Université de Liège

# Study programmes 2014-2015
# Faculty of Sciences
# Master in Space Sciences

## First Year

### Compulsory courses

| | | Or | Th | Pr | Au | Cr |
|---|---|---|---|---|---|---|
| SPAT0039-1 | *Spectroscopy in Astrophysics and Geophysics* - Jerôme LOICQ | TA | 20 | 10 | - | **3** |
| PHYS0124-1 | *Instrumental Optics I* - Serge HABRAKEN | Q1 | 20 | 15 | - | **3** |
| SPAT0040-1 | *Fluid mechanics* - Pierre DAUBY | Q1 | 20 | 10 | - | **3** |
| SPAT0001-1 | *Plasma Physics* - Hervé LAMY, Anne THOUL | Q2 | 25 | 5 | - | **3** |
| SPAT0002-1 | *Numerical methods and programming basics* - Guy MUNHOVEN | Q1 | 10 | 20 | - | **3** |

### Optional courses

Choose, in agreement with the Jury, several courses totalling 12 credits, from the two options offered below or from other Masters programmes, in particular the Masters in Civil Engineering and Aerospace :

**Astrophysics**

| | | | | | | |
|---|---|---|---|---|---|---|
| SPAT0064-1 | *Solar physics, activity phenomena and solar-earth relations* - Frédéric CLETTE | | 20 | 10 | - | **3** |
| SPAT0056-1 | *Planetary and exoplanetary atmospheres* - JeanClaude GÉRARD, Denis GRODENT | Q1 | 30 | 15 | - | **5** |
| SPAT0043-1 | *Small bodies in the solar system* - Emmanuel JEHIN | | 15 | 5 | - | **2** |
| SPAT0044-1 | *Stellar Structure and evolution I* - MarcAntoine DUPRET | Q1 | 20 | 20 | - | **3** |
| SPAT0045-1 | *Stellar structure and evolution II* - MarcAntoine DUPRET | Q2 | 20 | 20 | - | **3** |
| SPAT0005-1 | *Stellar stability and asteroseismology* - MarcAntoine DUPRET | Q2 | 30 | 10 | - | **4** |
| SPAT0007-2 | *Variable stars* - Grégor RAUW | Q1 | 20 | 10 | - | **3** |
| SPAT0006-1 | *Stellar atmospheres* - Grégor RAUW | Q2 | 20 | 10 | - | **3** |
| SPAT0008-1 | *Interstellar Medium* - Damien HUTSEMEKERS, Yaël NAZÉ | Q1 | 20 | 10 | - | **3** |
| GEOL0263-1 | *Astrobiology* - Philippe CLAEYS, Véronique DEHANT, Moreno GALLENI, Emmanuelle JAVAUX, Yaël NAZÉ, Annick WILMOTTE (Even years) | Q2 | 30 | 15 | - | **4** |
| SPAT0009-1 | *High-energy astrophysics* - Grégor RAUW | Q1 | 25 | 5 | - | **4** |
| SPAT0010-1 | *Theoretical physical cosmology* - Christian BARBIER, Michel TYTGAT | Q2 | 40 | - | - | **4** |
| SPAT0011-1 | *Extragalactic astrophysics* - Pierre MAGAIN | | 20 | 10 | - | **3** |
| SPAT0012-1 | *General relativity* - Yves DE ROP | TA | 60 | - | - | **6** |
| SPAT0014-1 | *Introduction to time series analysis* - Eric GOSSET | Q2 | 20 | 5 | - | **3** |
| PHYS0125-3 | *Instrumental Optics II* - Serge HABRAKEN | Q2 | 25 | 30 | - | **5** |
| SPAT0015-1 | *Signal acquisition and processing : application to embedded systems* - Christian SERVAIS | Q2 | 10 | 30 | - | **4** |
| SSTG0043-1 | *Placement* - N... - Suppl : Christian BARBIER, Yaël NAZÉ, Grégor RAUW, JeanPierre SWINGS | TA | - | 140 | - | **10** |
| AERO0018-3 | *Space Experiment Development* - Pierre ROCHUS | | 30 | 30 | - | **5** |
| SPAT0017-1 | *Current questions and seminars* - Alberto BORGES, JeanRené CUDELL, Benoît HUBERT, Damien HUTSEMEKERS | TA | - | 30 | - | **3** |
| SPAT0018-1 | *Evolution of ideas in Astronomy* - Yaël NAZÉ | Q1 | 15 | - | - | **2** |
| SPAT0019-1 | *Special Relativity* - Jean SURDEJ | Q1 | 15 | - | - | **2** |
| SPAT0020-2 | *Introduction to astrochemistry* - Michaël DE BECKER | Q2 | 30 | 10 | - | **4** |
| SPAT0021-1 | *Introduction to astroparticles* - Joseph CUGNON | Q1 | 20 | 10 | - | **3** |
| SPAT0060-1 | *Astroparticles, Part 1 : Astroparticles and standard model* - JeanRené CUDELL | Q2 | 20 | 10 | - | **4** |
| SPAT0060-2 | *Astroparticles, Part 2 : Astroparticles and gravitational effects* - JeanRené CUDELL | Q2 | 10 | 5 | - | **2** |
| SPAT0061-1 | *Theory group and astroparticle* (english language) - Diego ARISTIZABAL SIERRA | Q2 | 30 | - | - | **3** |
| SPAT0062-1 | *Quantum field theory, Part 1 : Quantum electrodynamics* - JeanRené CUDELL | Q2 | 20 | 10 | - | **4** |
| SPAT0062-2 | *Quantum field theory, Part 2 : Elements of renormalization* - JeanRené CUDELL | TA | 10 | 5 | - | **2** |
| PHYS2012-1 | *Relativistic quantum mechanics and relativistic statistics* - Peter SCHLAGHECK | Q1 | 20 | 5 | - | **3** |
| SPAT0063-1 | *Introduction to exoplanetary* - Michaël GILLON | Q2 | 15 | 5 | - | **2** |

**Earth and Planetary Sciences**

| | | | | | | |
|---|---|---|---|---|---|---|
| SPAT0023-1 | *Terrestrial magnetosphere and polar lights* - Benoît HUBERT | | 30 | 10 | - | **4** |
| SPAT0024-2 | *Meteorology* - Louis FRANÇOIS | Q1 | 40 | 20 | - | **6** |
| OCEA0072-1 | *Geophysical fluid dynamics - Part 2* - JeanMarie BECKERS | Q1 | 30 | 15 | - | **5** |

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|---|---|---|---|---|---|---|
| OCEA0059-2 | *Remote Sensing of the Oceans, Introduction to satellite oceanography* (english language) - Yves CORNET | Q1 | 15 | 15 | - | **3** |
| OCEA0045-1 | *Statistical methods of analysis of oceanographic data* - Aïda ALVERA AZCARATE | Q1 | 20 | 10 | - | **3** |
| GEOG0037-1 | *GNSS : Theory and applications* - René WARNANT | Q2 | 35 | 15 | - | **5** |
| GEOG0038-1 | *Space geodesy* - René WARNANT - [1d FW] | Q2 | 20 | - | [+] | **3** |
| SPAT0025-1 | *Environmental modelling* - Louis FRANÇOIS, Guy MUNHOVEN | Q2 | 20 | 10 | - | **4** |
| SPAT0026-1 | *Paleoenvironment and evolution of the Earth system* - Louis FRANÇOIS | Q2 | 30 | 10 | - | **4** |
| SPAT0027-3 | *Climate change and impacts* - Louis FRANÇOIS, Guy MUNHOVEN | TA | 15 | 45 | - | **5** |
| SPAT0028-2 | *Planetary magnetospheres and aurorae* - Denis GRODENT | Q2 | 20 | 10 | - | **3** |
| OCEA0081-1 | *Numerical Methods in Geophysics - Part 2* - JeanMarie BECKERS | Q2 | 15 | 30 | - | **5** |
| SPAT0064-1 | *Solar physics, activity phenomena and solar-earth relations* - Frédéric CLETTE | | 20 | 10 | - | **3** |
| SPAT0056-1 | *Planetary and exoplanetary atmospheres* - JeanClaude GÉRARD, Denis GRODENT | Q1 | 30 | 15 | - | **5** |
| SPAT0043-1 | *Small bodies in the solar system* - Emmanuel JEHIN | | 15 | 5 | - | **2** |
| GEOL0263-1 | *Astrobiology* - Philippe CLAEYS, Véronique DEHANT, Moreno GALLENI, Emmanuelle JAVAUX, Yaël NAZÉ, Annick WILMOTTE (Even years) | Q2 | 30 | 15 | - | **4** |
| SPAT0014-1 | *Introduction to time series analysis* - Eric GOSSET | Q2 | 20 | 5 | - | **3** |
| PHYS0125-3 | *Instrumental Optics II* - Serge HABRAKEN | Q2 | 25 | 30 | - | **5** |
| SPAT0015-1 | *Signal acquisition and processing : application to embedded systems* - Christian SERVAIS | Q2 | 10 | 30 | - | **4** |
| SSTG0043-1 | *Placement* - N... - Suppl : Christian BARBIER, Yaël NAZÉ, Grégor RAUW, JeanPierre SWINGS | TA | - | 140 | - | **10** |
| AERO0018-3 | *Space Experiment Development* - Pierre ROCHUS | | 30 | 30 | - | **5** |
| SPAT0029-1 | *Space environment* - Denis GRODENT | Q2 | 15 | 15 | - | **3** |
| SPAT0032-2 | *Remote sensing* - Christian BARBIER | Q1 | 30 | 30 | - | **5** |
| SPAT0063-1 | *Introduction to exoplanetary* - Michaël GILLON | Q2 | 15 | 5 | - | **2** |

**Research Focus**

**Compulsory courses**

| | | | | | | |
|---|---|---|---|---|---|---|
| SPAT0033-1 | *Astrophysics* - Pierre MAGAIN | | 30 | 15 | - | **4,5** |
| SPAT0055-1 | *Atmosphere of Earth* - Denis GRODENT | Q2 | 30 | 15 | - | **4,5** |
| OCEA0071-1 | *Geophysical fluid dynamics - Part 1* - JeanMarie BECKERS | Q2 | 30 | 15 | - | **4,5** |
| SPAT0035-1 | *Space operations* (english language) - Grégor RAUW | Q1 | 30 | 10 | - | **4** |
| SPAT0036-1 | *Celestial mechanics and space trajectories* - Grégor RAUW | Q1 | 20 | 10 | - | **3** |
| PHYS0931-1 | *Data processing* - Pierre MAGAIN | | 15 | 30 | - | **3** |
| SPAT0057-1 | *Observing the Sky* - Jean SURDEJ - [5d FW] | Q1 | 20 | 10 | [+] | **5** |
| SPAT0058-1 | *Observing Earth from space* - N... - Suppl : Christian BARBIER | Q1 | 15 | - | - | **1,5** |

## Second year

**Compulsory course**

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|---|---|---|---|---|---|---|
| SMEM0029-1 | *Final thesis* - COLLÉGIALITÉ | TA | - | - | - | **27** |

**Optional courses**

[...] Choose, in agreement with the Jury, several courses totalling 9 credits, from the two options offered below or from other Masters programmes, in particular the Masters in Civil Engineering and Aerospace :

***Choose one option from the following :***

**Option Astrophysics**

Choose courses, with the approval of the Jury, totalling 24 credits amongst :

| | | | | | | |
|---|---|---|---|---|---|---|
| SPAT0064-1 | *Solar physics, activity phenomena and solar-earth relations* - Frédéric CLETTE | | 20 | 10 | - | **3** |
| SPAT0056-1 | *Planetary and exoplanetary atmospheres* - JeanClaude GÉRARD, Denis GRODENT | Q1 | 30 | 15 | - | **5** |

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|---|---|---|---|---|---|---|
| SPAT0043-1 | *Small bodies in the solar system* - Emmanuel JEHIN | | 15 | 5 | - | **2** |
| SPAT0044-1 | *Stellar Structure and evolution I* - MarcAntoine DUPRET | Q1 | 20 | 20 | - | **3** |
| SPAT0045-1 | *Stellar structure and evolution II* - MarcAntoine DUPRET | Q2 | 20 | 20 | - | **3** |
| SPAT0005-1 | *Stellar stability and asteroseismology* - MarcAntoine DUPRET | Q2 | 30 | 10 | - | **4** |
| SPAT0007-2 | *Variable stars* - Grégor RAUW | Q1 | 20 | 10 | - | **3** |
| SPAT0006-1 | *Stellar atmospheres* - Grégor RAUW | Q2 | 20 | 10 | - | **3** |
| SPAT0008-1 | *Interstellar Medium* - Damien HUTSEMEKERS, Yaël NAZÉ | Q1 | 20 | 10 | - | **3** |
| GEOL0263-1 | *Astrobiology* - Philippe CLAEYS, Véronique DEHANT, Moreno GALLENI, Emmanuelle JAVAUX, Yaël NAZÉ, Annick WILMOTTE (Even years) | Q2 | 30 | 15 | - | **4** |
| SPAT0009-1 | *High-energy astrophysics* - Grégor RAUW | Q1 | 25 | 5 | - | **4** |
| SPAT0010-1 | *Theoretical physical cosmology* - Christian BARBIER, Michel TYTGAT | Q2 | 40 | - | - | **4** |
| SPAT0011-1 | *Extragalactic astrophysics* - Pierre MAGAIN | | 20 | 10 | - | **3** |
| SPAT0012-1 | *General relativity* - Yves DE ROP | TA | 60 | - | - | **6** |
| SPAT0014-1 | *Introduction to time series analysis* - Eric GOSSET | Q2 | 20 | 5 | - | **3** |
| PHYS0125-3 | *Instrumental Optics II* - Serge HABRAKEN | Q2 | 25 | 30 | - | **5** |
| SPAT0015-1 | *Signal acquisition and processing : application to embedded systems* - Christian SERVAIS | Q2 | 10 | 30 | - | **4** |
| SSTG0043-1 | *Placement* - N... - Suppl : Christian BARBIER, Yaël NAZÉ, Grégor RAUW, JeanPierre SWINGS | TA | - | 140 | - | **10** |
| AERO0018-3 | *Space Experiment Development* - Pierre ROCHUS | | 30 | 30 | - | **5** |
| SPAT0017-1 | *Current questions and seminars* - Alberto BORGES, JeanRené CUDELL, Benoît HUBERT, Damien HUTSEMEKERS | TA | - | 30 | - | **3** |
| SPAT0018-1 | *Evolution of ideas in Astronomy* - Yaël NAZÉ | Q1 | 15 | - | - | **2** |
| SPAT0019-1 | *Special Relativity* - Jean SURDEJ | Q1 | 15 | - | - | **2** |
| SPAT0020-2 | *Introduction to astrochemistry* - Michaël DE BECKER | Q2 | 30 | 10 | - | **4** |
| SPAT0021-1 | *Introduction to astroparticles* - Joseph CUGNON | Q1 | 20 | 10 | - | **3** |
| SPAT0060-1 | *Astroparticles, Part 1 : Astroparticles and standard model* - JeanRené CUDELL | Q2 | 20 | 10 | - | **4** |
| SPAT0060-2 | *Astroparticles, Part 2 : Astroparticles and gravitational effects* - JeanRené CUDELL | Q2 | 10 | 5 | - | **2** |
| SPAT0061-1 | *Theory group and astroparticle* (english language) - Diego ARISTIZABAL SIERRA | Q2 | 30 | - | - | **3** |
| SPAT0062-1 | *Quantum field theory, Part 1 : Quantum electrodynamics* - JeanRené CUDELL | Q2 | 20 | 10 | - | **4** |
| SPAT0062-2 | *Quantum field theory, Part 2 : Elements of renormalization* - JeanRené CUDELL | TA | 10 | 5 | - | **2** |
| PHYS2012-1 | *Relativistic quantum mechanics and relativistic statistics* - Peter SCHLAGHECK | Q1 | 20 | 5 | - | **3** |
| SPAT0063-1 | *Introduction to exoplanetary* - Michaël GILLON | Q2 | 15 | 5 | - | **2** |

**Option Earth and Planetary Sciences**

Choose courses, with the approval of the Jury, totalling 24 credits amongst :

| | | | | | | |
|---|---|---|---|---|---|---|
| SPAT0023-1 | *Terrestrial magnetosphere and polar lights* - Benoît HUBERT | | 30 | 10 | - | **4** |
| SPAT0024-2 | *Meteorology* - Louis FRANÇOIS | Q1 | 40 | 20 | - | **6** |
| OCEA0072-1 | *Geophysical fluid dynamics - Part 2* - JeanMarie BECKERS | Q1 | 30 | 15 | - | **5** |
| OCEA0059-2 | *Remote Sensing of the Oceans, Introduction to satellite oceanography* (english language) - Yves CORNET | Q1 | 15 | 15 | - | **3** |
| OCEA0045-1 | *Statistical methods of analysis of oceanographic data* - Aïda ALVERA AZCARATE | Q1 | 20 | 10 | - | **3** |
| GEOG0037-1 | *GNSS : Theory and applications* - René WARNANT | Q2 | 35 | 15 | - | **5** |
| GEOG0038-1 | *Space geodesy* - René WARNANT - [1d FW] | Q2 | 20 | - | [+] | **3** |
| SPAT0025-1 | *Environmental modelling* - Louis FRANÇOIS, Guy MUNHOVEN | Q2 | 20 | 10 | - | **4** |
| SPAT0026-1 | *Paleoenvironment and evolution of the Earth system* - Louis FRANÇOIS | Q2 | 30 | 10 | - | **4** |
| SPAT0027-3 | *Climate change and impacts* - Louis FRANÇOIS, Guy MUNHOVEN | TA | 15 | 45 | - | **5** |
| SPAT0028-2 | *Planetary magnetospheres and aurorae* - Denis GRODENT | Q2 | 20 | 10 | - | **3** |
| OCEA0081-1 | *Numerical Methods in Geophysics - Part 2* - JeanMarie BECKERS | Q2 | 15 | 30 | - | **5** |
| SPAT0064-1 | *Solar physics, activity phenomena and solar-earth relations* - Frédéric CLETTE | | 20 | 10 | - | **3** |
| SPAT0056-1 | *Planetary and exoplanetary atmospheres* - JeanClaude GÉRARD, Denis GRODENT | Q1 | 30 | 15 | - | **5** |

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|---|---|---|---|---|---|---|
| SPAT0043-1 | *Small bodies in the solar system* - Emmanuel JEHIN | | 15 | 5 | - | **2** |
| GEOL0263-1 | *Astrobiology* - Philippe CLAEYS, Véronique DEHANT, Moreno GALLENI, Emmanuelle JAVAUX, Yaël NAZÉ, Annick WILMOTTE (Even years) | Q2 | 30 | 15 | - | **4** |
| SPAT0014-1 | *Introduction to time series analysis* - Eric GOSSET | Q2 | 20 | 5 | - | **3** |
| PHYS0125-3 | *Instrumental Optics II* - Serge HABRAKEN | Q2 | 25 | 30 | - | **5** |
| SPAT0015-1 | *Signal acquisition and processing : application to embedded systems* - Christian SERVAIS | Q2 | 10 | 30 | - | **4** |
| SSTG0043-1 | *Placement* - N... - Suppl : Christian BARBIER, Yaël NAZÉ, Grégor RAUW, JeanPierre SWINGS | TA | - | 140 | - | **10** |
| AERO0018-3 | *Space Experiment Development* - Pierre ROCHUS | | 30 | 30 | - | **5** |
| SPAT0029-1 | *Space environment* - Denis GRODENT | Q2 | 15 | 15 | - | **3** |
| SPAT0032-2 | *Remote sensing* - Christian BARBIER | Q1 | 30 | 30 | - | **5** |
| SPAT0063-1 | *Introduction to exoplanetary* - Michaël GILLON | Q2 | 15 | 5 | - | **2** |