Growing and Sustaining a Community of Telescope Users

John Baruch – Bradford Robotic Telescope

Robotic Telescopes for Everyone

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Robotic Telescopes are much more important than you dreamed….

- Newton introduced his laws of motion and changed the world…..
- We are introducing Robotic telescopes with the potential to change the world!
- How?

Newton

- His three laws of motion were derived from astronomy….
- They were applied elsewhere and powered the industrial revolution….
  - Machines of all kinds…
  - Steam Engines, Guns and Rockets
  - Railways and Cars
  - Petrol engines – jets and aircraft…

How can Astronomy repeat…..?

- with Robot telescopes it can make a massive contributions to our economies……

Unemployment is a massive problem

- Unemployment for the young
- Unemployment for older people caught up in Change…
  - Change to move manufacturing to low wage economies
  - Change to move service industries to low wage economies

We need the skills for innovation and creativity – for a Knowledge Economy

- It is developing the skills of innovation and creativity that robotic telescopes can deliver

What is the Knowledge Economy?

- The World Bank, the UN and many other detail a knowledge economy and what it requires…
- A knowledge economy is where design and innovation in new products and services is the key to the economy with robots doing the manufacturing and most of the services….
- There are vast opportunities with innovation and creativity……

The Knowledge Economy

- Robots make the mass produced products
- People innovate to make the products better
- Localisation of fashion and design in food furniture, clothing, and more specialist products such as classic cars….
- Creative industries in film, TV, and all the new media…
- Exploitation of the revolution in materials and bio materials making many new products possible.

Jobs in the Knowledge Economy

- Jobs are essentially well paid and rewarding
- Businesses tend to be small since large companies are generally very poor at innovating.
- Markets tend to be web based and local but with a world wide interest as well.

Knowledge Economy Requirements

- The fundamental requirement is an innovative and creative workforce.
- In technological innovation the World Bank the UN and many others regard practical science the key to educating for innovation and creativity.
- Practical Science is the route into a knowledge Economy…..Everyone agrees…..

Practical Science

- Practical Science is a big problem for most countries.
  - They do not include practical science in their school curricula
  - Where it exists it is normally in after-school clubs
    - Science clubs
    - Raspberry pie clubs
    - Gardening and cooking are not totally removed from practical science but most schools have dropped them.

Practical Science (2)

- Where practical science exists like in the UK it is regarded as expensive requiring:
  - Laboratories
  - Laboratory technicians
  - Teachers who can teach practical science

What is Practical Science?

- Question the world around us…
- Develop a theory as to why it is like it is…
- Test out the theory with an experiment….
- Evaluate the results of the experiment….
- Was your theory true or not?
  - how far does it go in describing the real world?
  - How must you alter it to describe it better?
  - How can you further test it?

Practical Science

- Practical science is about developing the skills of innovation and creativity…..
  - How can we do an experiment to test out our ideas about the real world?
  - How well will this experiment test out our theory?
  - How can we innovate and creatively make our experiment better?

Practical Science

- Practical Science is about addressing problems and using the available technology to find a solution.
- This is exactly the same challenge that small businesses face…..
  - How can I innovate and creatively make a solution to a problem:- a solution that I can sell?
  - What can I create that is entirely new and people will want?

How to deliver Practical Science?

- Without trained teachers…..
- Without laboratories or technicians…
  - Of course with Robots….. Robot science laboratories that you can access on the Web….

Germany decided to set up a Robot Chemistry Laboratory…..

- I believe it closed this year after 15 years with little progress and many problems. I can no longer find it on the web.
- No others have been tried apart from robotising a few chemistry and physics experiments…

Astronomy with Robots is Ideal

- The whole laboratory is easily accessible: the universe goes over your head every night…
- With a robot telescope you can do everything that astronomers can do.
- Astronomy is the only practical science that can be robotised……

Astronomy can deliver Practical Science

- The key for practical science is
  - being innovative and creative in the experiments to test out your ideas
  - Thinking about why and how and how better…..
  - Having the tools to analyse the results……

The Bradford Robotic Telescope(BRT)

- The Bradford Robotic is an example of this
  - There are dozens of experiments that students can do in optical astronomy covering all the curricula that we know up to first year university.
  - They need to think why these experiments and how they can make them better…..

- The BRT delivers Practical Science……
- Practical science develops the skills of innovation and creativity…..

Practical Science – Do governments know?

- Yes and no.
  - This year the Bradford Robotic Telescope led the presentation to the British Government from the research Council showing how we were contributing to building a knowledge economy…
- In Ireland, China and Poland there are projects going on to demonstrate the value of astronomy
- Nature 13 March 2014 has a piece about the importance of practical science and robotic telescopes

e.g. Practical Science in China

- Practical Science is not taught in Chinese Schools
- The Chinese Government is very keen to include creativity and innovation in their education system….
- they see practical science as a route to developing innovation and creativity….

The Chinese Examination System

- In China everything is determined by your marks in the Chinese School Leaving Examination – the Gaokao： 高考。
- This year a pilot programme is running in the Beijing Area (about 30 mllion people) in which a practical science project can contribute to the Gaokao marks.
- The only project listed is the Bradford Robotic Telescope!

The Future for Robotic Telescopes

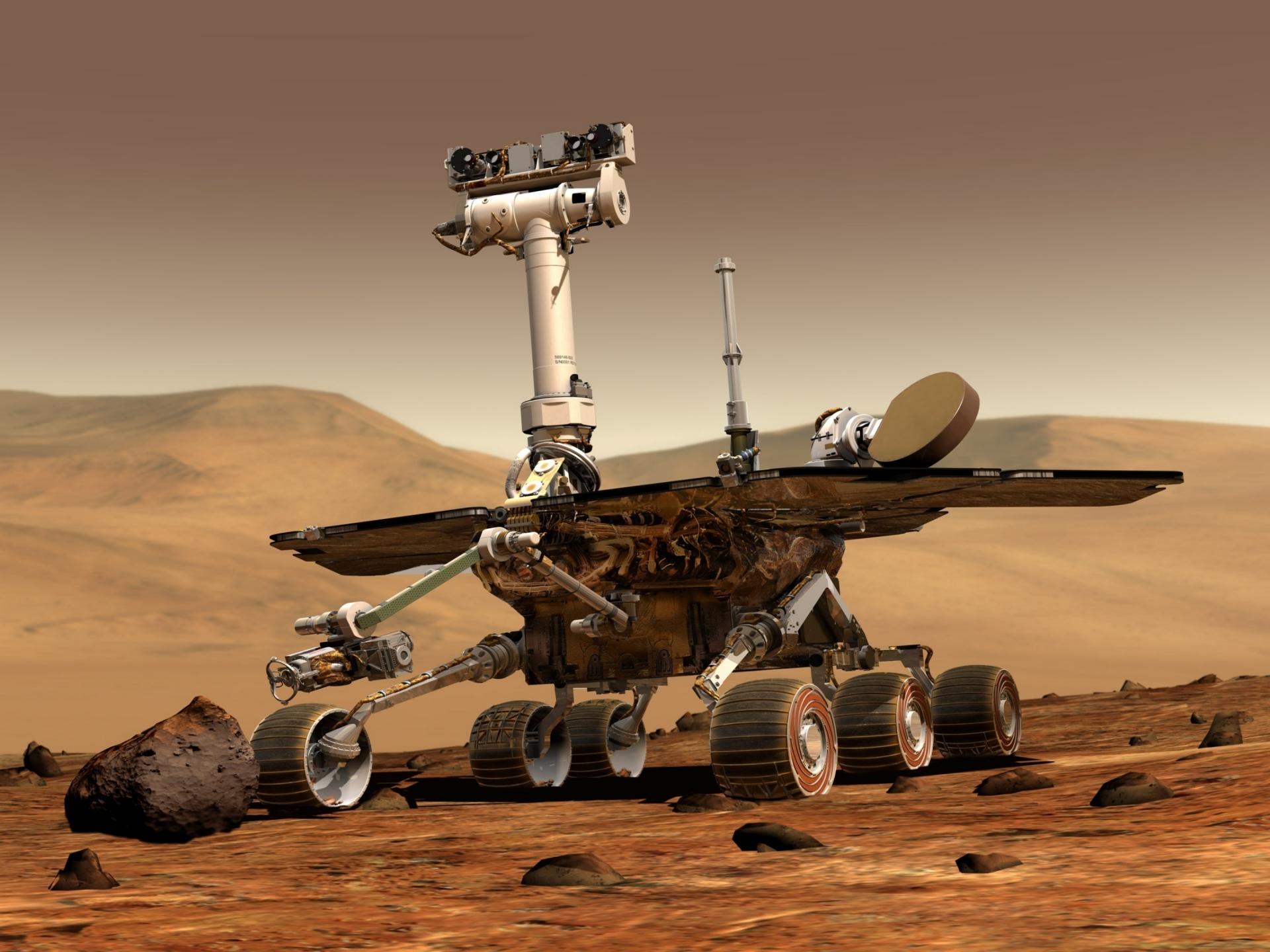
- In Europe….
  - A major item must be delivering practical science for school children.
  - We would be very pleased to work with others to develop such a practical science network.
  - A telescope which delivers practical science for 50% of the time can spend the remaining 50% servicing research and amateur astronomers.

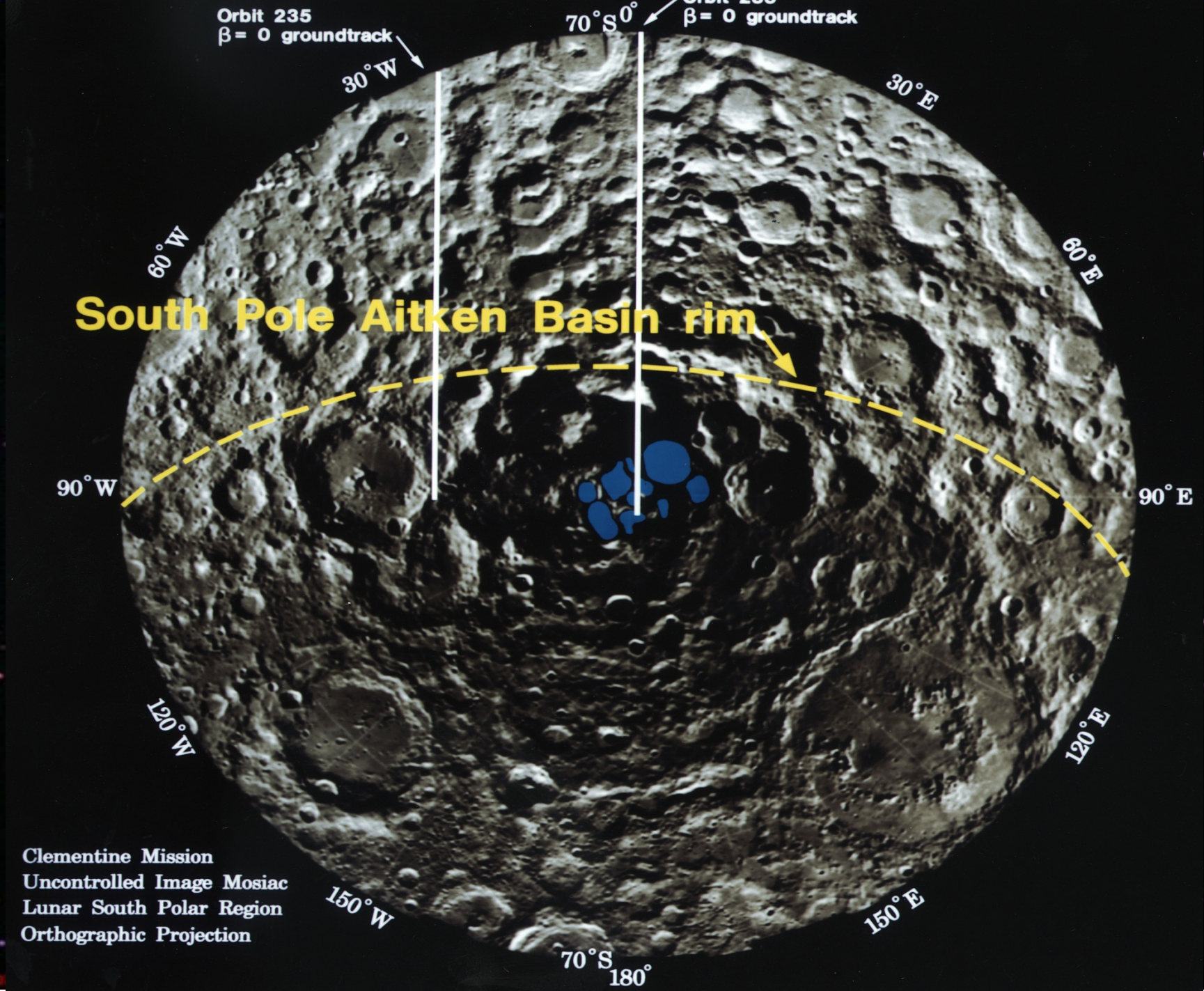
Delivering Practical Science

- 99.9% of the BRT users developing innovation and creativity follow the paths laid out and ask for standard observations. Thus we can service a million users.
- We now have 150,000 users. Most are school children and they have the priority. Most of the telescope time is taken with amateur astronomers and research programmes.
- BUT the BRT needs to be introduced by Astronomers…

Space is also really exciting.....

- Rosetta
- Mars
- The new interest in the Moon
- The search for life
- The new really big telescopes
- Gravitational Waves....

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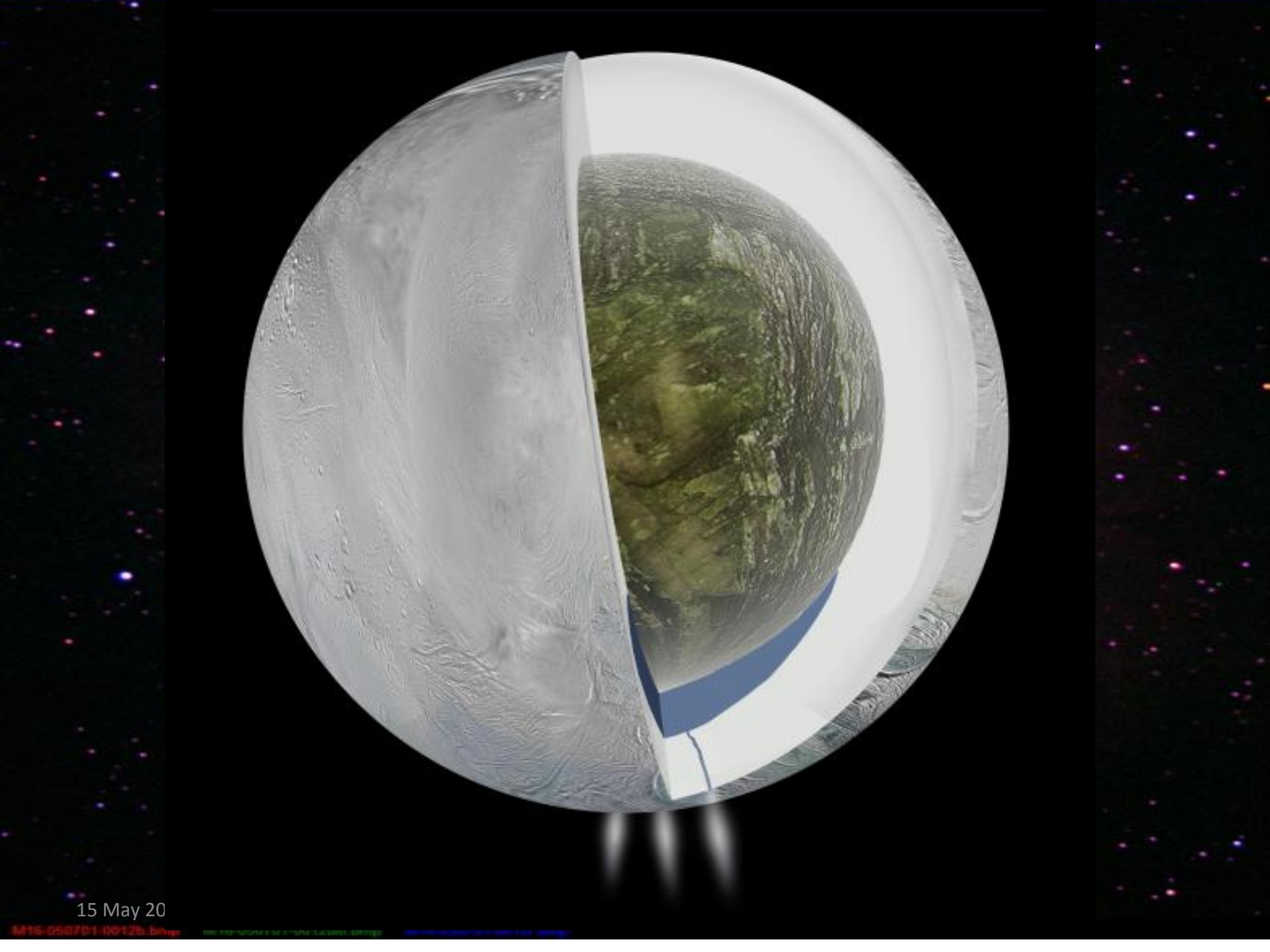
Orthographic Projection



The best finder of planets:

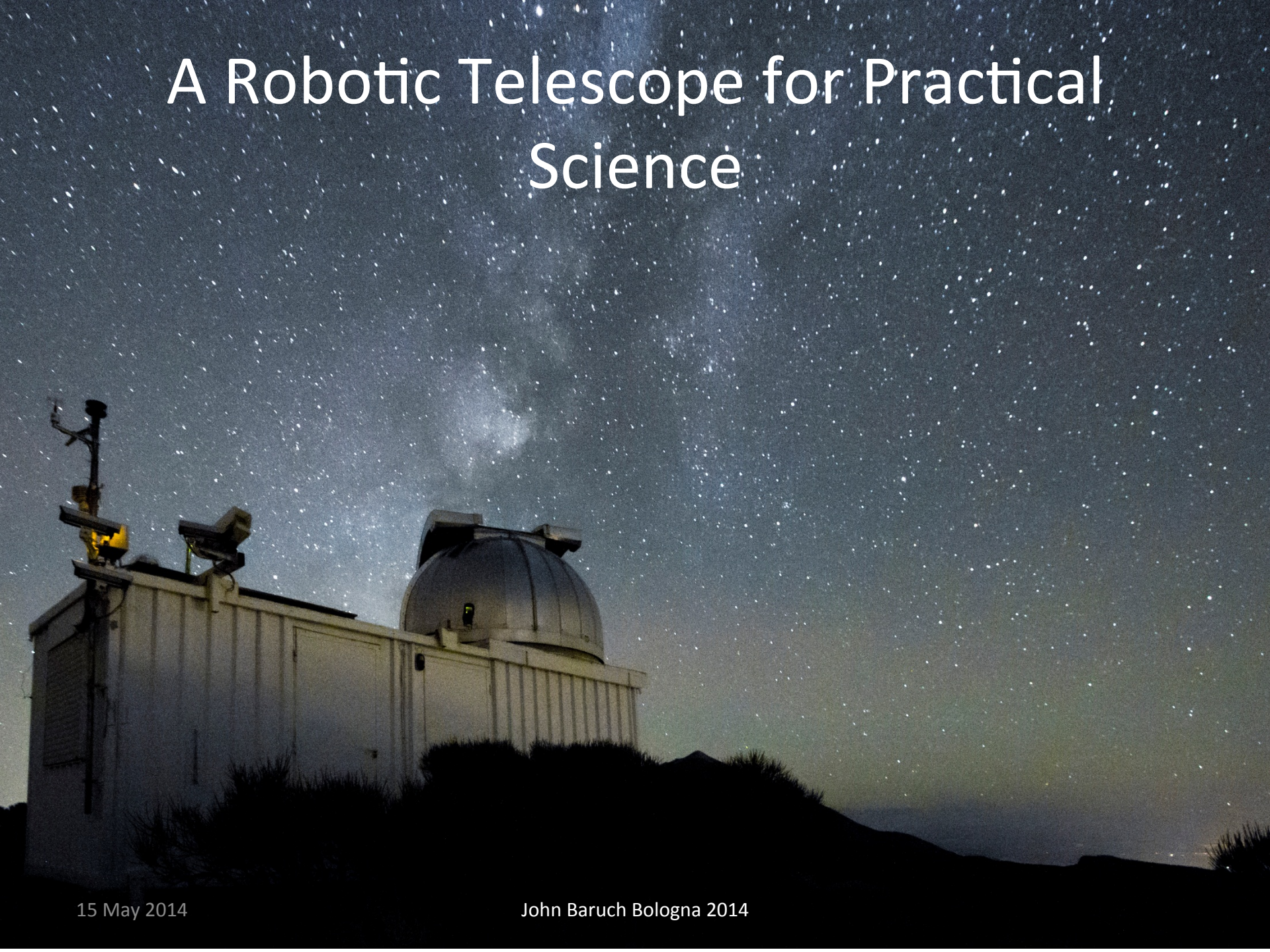
The Nasa Kepler Satellite:

Radio Telescope: total area 1km square

A new description of the Universe in 2009

- Not Billions of galaxies with billions of stars
- Now Billions of galaxies with billions of PLANETS

A Robotic Telescope for Practical Science



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Astronomy: Exciting and Important

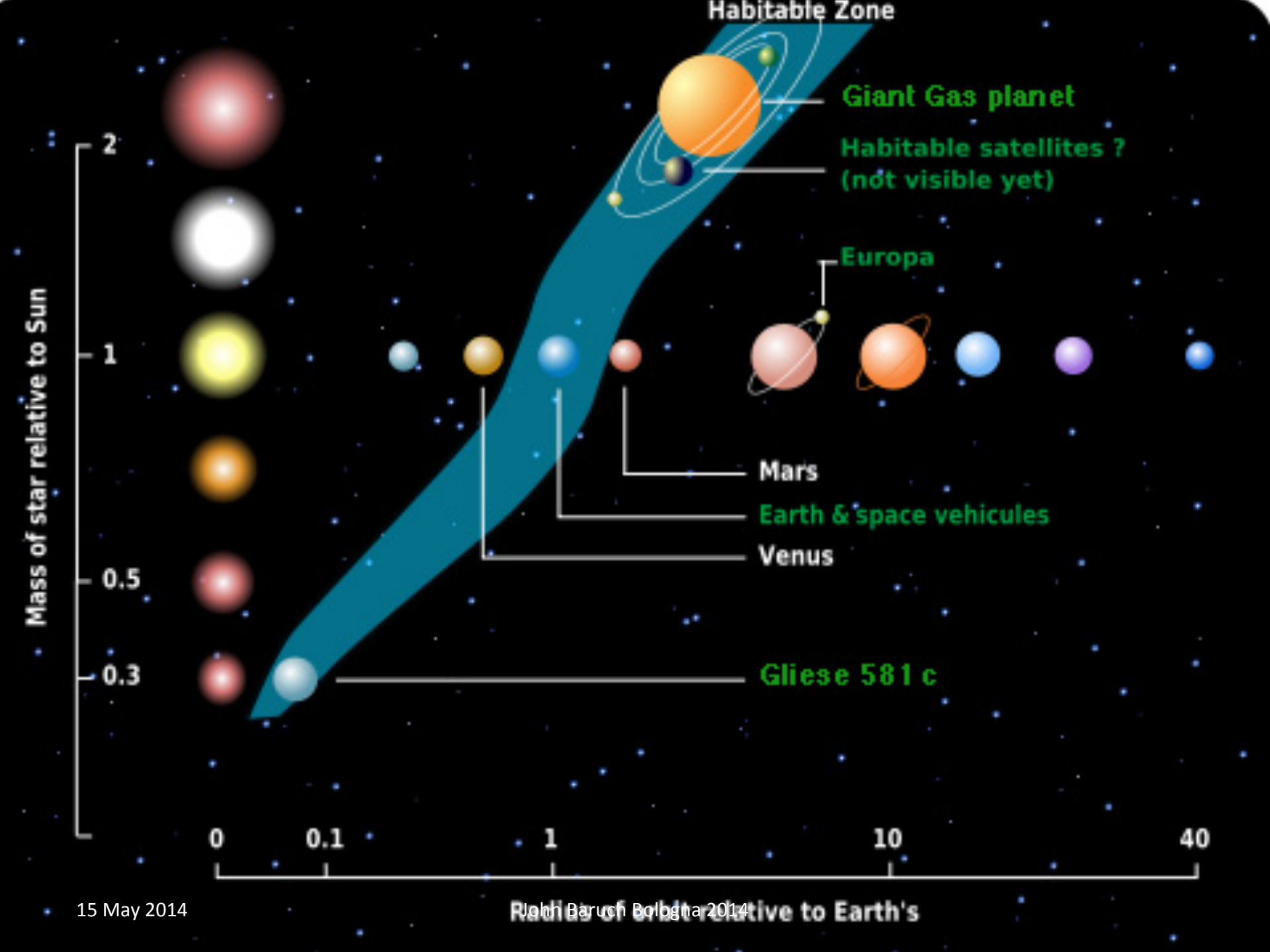
- Astronomy does hold a key to generating jobs in future knowledge economies.
- How can astronomers with robotic telescopes deliver
- How can they persuade Government that they are still as important as Newton……

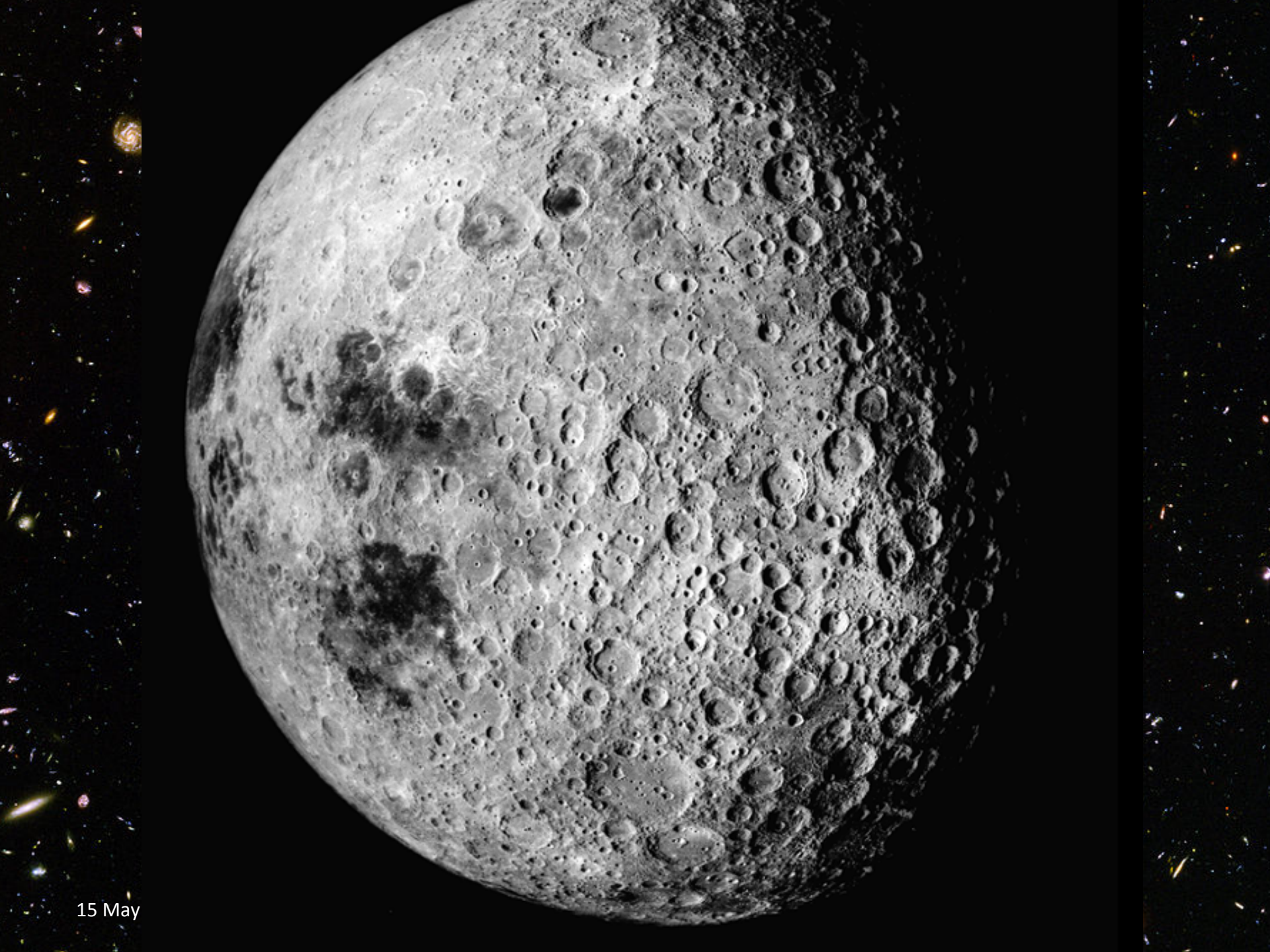
We need to create jobs for our people

- The skills of innovation and creativity open up the Knowledge Economy….
- Practical Science is the route into developing technological innovation and creativity
- Astronomy is the only practical science that can be robotised and delivered on a mass basis.
- Robot Telescopes can change the world……

Thank – you

http://www.telescope.org
http://schools.telescope.org





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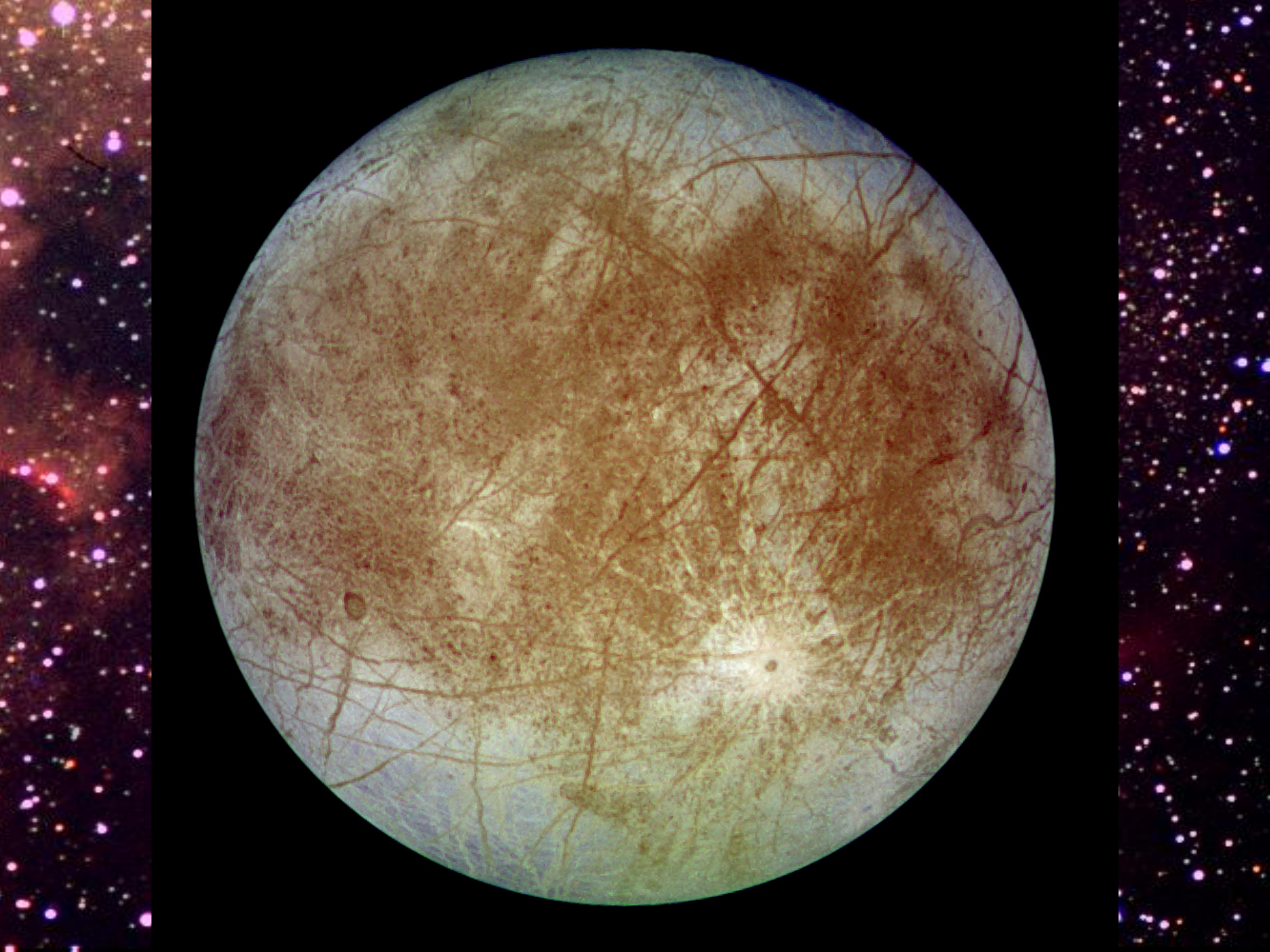
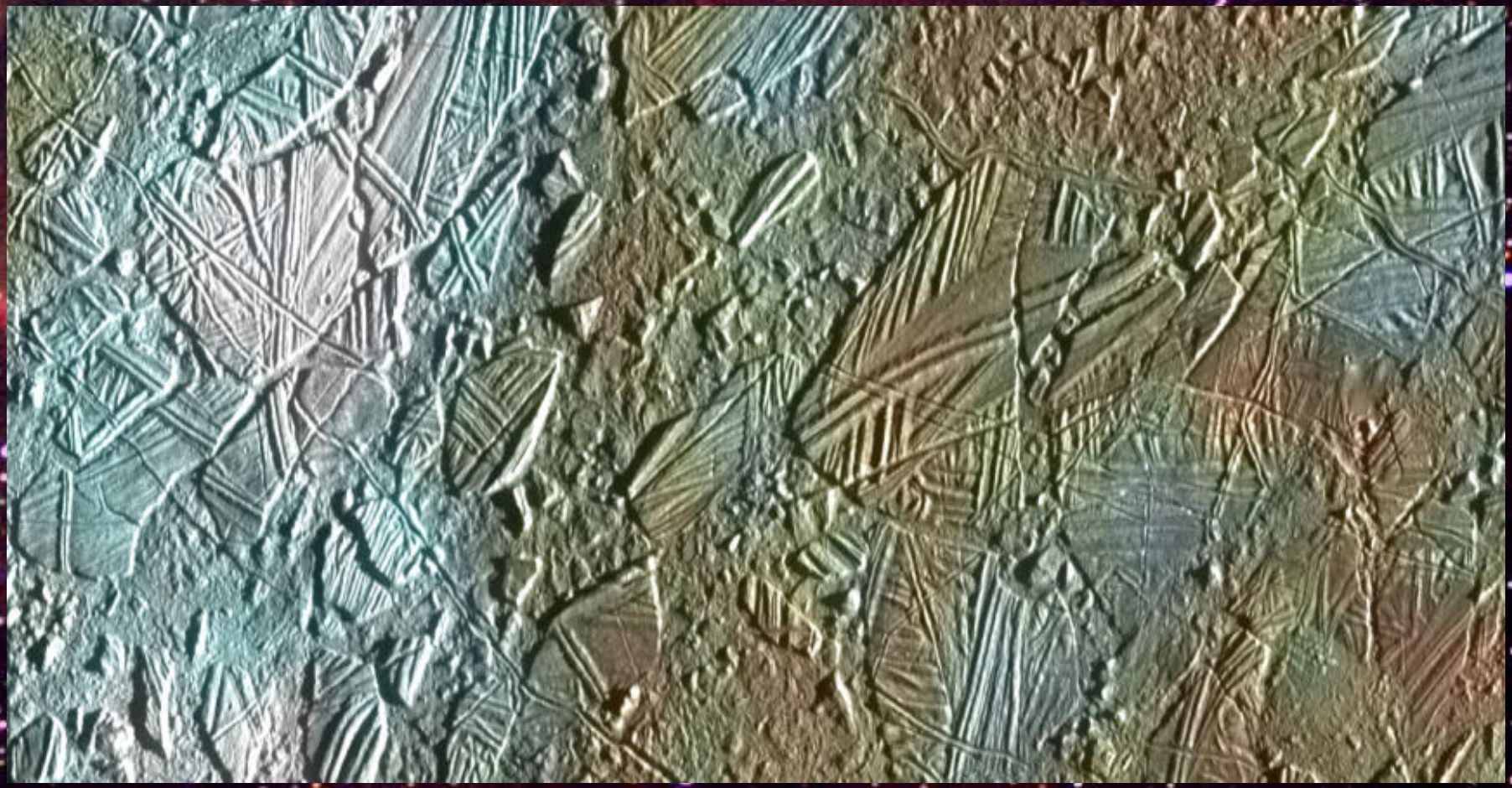
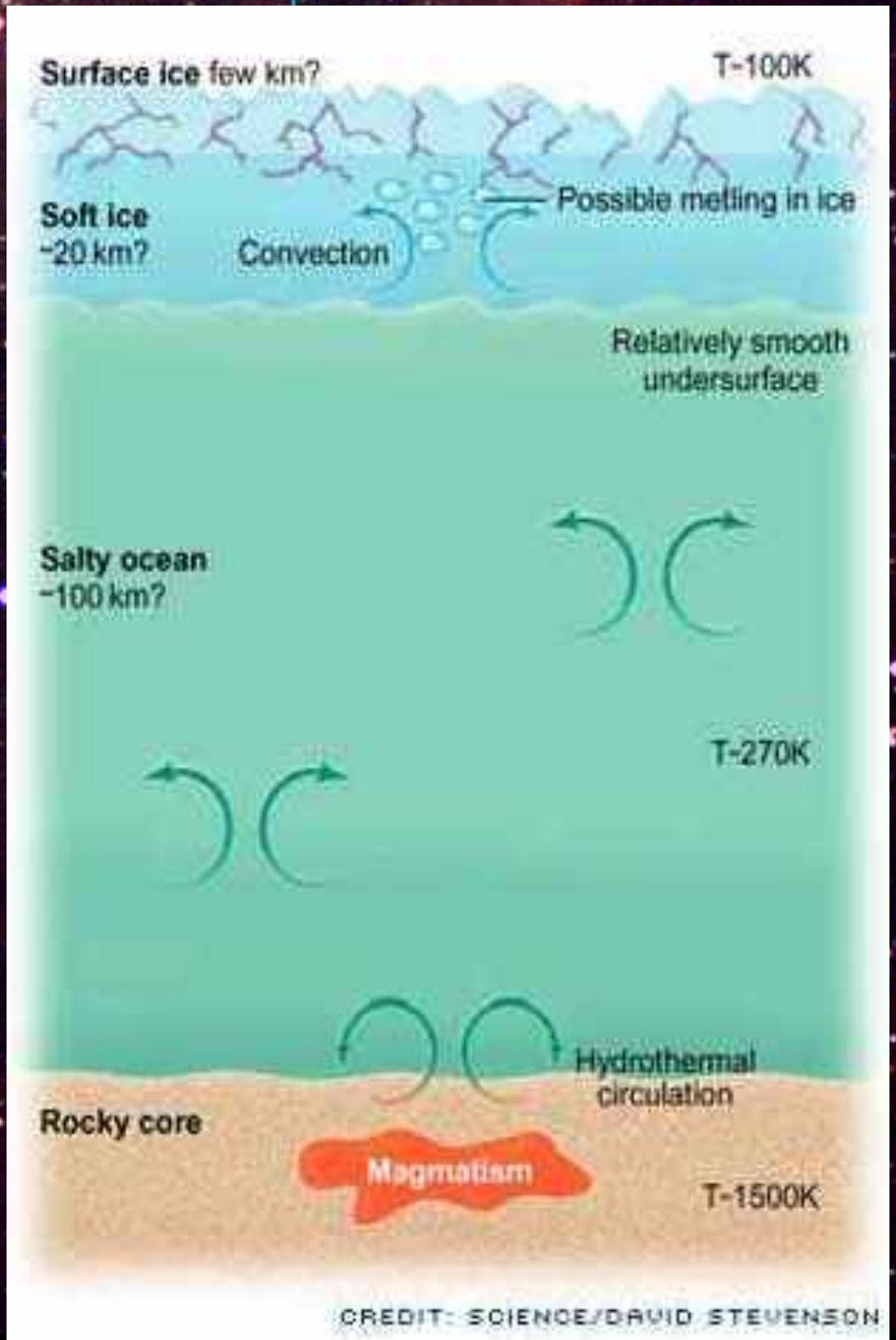
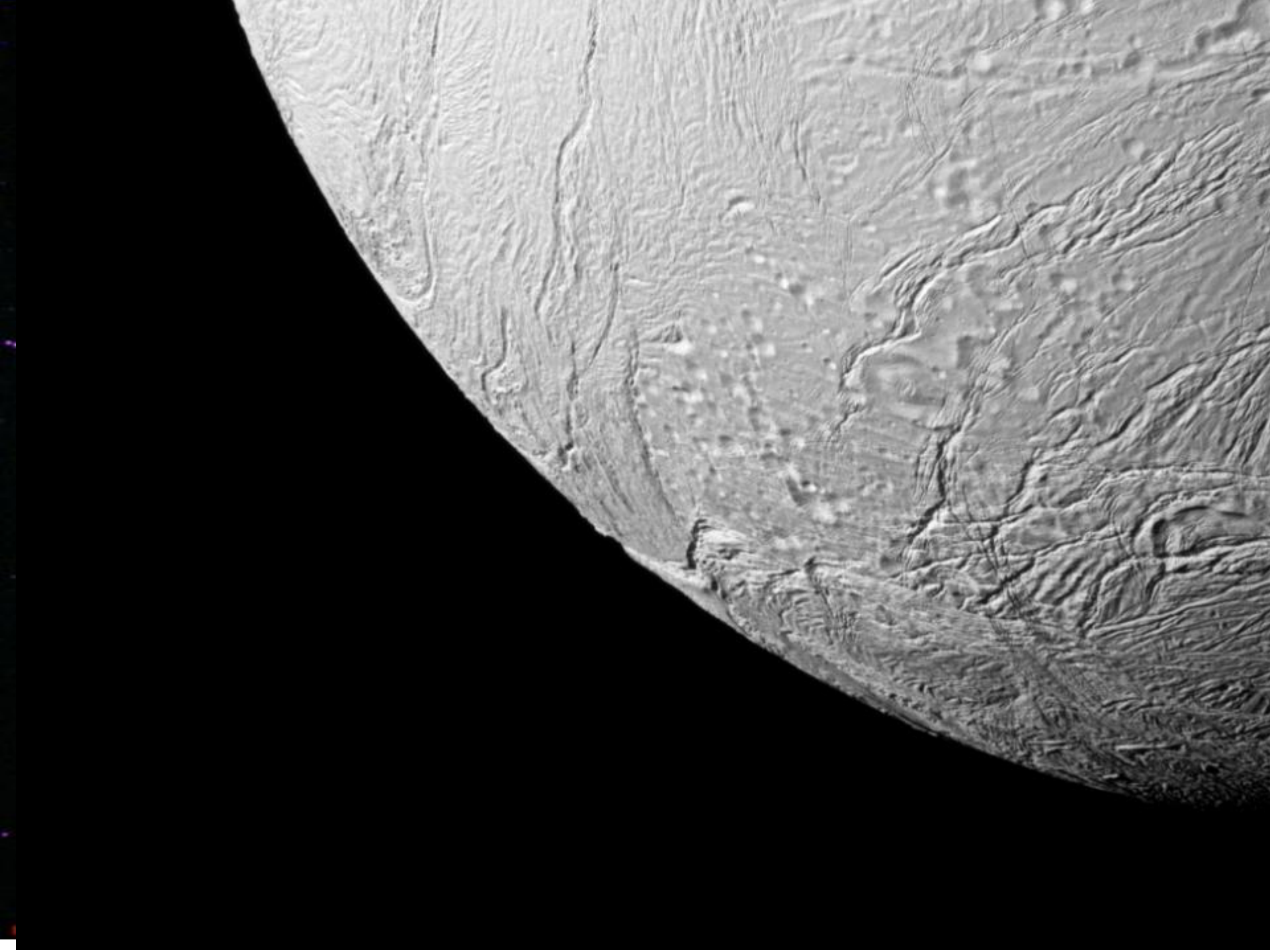


Details of the surface of Europa



Europa


Surface ice few km?
T-100K
Possible melting in ice
Soft ice
~20 km?
Convection
Relatively smooth
undersurface
Salty ocean
~100 km?
T-270K
Hydrothermal
circulation
Rocky core
Magmatism
T-1500K
CREDIT: SCIENCE/DAVID STEVENSON



There is a great interest in finding Earth like planets

- Bigger telescopes
- SETI
- Radio telescopes

Our Galaxy- the Milky Way

- 200,000 Million stars
- With the chance of finding an Earth like planet the same as winning the lottery about 1 in 14 million
- There will be about 14,000 Earths in our Galaxy! – not the large Earth-like planets found almost every week.

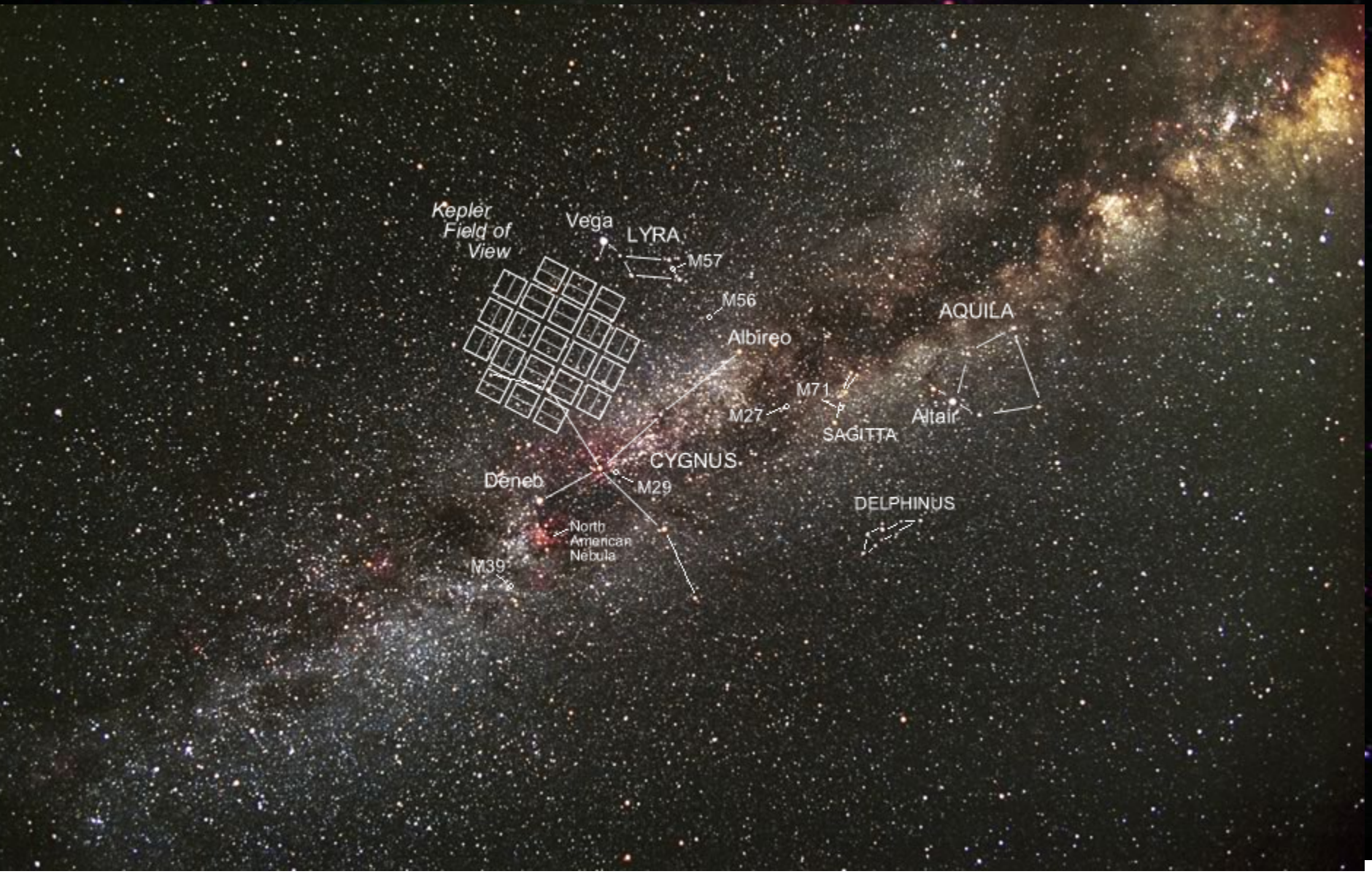
We live in exciting times

- When I went to school…
  - Only 9 planets - Pluto

- This week we have reached 4624 possible exo-planets going around 764 stars with 1022 confirmed almost all within 300 light years of our Sun. Our galaxy is 100,000 light years in diameter (0.3%)

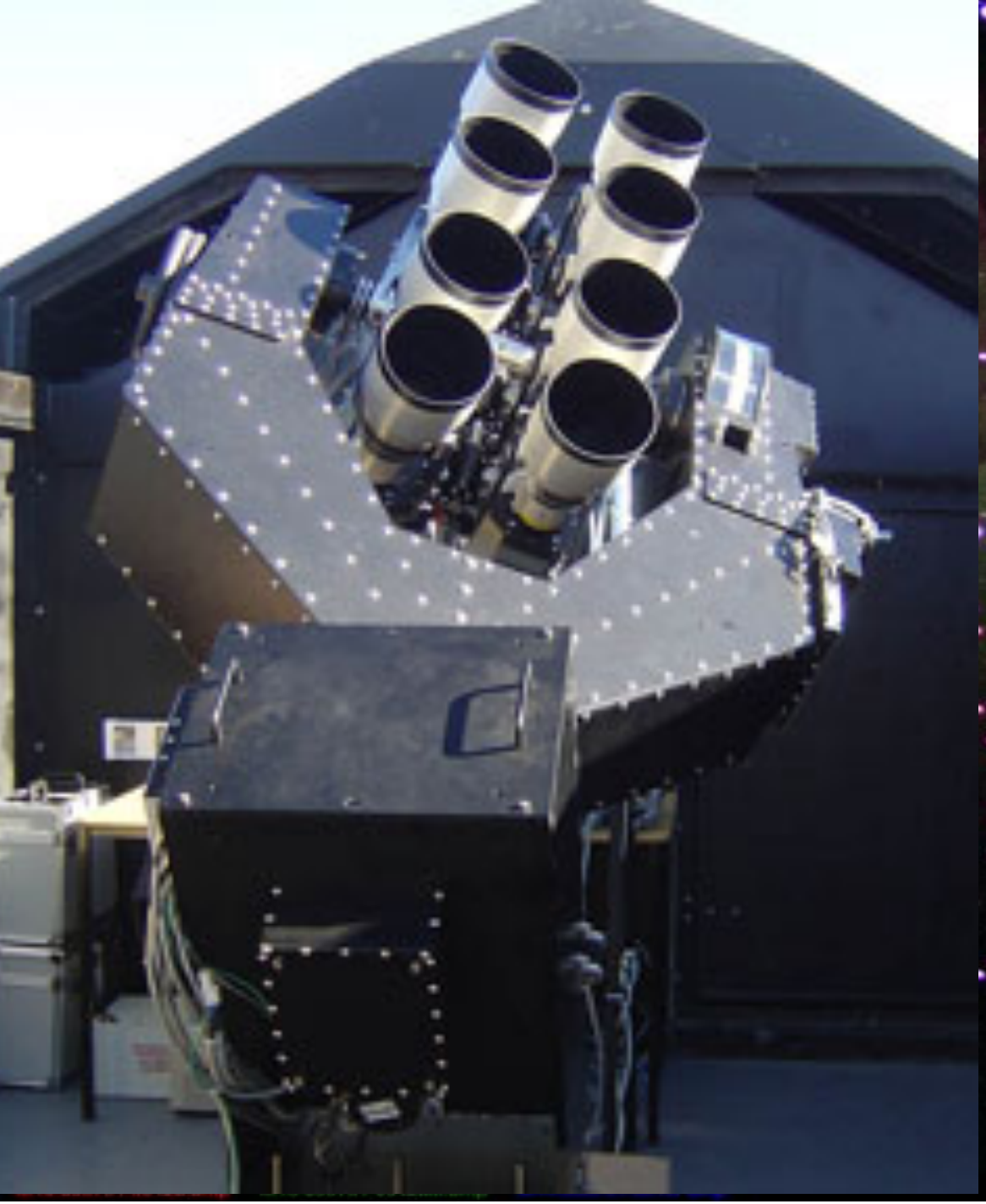
How does Kepler find planets?

Kepler stares at thousands of nearby Stars



In this small area of sky Kepler has found:-

- 2165 Double eclipsing stars
- 3538 Possible planets
- 242 Confirmed planets
- 5 Rocky planets



- The Super Wasp Planet finder in the Canary Islands
- 65 planets found.

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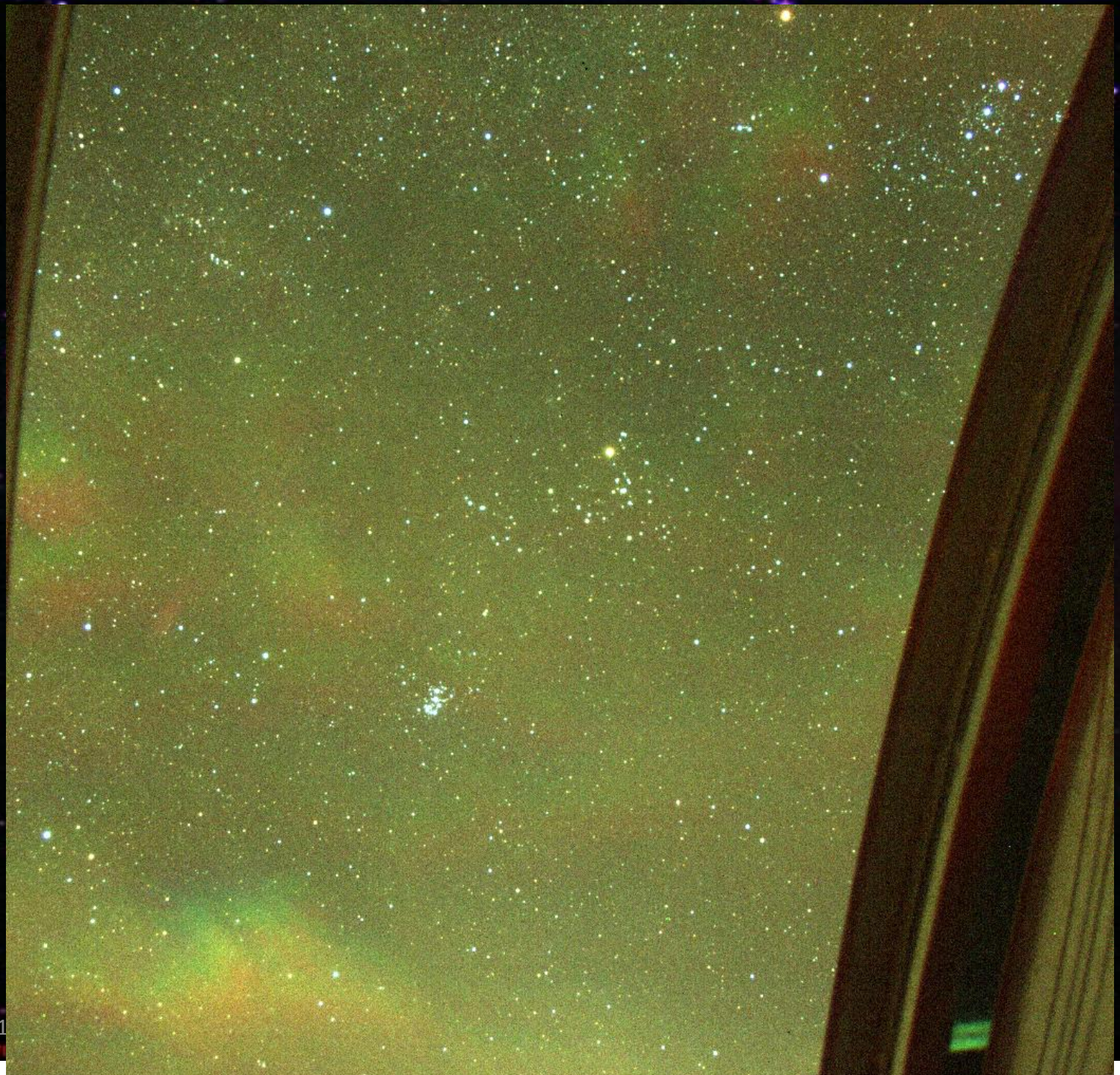
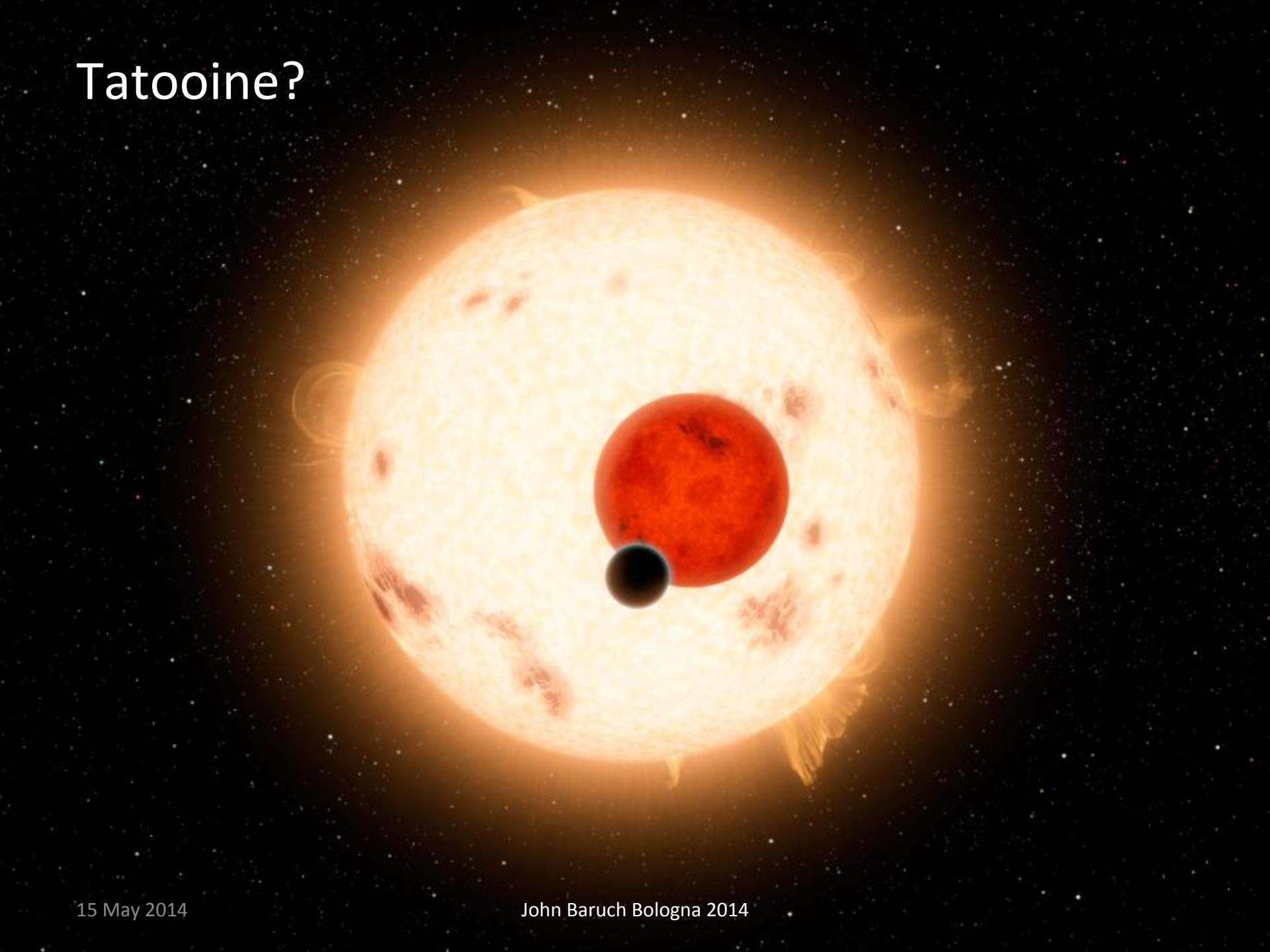
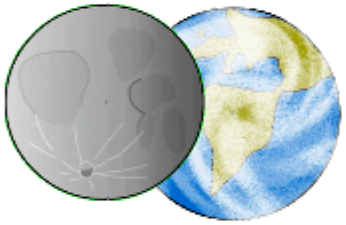


Tatooine?





Zoom Out

Zoom In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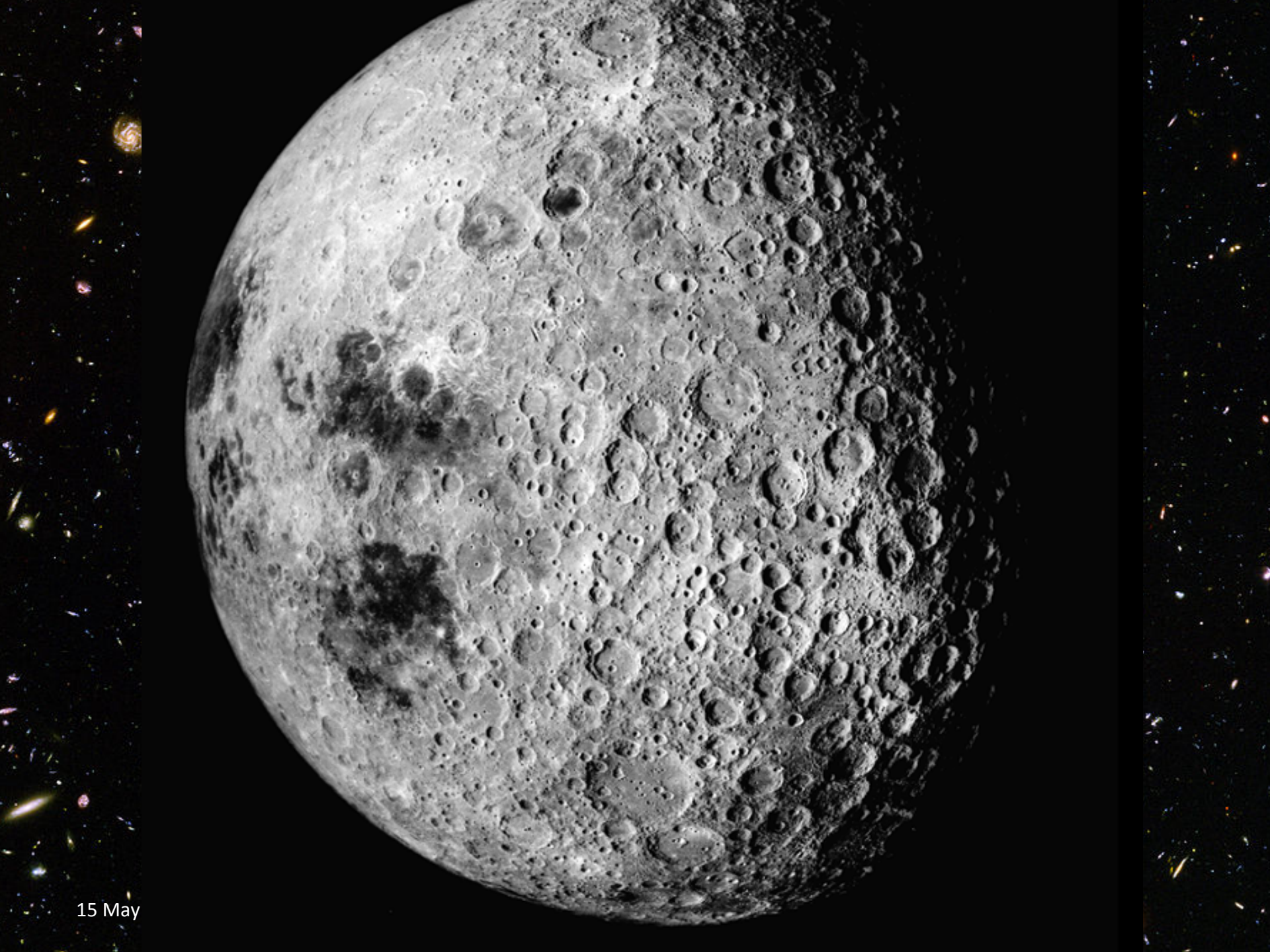

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