Aalto University
School of Electrical
Engineering

Space Instrumentation

Part 1/2

ELEC-E4220 (5 cr)

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Assistant: Dr. Riku Järvinen

Aalto University
School of Electrical Engineering
Department of Electronics and Nanoengineering

Today

Practical issues

Roadmap *(Part ½: Solar System)*

Introduction to Space Instrumentation Part ½

Practical issues

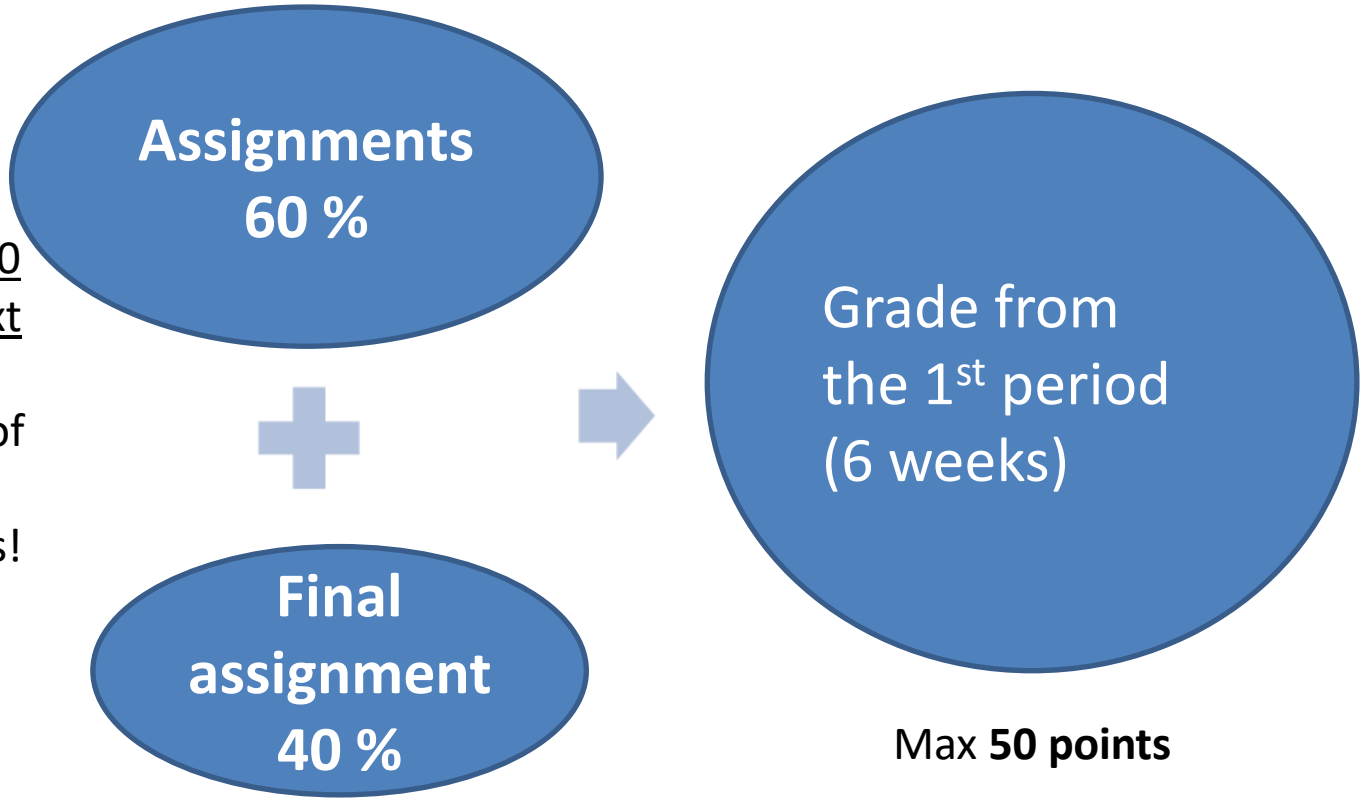
Part ½: Solar System

Evaluation and grading of the first period *(six weeks)*

5 assignments,
max 6 p / assignment
⇒ Max **30 points**

- Available on Wednesday at 12:00
- Return time: by next Fri. at 12:00
- Note: copy&paste of the text **does no** give points!
- Self-evaluation

Final assignment:
Max **20 points**



Max **50 points**

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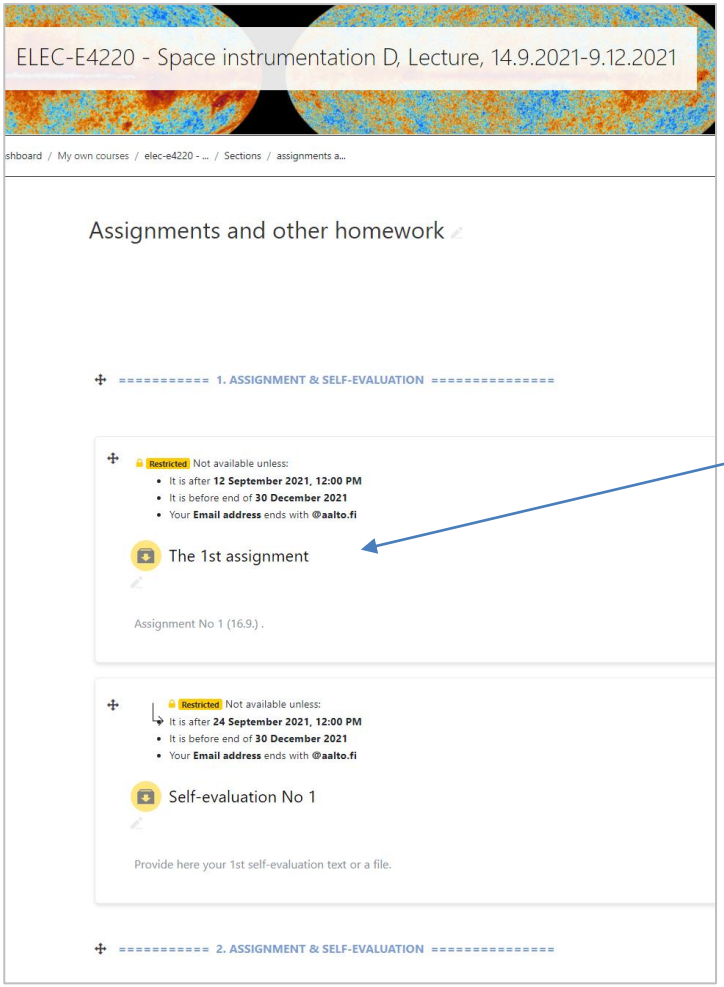
Note: Occasionally may also be preliminary work. Will be given at MyCourses before Monday.

Note: The 1st assignment is already open!



Assignment 1/5 16.9.2021

Space instrumentation (ELEC-E4220), Part 1: Solar System

Return solutions by Fri. 24.9. at 12:00 (*noon*)

Return self-grading by Fri. 1.10. at 12:00 (*noon*)

A mental orientation to the topics measurements & instruments and "from weather to space weather"

1. Topic: single point measurement and the needed time resolution measurement *(max 3 points)*

Go to http://en.ilmatieteenlaitos.fi/observations-in-finland and make similar temperature and wind speed plots as shown in Figures 1a and 1b at an arbitrary time.
Analyze your time variation plot and write briefly about your considerations about these issues:
- How many measurements would have been needed to get the basic trend of the temperature and velocity change? *(what about if you would need to pay 1 euro for a measurement?)*
- How many measurements would you need in your everyday life, (e.g., decide which clothes to take etc.)?
- What other atmospheric measurements would be useful to do when you consider the needs of (1) the public and (2) science?
- What temperature range (T_{max},T_{min}) and temperature resolution (dT) would you require the thermometer to have in order it would be useful to you, and probably to somebody else (to whom?). Recall, that all the more requirements you give, the more expensive the instrument is.

http://en.ilmatieteenlaitos.fi/observations-in-finland

Fig. 1a

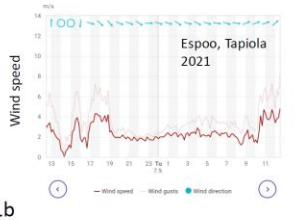


Fig. 1b

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School of Electrical Engineering

Space science and technology courses

- **ELEC-E4220 Space instrumentation *(part ½)***
- ELEC-E4230 Microwave Earth Observation instrumentation
- ELEC-E4240 Satellite systems
- ELEC-E4510 Earth Observation
- ELEC-E4520 Space physics *[Physical laws, basic phenomena]*
- ELEC-E4530 Radio astronomy
- ELEC-E4920 Space technology project (5 – 10 cr)
- ELEC-E4930 Special assignments (5 – 10 cr)

Roadmap

Part ½: Solar System

REAL LIFE GEOSPACE AND SPACE WEATHER RESEARCH

SPACE REGIONS

4. THE SUN

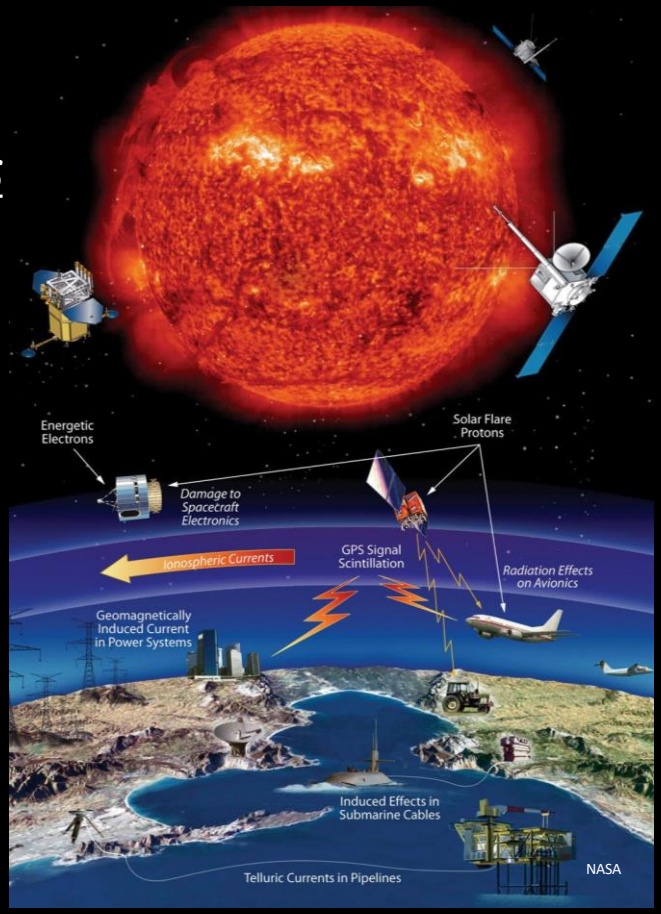
5. SOLAR WIND

6. MAGNETOSPERE

1. IONOSPHERE

2. ATMOSPHERE

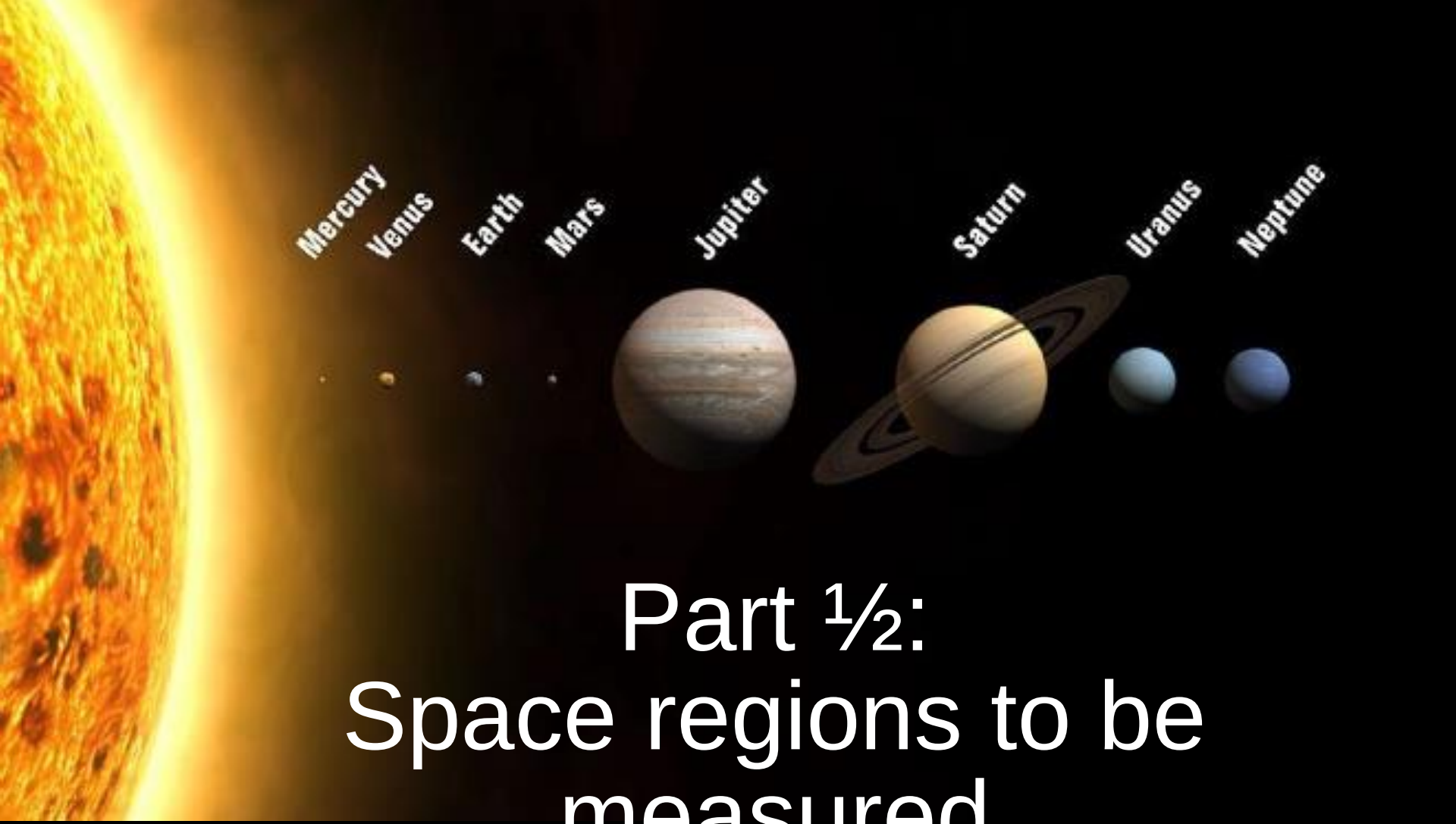
3. SURFACE



SPACE INSTRUMENTS	***Theory [data]***
Multi wavelength camera	***emission and absorption [SOHO, Stereo, SDO]***
Particle instrument	***velocity distribution function [ACE, SOHO, etc.]***
Magnetometer	***Ohm's law, reconnection [ACE, DSCOVR, etc.]***
Radio instrument	***waves and their propagation [Suomi 100 satellite, etc.]***
Langmuir probe	***Debye layer [QB50 satellites, etc.]***
High energy particle instr.	***surface charging [Aalto-1 satellite, etc.]***
Radar & ionosonde	***ionosphere***
Magnetometer, camera	***[EISCAT, ionosondes, etc.]***

ESA KALLIO

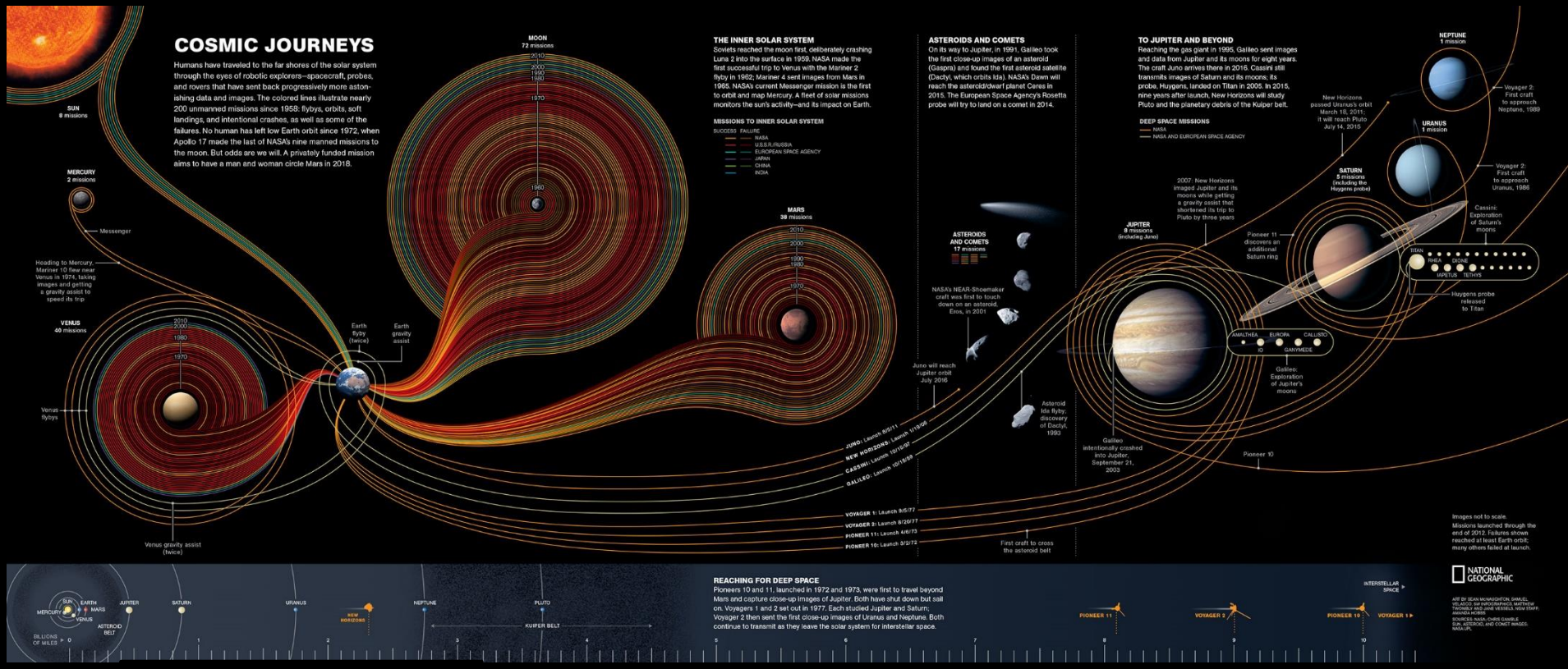
Introduction to Space Instrumentation *(Part ½)*: Regions & missions



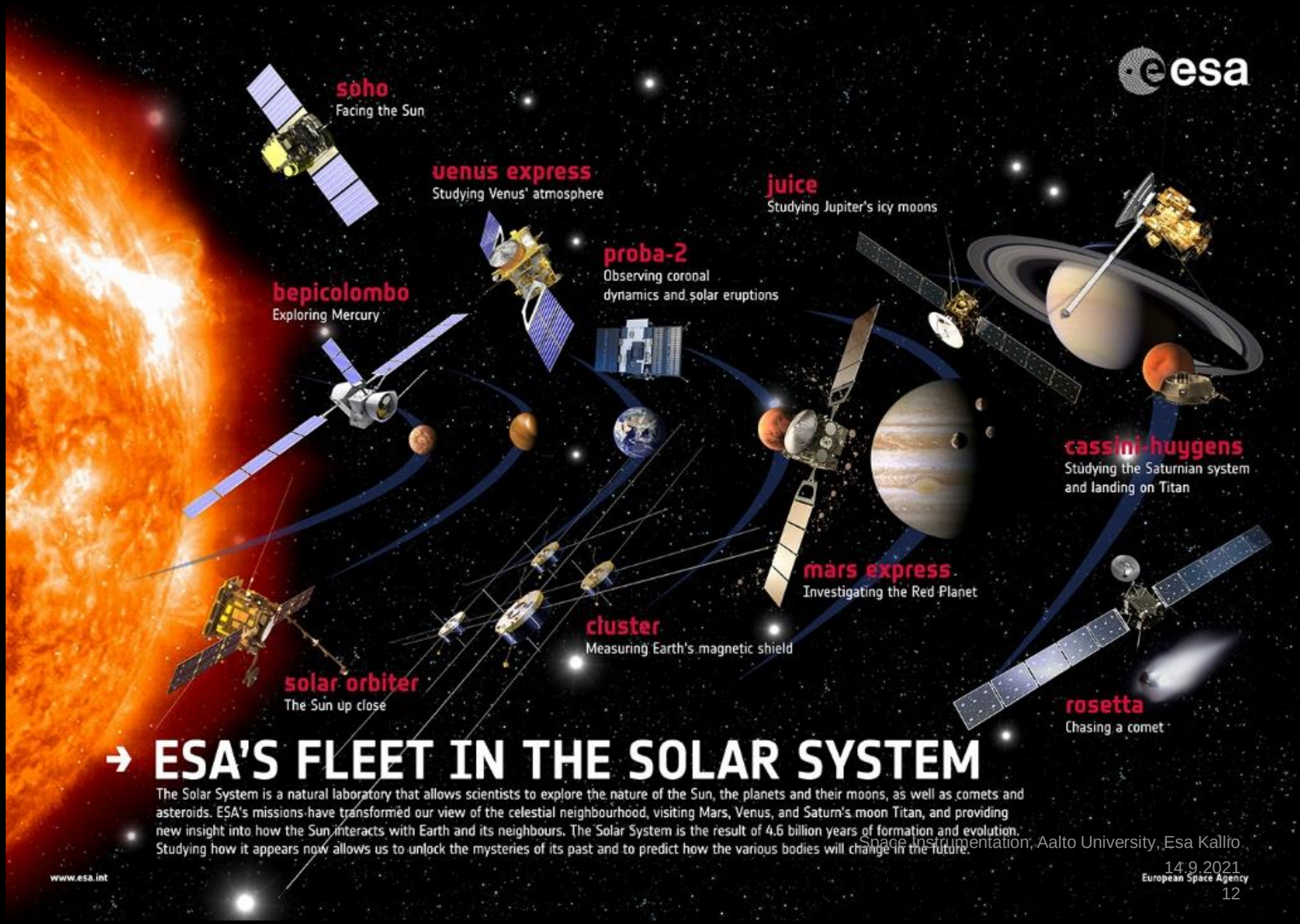
Part ½: Space regions to be measured

Space missions

COSMIC JOURNEYS: The colored lines illustrate nearly 200 unmanned missions at 1958 - end of 2014

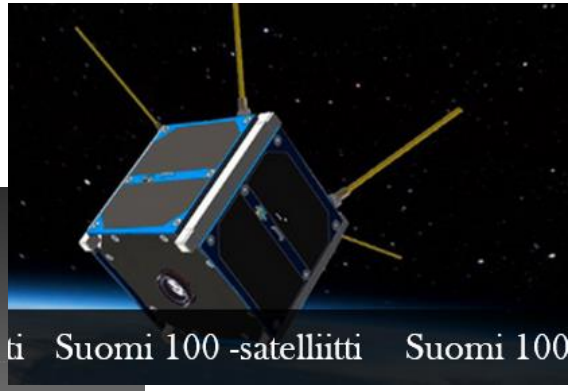


http://www.5wgraphics.com/img/newsletter/50-years-of-exploration.jpg

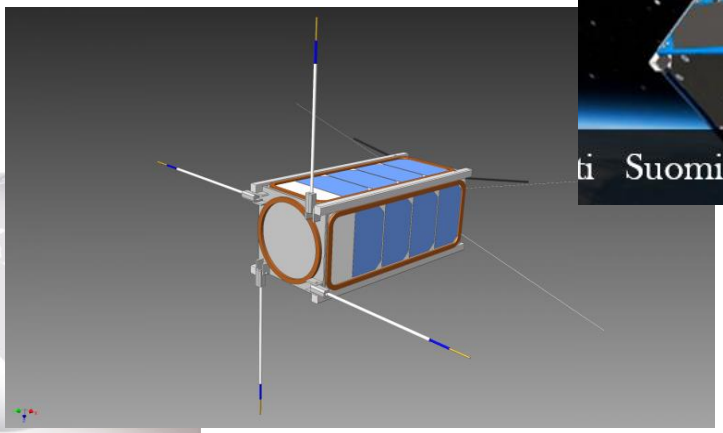

esa
soho
Facing the Sun
venus express
Studying Venus' atmosphere
juice
Studying Jupiter's icy moons
proba-2
Observing coronal dynamics and solar eruptions
bepicolombo
Exploring Mercury
cassini-huygens
Studying the Saturnian system and landing on Titan
mars express
Investigating the Red Planet
cluster
Measuring Earth's magnetic shield
solar orbiter
The Sun up close
rosetta
Chasing a comet
ESA'S FLEET IN THE SOLAR SYSTEM
The Solar System is a natural laboratory that allows scientists to explore the nature of the Sun, the planets and their moons, as well as comets and asteroids. ESA's missions have transformed our view of the celestial neighbourhood, visiting Mars, Venus, and Saturn's moon Titan, and providing new insight into how the Sun interacts with Earth and its neighbours. The Solar System is the result of 4.6 billion years of formation and evolution. Studying how it appears now allows us to unlock the mysteries of its past and to predict how the various bodies will change in the future.
www.esa.int
European Space Agency

Aalto University's cubesat program

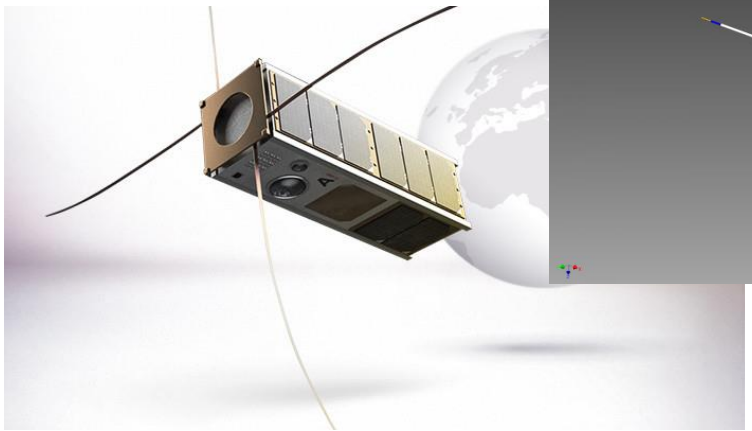
Suomi 100



Aalto-2



Aalto-1



6/2017

4/2017

3.12.2018 (Falcon-9)

Suomi 100 left from Aalto almost exactly three years ago (11.9.2018)


WELCOME TO SPACE