

Planets and Exoplanets

Introduction

OUTLINE

- Course Content
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- Recommended Book and Lecture Copies
- Schedule and Requirements
- Exams and Grades
- Lecture Overview
- Presentation Topics

COURSE GOAL

Understand the wonders (and physics) of our own solar system planets and the recently discovered exoplanets around other stars.

PEOPLE

Christoph Keller, UU

Professor of Experimental Astrophysics

Daphne Stam, SRON

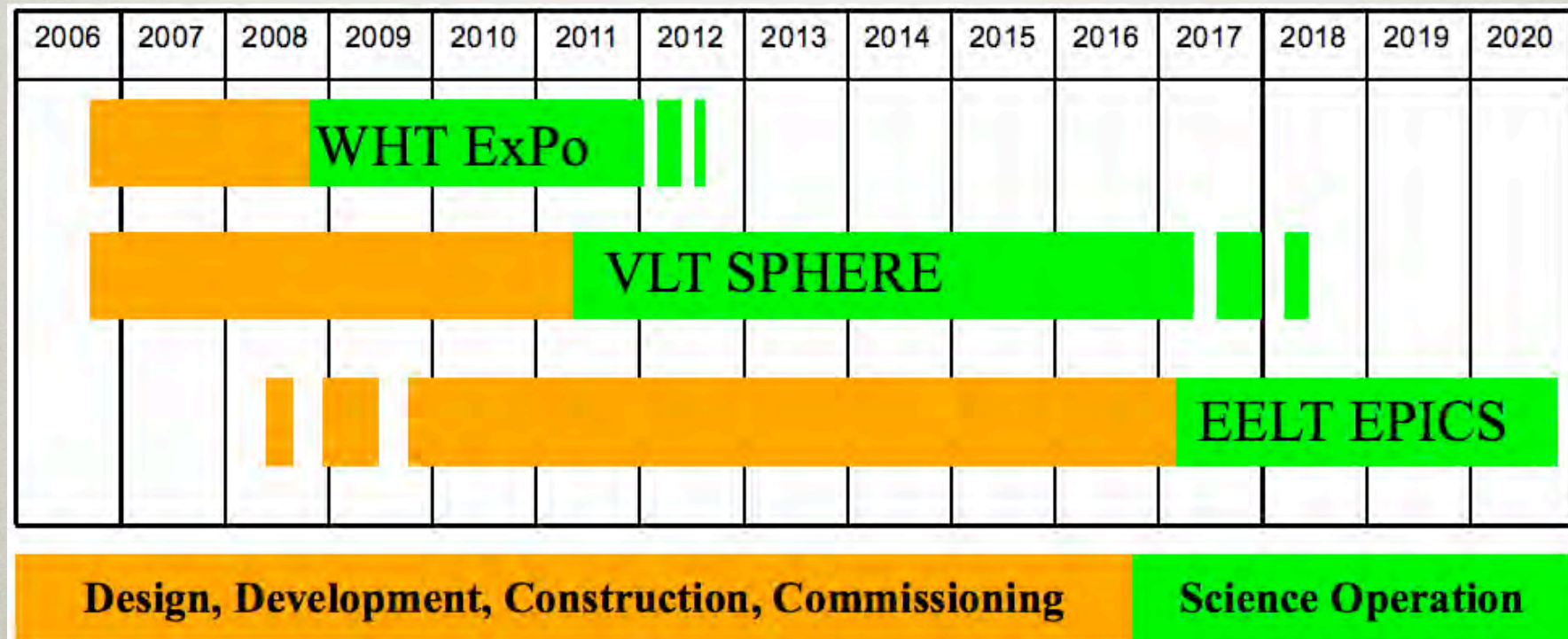
Senior Researcher of the Planetary Sciences Group

Theodora Karalidi, SRON

PhD student with Daphne Stam, Christoph Keller

(EXO-)PLANETARY RESEARCH AT UU

- Detection and characterization of exoplanets in polarized light
- Instruments for spectropolarimetry of solar-system planetary atmospheres



(EXO-)PLANETARY PEOPLE AT UU

Hector Canovas, PhD Student, ExPo, polarimetric data analysis

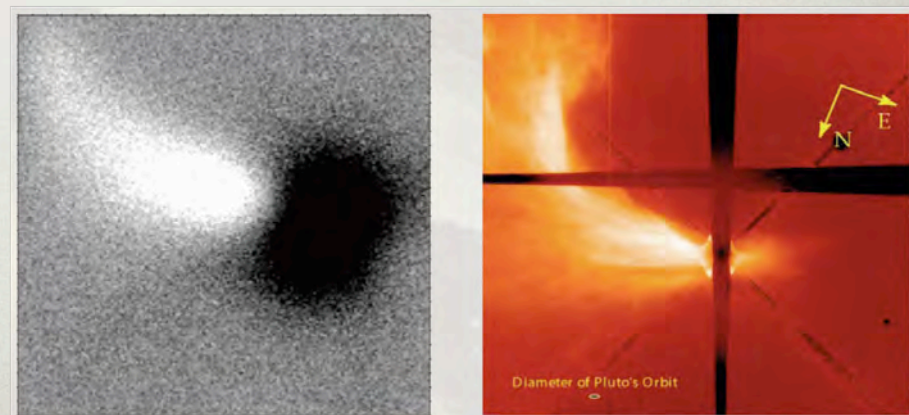
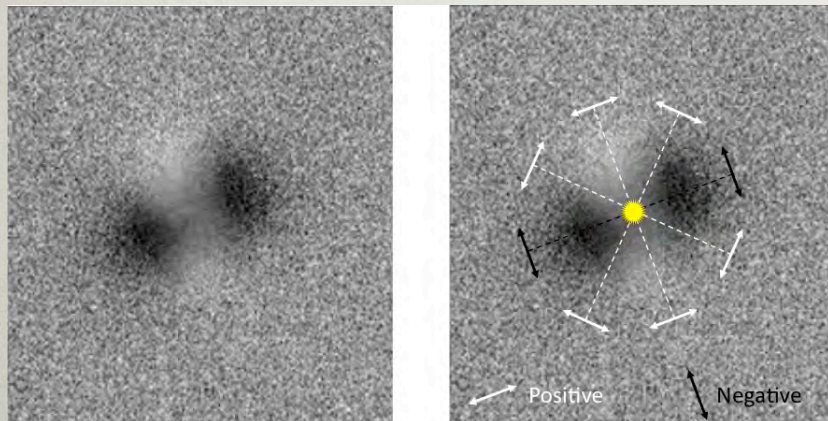
Sandra Jeffers, Postdoc, ExPo, polarimetric observations

Christoph Keller, Prof., ExPo, administration and bureaucracy

Michiel Min, Postdoc, Modeling of circumstellar disks

Michiel Rodenhuis, PhD Student, ExPo, polarimetry instrument

Frans Snik, PhD Student, EPICS, SPEX, polarimetry instruments



Planetary research at SRON

SRON divisions:

- High Energy Astrophysics X-ray/gamma-ray regime (XMM, Chandra, IXO, ...)
- Low Energy Astrophysics infrared/submm (ISO, HIFI, ALMA, SPICA, ...)
- Earth Oriented Science UV/vis/infrared (GOME, SCIAMACHY, OMI, TROPOMI, ...)*
- Sensor Research and Technology detector development
- Engineering Division mechanical/electronics design

Planetary research at SRON's EOS Division

Research:

- Atmospheres of Solar System planets and exoplanets
- Spectropolarimetry of Solar System planets and exoplanets

People:

- Dr. Daphne Stam - polarized radiative transfer, (exo)planetary atmospheres, remote-sensing of Solar System planets
- Theodora Karalidi (PhD student) - polarized radiative transfer of terrestrial exoplanets
- Dr. Martijn Smit - instrument (spectropolarimeter) development for Solar System missions
- Dr. Jeroen Rietjens - instrument (spectropolarimeter) development for Solar System missions

COMMUNICATION

- Blackboard
 - Students sign up themselves
 - Everybody else provide solis-ID and will be signed up on Blackboard only

- Email:

C.U.Keller@uu.nl

D.M.Stam@sron.nl

T.Karalidi@sron.nl

COURSE WEB PAGE

- www.astro.uu.nl/~keller/Teaching/Planets_2009
 - contact information
 - course schedule, subscribe to iCal link
 - lecture presentations, exercises, exercise materials
 - presentation topics and assignments
- course web page takes precedence over OSIRIS

BOOK



- Planetary Sciences
- By Imke de Pater and Jack J. Lissauer
- Published by Cambridge University Press
- Available at bookstores, www.amazon.co.uk, www.cambridge.org
- Lectures, exercises available online on course web page

COURSE SCHEDULE

Day	Time	Room	Type
Tuesday	13:15-15:00	BBL 768	Exercises
Tuesday	15:15-17:00	BBL 768	Presentations
Thursday	11:00-12:45	BBL 768	Lecture

COURSE REQUIREMENTS

- Exercises are integral part of course
- Home work and some exercises have to be submitted by deadline
- Submitted work will be checked and / or discussed
- Exercise solutions will not be made available in writing or online

EXAMS AND GRADES

- Relevant documents for open-book exam:
 - Lectures
 - Exercises and home work
 - Presentations
- Written exam after course, oral exams after that
- Grade composition
 - 20% presentations
 - 20% exercises and home work
 - 60% exam

LECTURES

Title	Chapter	Instructor
Solar System Structure and Orbital Mechanics	1,2	Keller
Exoplanet Detections	13	Keller
Planet Formation and Migration	12	Stam
Planetary Interiors and Surfaces	5, 6	Stam
Planetary Atmospheres	4	Stam
Radiative Transfer	3, 4	Stam
Observations of Solar System Planets		Keller
Observations of Exoplanets		Keller

SOLAR SYSTEM STRUCTURE AND ORBITAL MECHANICS

- Inventory of the solar system
- Solar system planet properties
- Two-body problem
- Three-body problem
- Tides
- Other forces

EXOPLANET DETECTIONS

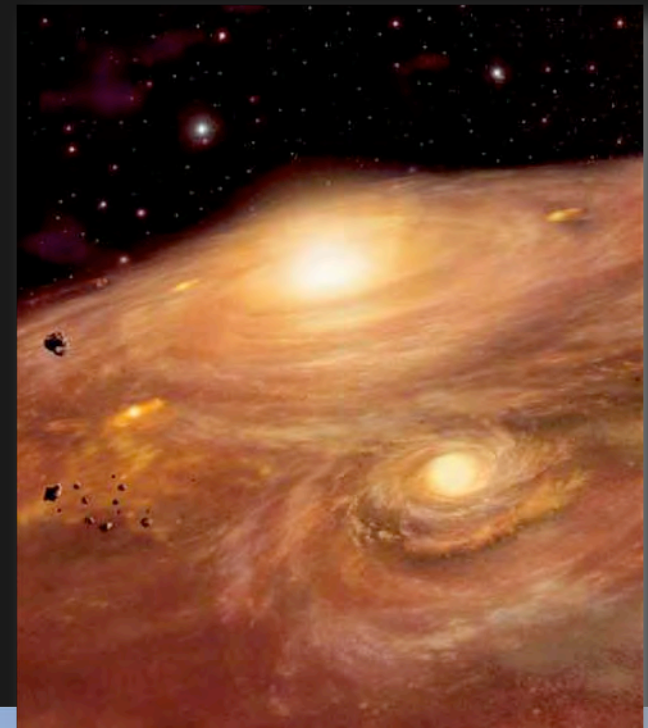
- Radial velocity
- Transits
- Microlensing
- Imaging

24 September 2009, 11:00-12:45 h, BBL 768

Planetary formation and migration

Planetary Sciences Chapter 12

- Observational constraints
- Star formation
- Early stages of planet formation
- Terrestrial planet formation
- Giant planet formation
- Planetary migration
- Asteroids and comets
- Moons and rings

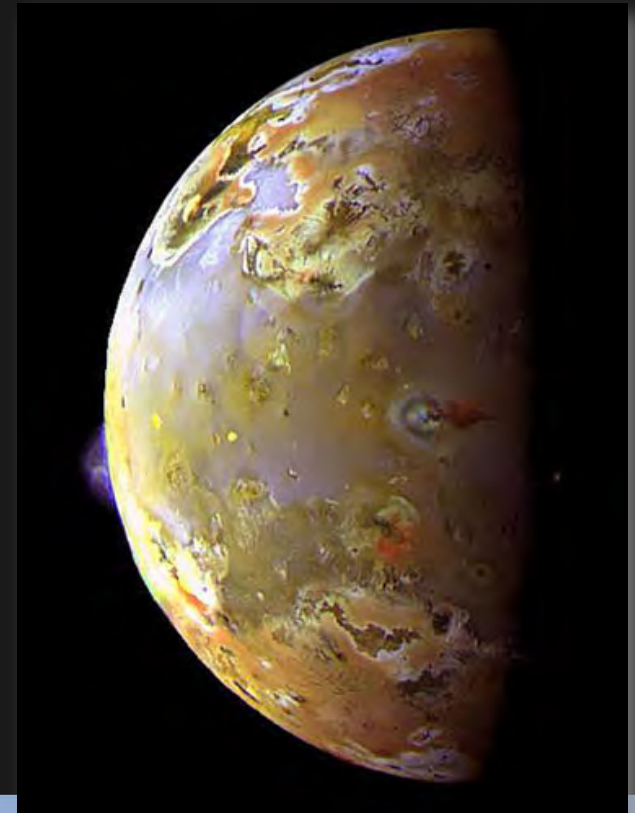


1 October 2009, 11:00-12:45 h, BBL 768

Planetary interiors and surfaces

Planetary Sciences Chapters 6 and 5

- Modelling the interior structure of a planet
- Interiors of terrestrial planets
- Interiors of giant planets
- Magnetic fields
- Surface morphology
- Impact cratering
- Surfaces of individual bodies

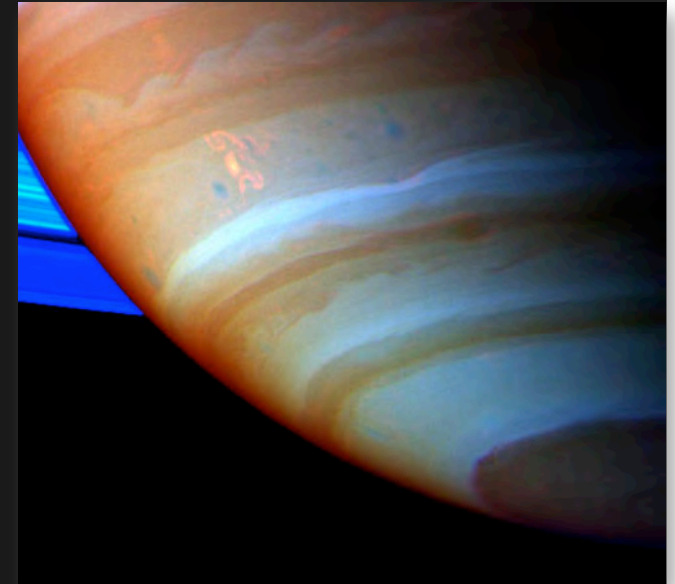


8 October 2009, 11:00-12:45 h, BBL 768

Planetary atmospheres

Planetary Sciences Chapter 4

- Origin of planetary atmospheres
- Pressure and temperature profiles
- Atmospheric composition
- Cloud formation
- Meteorology
- Photochemistry
- Evolution of atmospheres



15 October 2009, 11:00-12:45 h, BBL 768

Radiative transfer

Planetary Sciences Chapters 3 and (parts of) 4

- Description of radiation
- Thermal radiation
- Scattering and reflection
- Polarisation
- Planetary spectra



OBSERVATIONS OF SOLAR SYSTEM PLANETS

- Surfaces
- Atmospheres
- Interior
- Moons
- Rings
- Asteroids
- Comets
- Kuiper Belt

OBSERVATIONS OF EXOPLANETS

- Orbits; distances, periods, eccentricities
- Masses
- Temperatures
- Atmospheres

PRESENTATIONS

- select one space mission and present science results to classmates
- 15-minute presentation in English or Dutch
- questions
- public and private discussion of presentation
- grade is for level of science understanding

PRESENTATION TOPICS

- Messenger (Mercury), 22.9.2009
- Venera 13, 14 (Venus), 22.9.2009
- Magellan (Venus), 22.9.2009
- Venus Express (Venus), 22.9.2009
- Lunar Reconnaissance Orbiter (Moon), 29.9.2009
- Mars Express (Mars), 29.9.2009
- Spirit, Opportunity (Mars), 29.9.2009
- Phoenix (Mars), 29.9.2009
- Near Earth Asteroid Rendezvous (Mathilde, Eros), 6.10.2009
- Hayabusa (asteroid Itokawa), 6.10.2009
- Galileo (Jupiter), 6.10.2009
- Cassini (Saturn), 6.10.2009
- Huygens (Titan), 13.10.2009
- Voyager (Uranus), 13.10.2009
- Voyager (Neptune), 13.10.2009
- Pluto Express (Pluto), 13.10.2009
- Giotto (Comet Halley), 20.10.2009
- Deep Impact (Comet 9P / Tempel), 20.10.2009
- Corot (Exoplanets), 20.10.2009
- Kepler (Exoplanets), 20.10.2009