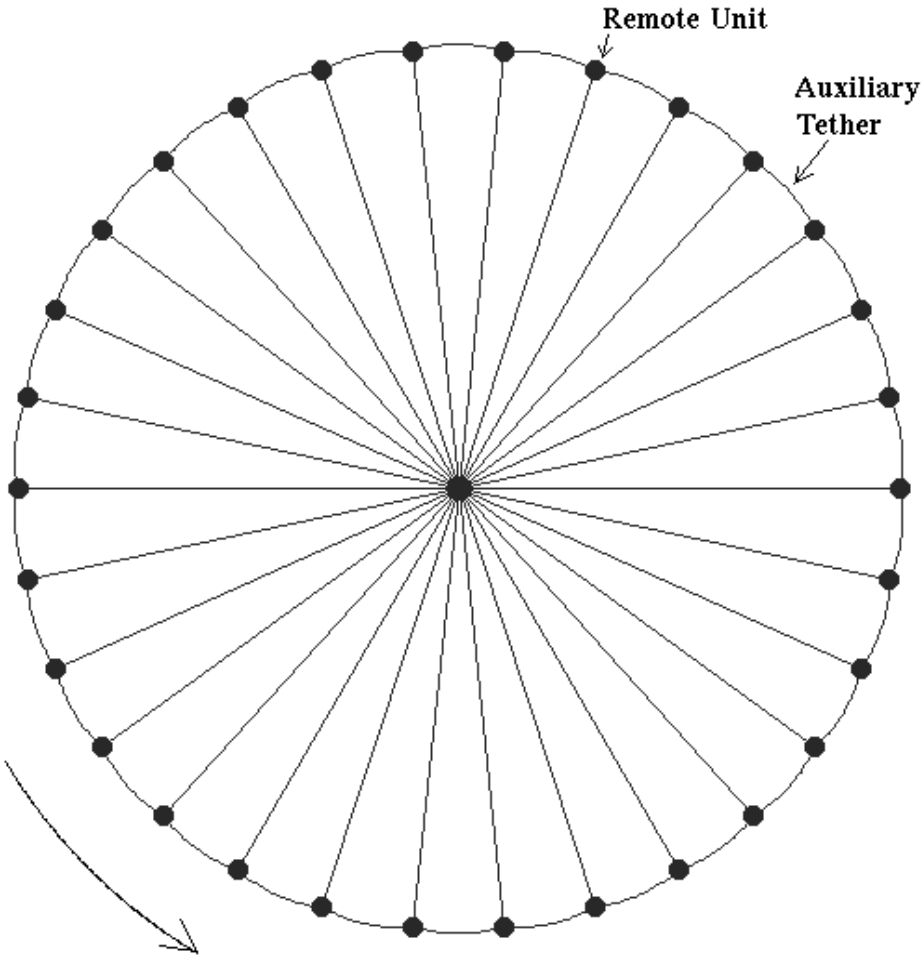
Read more at www.electric-sailing.com, where also all references can be found

UNIVERSITY OF TARTU 1632

Electric Solar Wind Sail (E-sail)

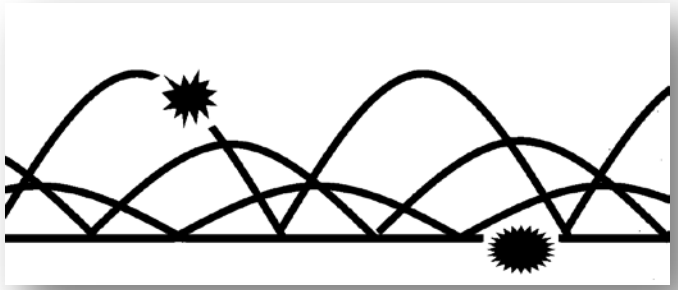


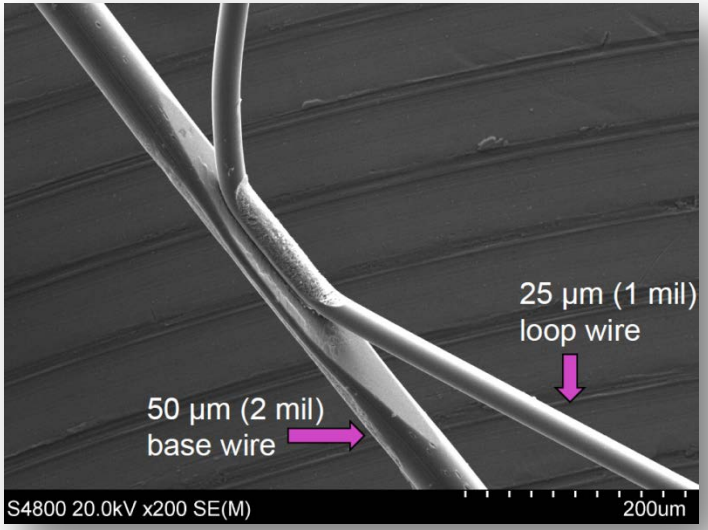
Electric Solar Wind Sail (E-sail)

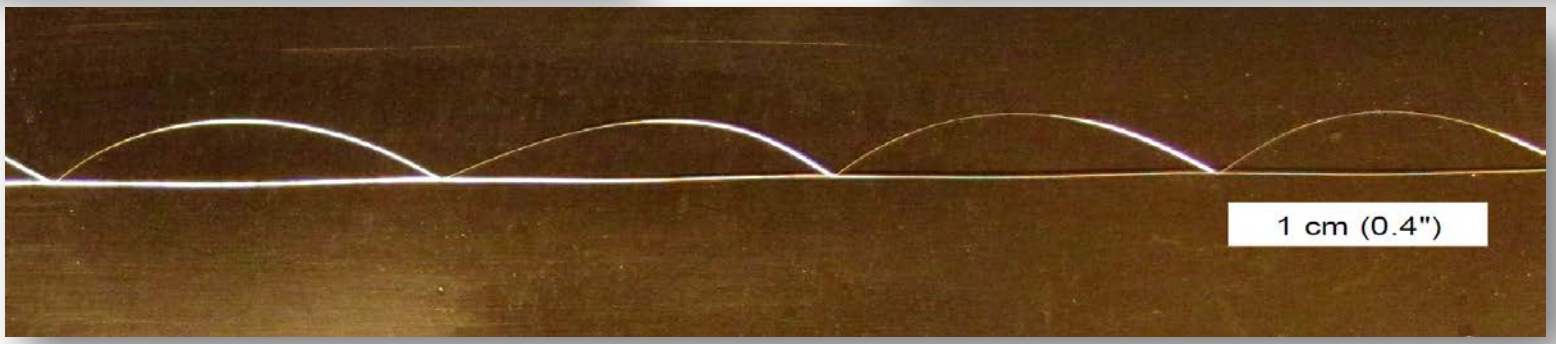


Technological challenges

- ✓ Tether production
- ✓ Tether deployment







Imges: Dep. Physics, Helsinki University

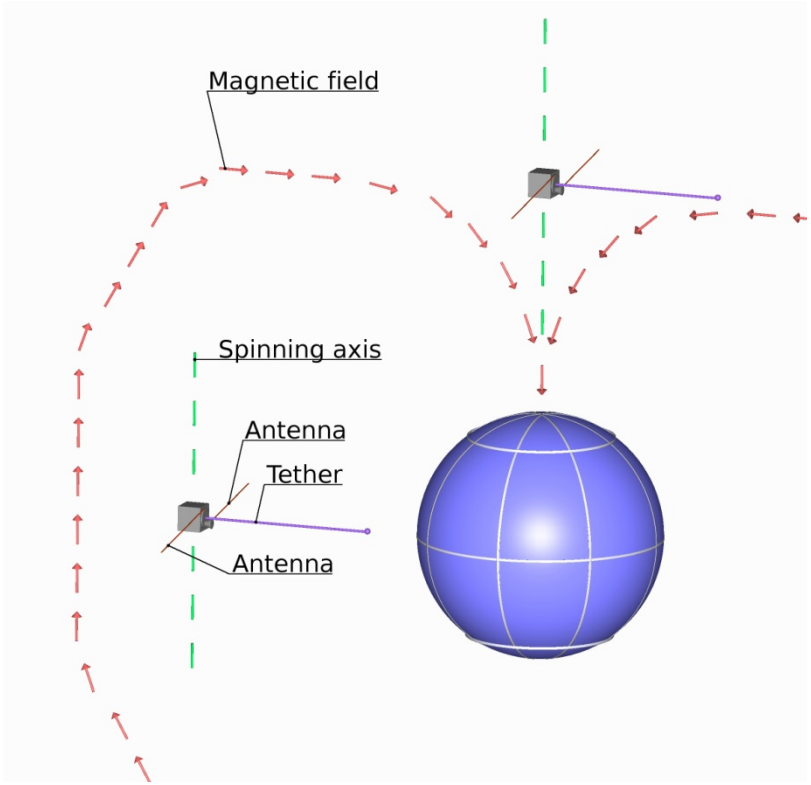
ESTCube-1 mission objectives

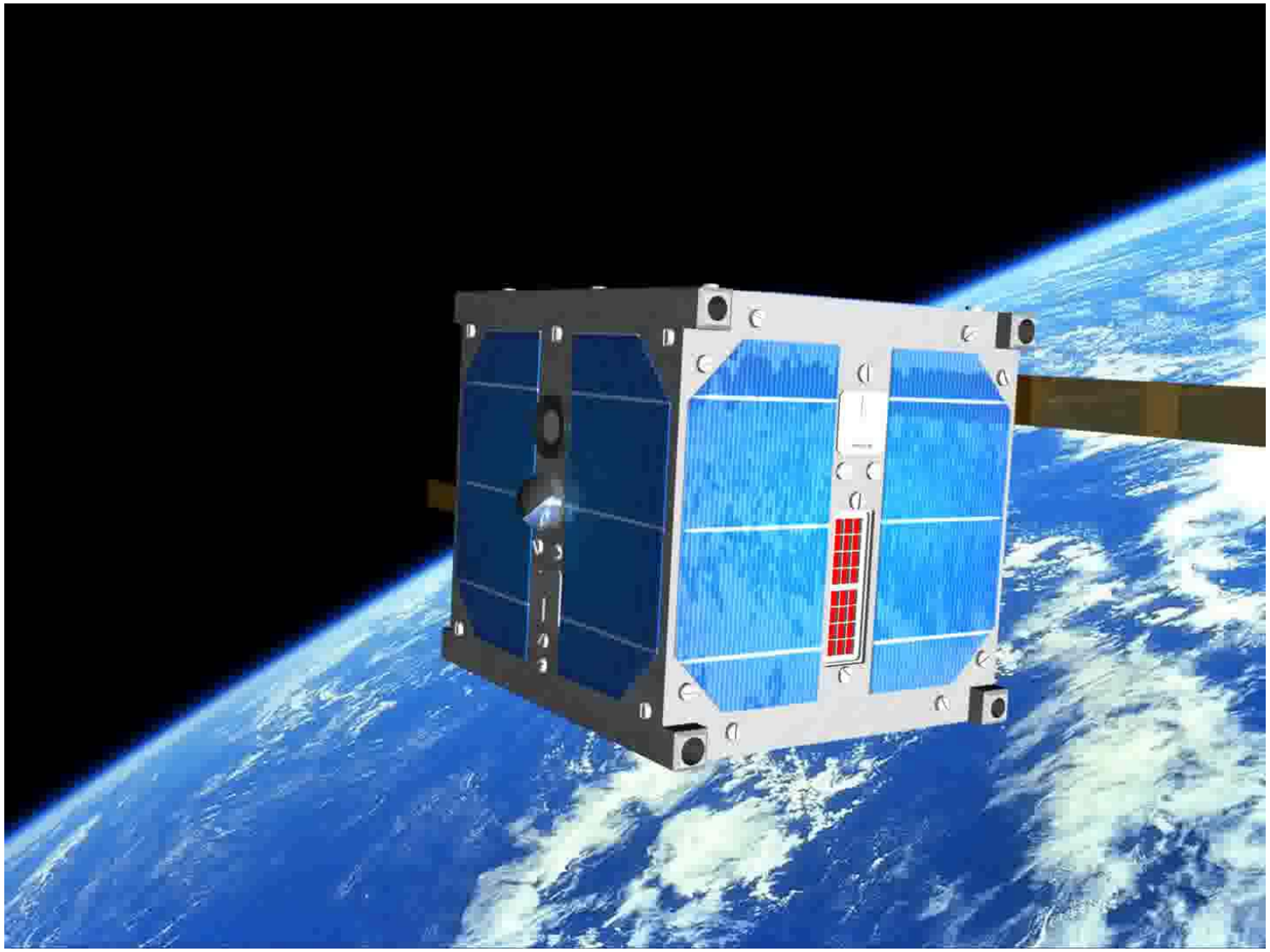
- ✓To deploy and confirm the deployment of a 10 m conductive Heytether from a 1U CubeSat
- ✓To measure the electric sail force, interacting with the tether. The success criteria for this objective is the measured effect on the satellite attitude resulting from electric sail force

Launch planned for 2013

ESTCube-1 experiment

- ✓ Polar LEO, 600-800 km
- ✓ A 10 meter 4-fold 25-50 µm Heytehter at 450 V charge
- ✓ Deployment by centrifugal force
- ✓ Magnetic coils for spin up





ESTCube-1 animation: Austin Hess, MIT

Next steps

- European Commission 7th framework program project ESAIL (2010-2013): development of full E-sail mission components to TRL 4-5
- Test of a 100 m tether deployment on Aalto-1 3U CubeSat (2014)
- CubeSat mission to solar wind (next presentation)