



HONORS TRACK RADIO ASTRONOMY

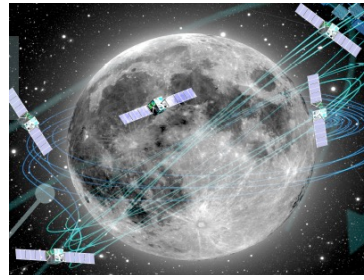
Mark Bentum
Eindhoven University of Technology/ASTRON
Jasmina Lazendic-Galloway
Eindhoven University of Technology

Content of today

- ▶ Who are we?
- ▶ Radio Astronomy
- ▶ Structure of the module
 - ▶ Seminars
 - ▶ What are you supposed to do ...
- ▶ Questions

Mark Bentum

- ▶ TU/e – Electrical Engineering :
Professor Radio Science & Dean
- ▶ ASTRON – was Head of the
Astronomy & Operations
department



TU/e

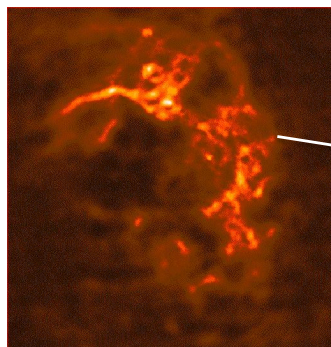
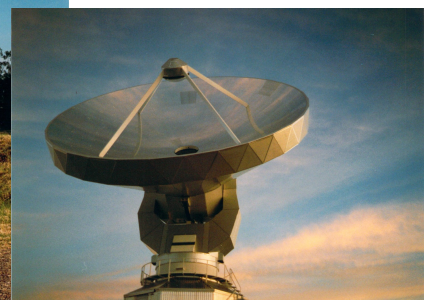
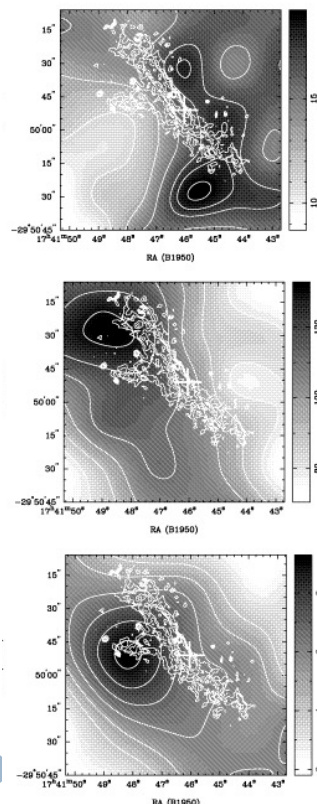
ASTRON
Netherlands Institute for Radio Astronomy

SKA
SQUARE KILOMETRE ARRAY



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Jasmina Lazendic-Galloway



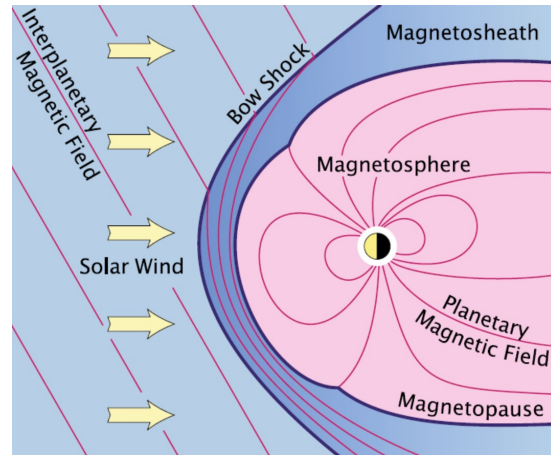
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Simon Petyniak (BSc Applied Maths)

- ▶ HA RA project: Star-planet interactions

Magnetospheres and Habitability

- Separates the regions dominated by IMF and planetary magnetic field
- Helps maintain atmosphere and liquid water on the surface (McIntyre et al, 2019)
- Protects the planet from radiation



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Goals

- ▶ Your personal development
- ▶ Learn about astronomy / cosmology / life origins
- ▶ Learn to study complex matter
- ▶ Learn to work & communicate in teams
- ▶ Work on a large challenge-based project
- ▶ You are in the driving seat and we are here to help:
 - ▶ Both applied and research-based projects are possible
 - ▶ Non-physics majors are also very welcome (we have computer science and architecture students! Everyone's expertise can be applied to astronomy or space projects!)

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Question you might have ...

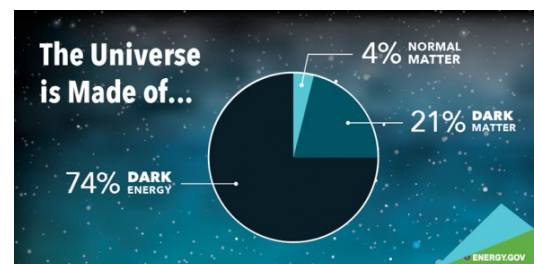
- ▶ 'How did our universe come into existence?'
- ▶ 'Is life possible in other places in our galaxy?'
- ▶ 'What is intelligent behavior?'
- ▶ 'What is a black hole?'
- ▶ 'What is the faith of our planet, our solar system, our galaxy, our universe ??'

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The 5 biggest questions about the Universe

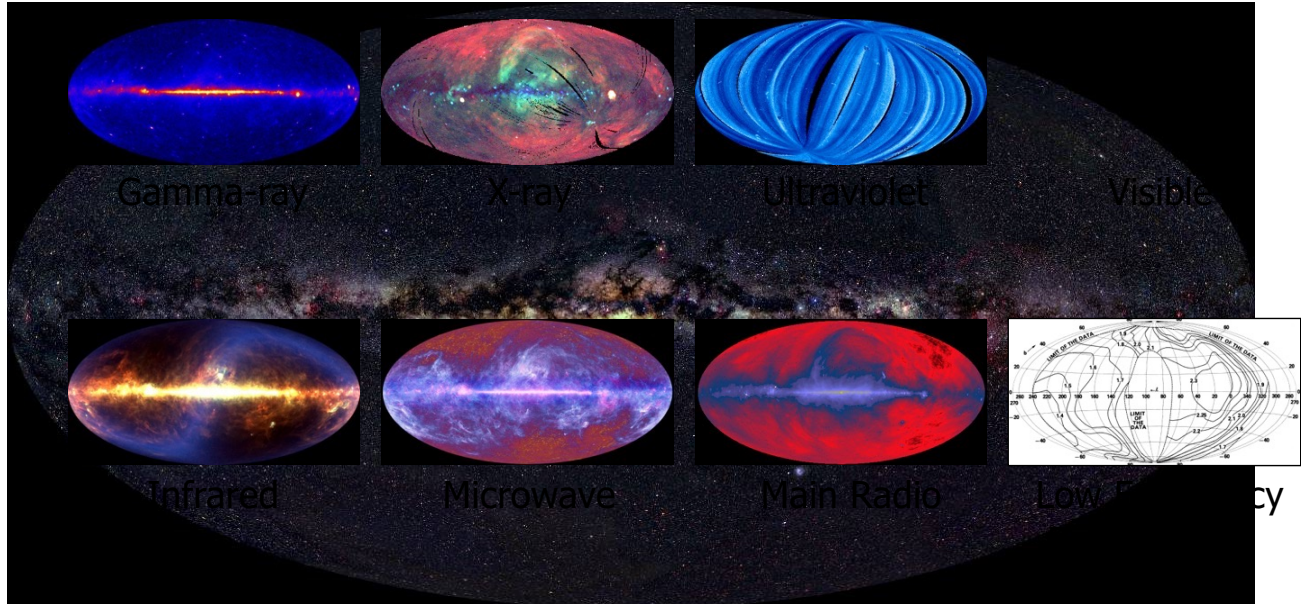
- ▶ What is dark matter?
- ▶ What is dark energy?
- ▶ What came before the big bang?
- ▶ What's inside a black hole?
- ▶ Are we alone?



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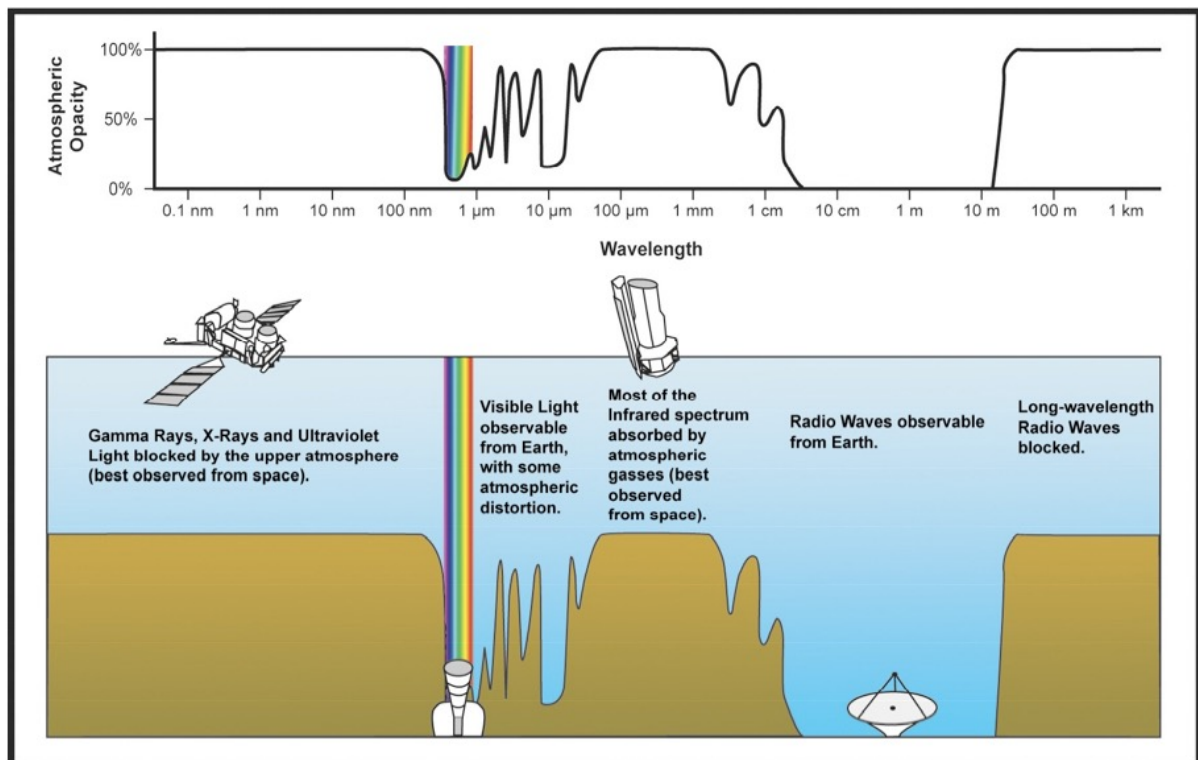
“Images” from space

- ▶ Celestial sky: has been mapped for nearly every type of electromagnetic radiation
- ▶ major exception: ultra-low frequency radiowaves (<30 MHz)



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How to capture the signals

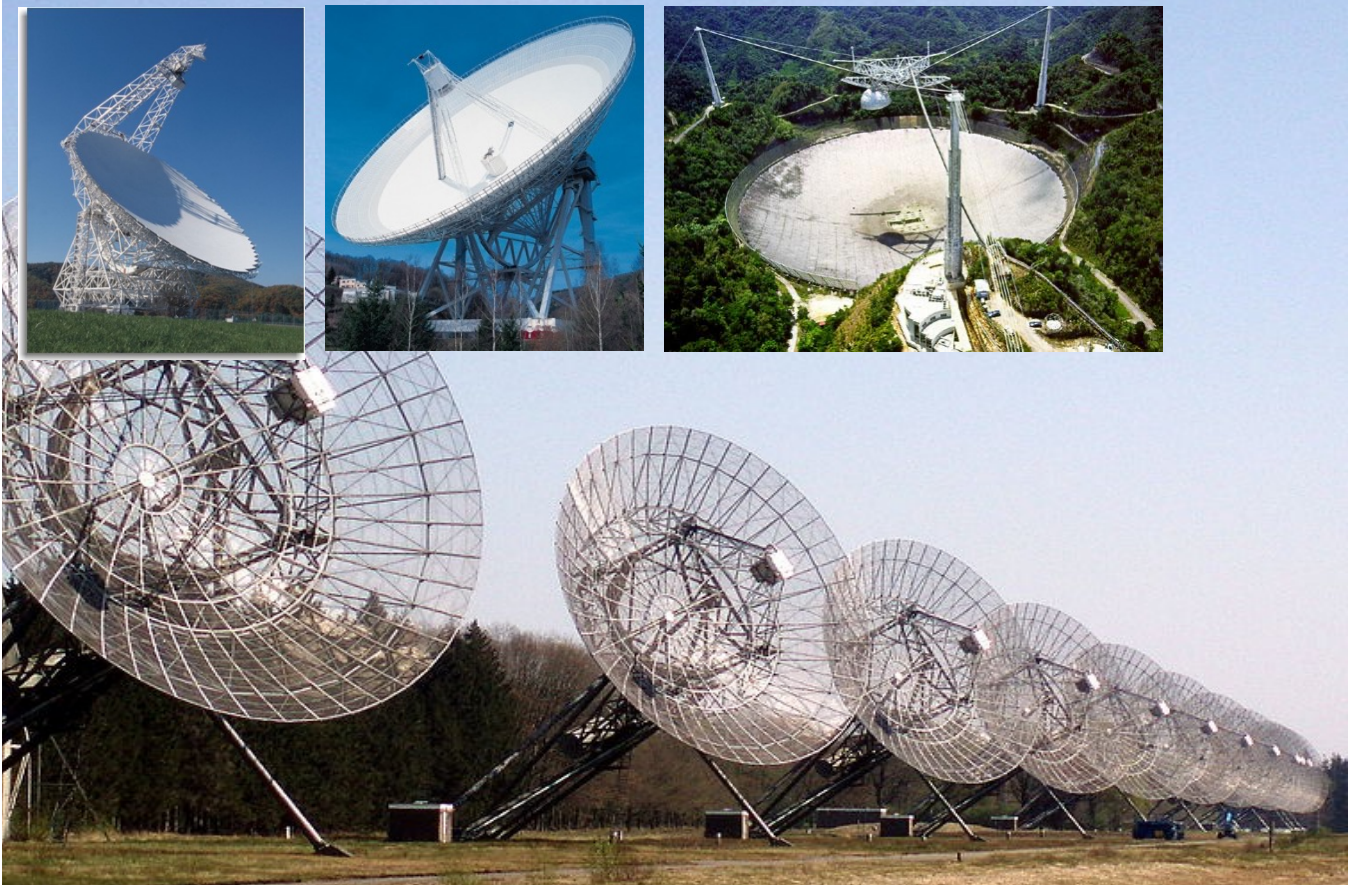


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Optical

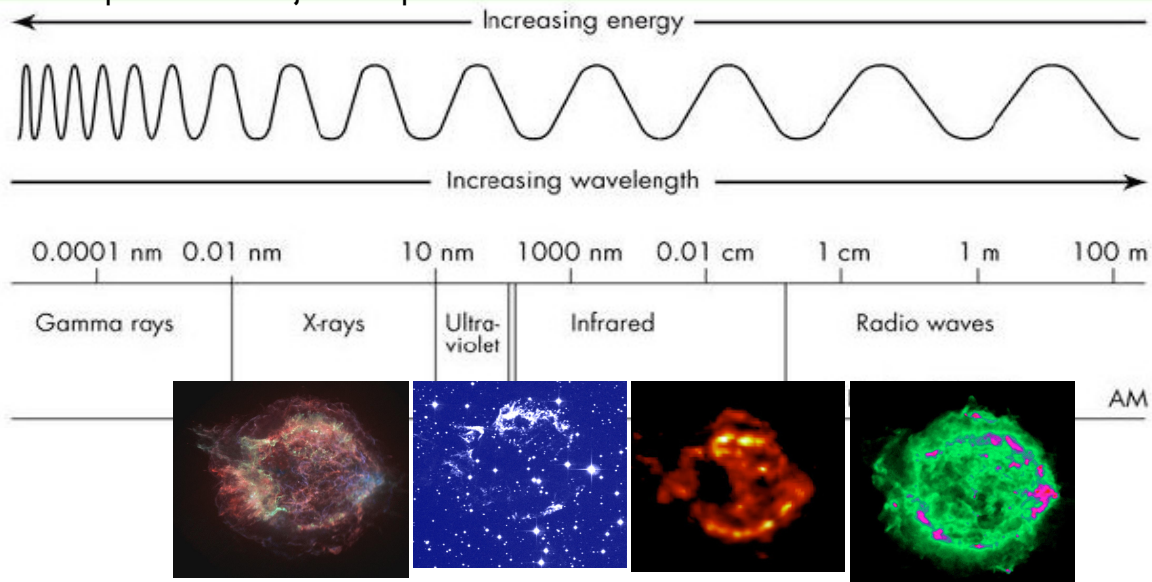


Radio



Example: Supernova Remnants across λ

- ▶ **Radio:** Accelerated particles: synchrotron radiation from e^- in magnetic field
- ▶ **Optical:** Continuum and emission lines from ejecta, progenitor wind, blast wave
- ▶ **Infrared:** Continuum and emission lines from cooling ejecta, shock-heated dust
- ▶ **X-ray:** Continuum and emission lines from shock wave, ejecta, accelerated particles, compact central object and pulsar wind nebulae



Interesting topics (not limited)

- ▶ Navigation using pulsars
- ▶ Making a radio telescope
- ▶ AI system for searching for features in radio astronomy data
- ▶ Auxiliary science with astronomical data (example: lightning)
- ▶ SETI
- ▶ Cosmic-ray acceleration
- ▶ Star-planet interactions
- ▶ ...

Structure of this module

(to be finalized ... also depending on you)

- A. Seminars to introduce you to the topics
- B. Reading books / studying articles etc..
- C. Working on a project (CBL)
 - A. Several groups ..
 - B. For two years (two one-year long projects are also possible)
- D. Of course: visit to ASTRON – Dwingeloo/Westerbork/ LOFAR/..

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Application

- ▶ Due 12 May
- ▶ If you have more questions:
- ▶ Mark: m.j.bentum@tue.nl
- ▶ Jasmina: j.lazendic.galloway@tue.nl
- ▶ HA RA student Simon: s.w.petyniak@student.tue.nl

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