

# EIPHI-BFC

GRADUATE SCHOOL  
CROSS DISCIPLINARY SCIENCE  
AND TECHNOLOGY



**EIPHI graduate school**  
University Bourgogne Franche-Comté  
France

- 5 outstanding Research Areas
- Worldclass Research labs
- Close connection with industry
- Broad mobility opportunities
- Tutoring and mentoring
- Scholarships

**APPLY ONLINE**

<http://gradschool.eiphi.ubfc.fr/>



## Master/PhD in 5 Research Areas



**PHYSICS, MATHEMATICS and APPLICATIONS**



**ENERGY**



**COMPUTER SCIENCE**



**SMART SYSTEMS & STRUCTURES**



**MATERIAL SCIENCE**

# EIPHI graduate school

Engineering and Innovation through Physical Sciences, High-technologies, and cross-disciplinary research

EIPHI proposes 10 Master Degrees covering 5 research areas with a strong interdisciplinary content. Outstanding students will acquire a solid knowledge in various topics, ranging from fundamental to applied sciences, allowing them to build a successful career in R&D sectors.



## PHYSICS, MATHEMATICS and APPLICATIONS

Master degrees in theoretical and experimental physics or mathematics for physics, providing knowledge and lab expertise in photonics, non-linear physics, time & frequency metrology, micro/nano- and quantum technologies.

> 3 Masters: PPN, PICS, Maths4Phys

### > Career Sectors:

Photonics, nano-technology, Time & Frequency Metrology, aeronautics, space industry, Industrial consulting, numerical analysis for industrial applications, big data analysis



## COMPUTER SCIENCE

Research aspects of network applications (web, distributed, mobile, the Internet of Things) and quality assurance (verification and validation) of systems

> Master : Computer Science, IoT

### > Career Sectors:

Software development, web, network, embedded software in mechatronic system, Assurance quality, Tests



## SMART SYSTEMS & STRUCTURES

Master Degrees in mechanics, electronics and control for applications in smart systems and Tomorrow's structures (vibro-acoustic, control, composites, microtechnology and embedded electronics...)

> 3 Masters: GREEM, SMART MECHANICS, MIR

### > Career Sectors:

Aeronautics and space industry, ground transportations, energy, luxury watches, micro-technology, Time & Frequency instrumentation, robotics, control, classical manufacturing, R&D in automotive industry, large machines design & development



## ENERGY

Optimization and Integration of thermal, electrical and hydrogen-based systems in stationary and transportation applications for a sustainable development.

> Master : ELECTRICAL ENERGY, THERMAL ENERGY

### > Career Sectors:

Energy, Renewable Energies. Hydrogen Energy, Electrical Vehicles, Eco-systems



## MATERIAL SCIENCE

Chemistry of materials, interfacial electrochemistry, physical-chemistry, inorganic chemistry with a focus on complex materials (polymers, hybrid materials, ceramics...).

> Master CDM

### > Career Sectors:

Transportation (automotive, aeronautics), energy (production, transportation), glass industry, cement & concrete industry.

## EIPHI curriculum

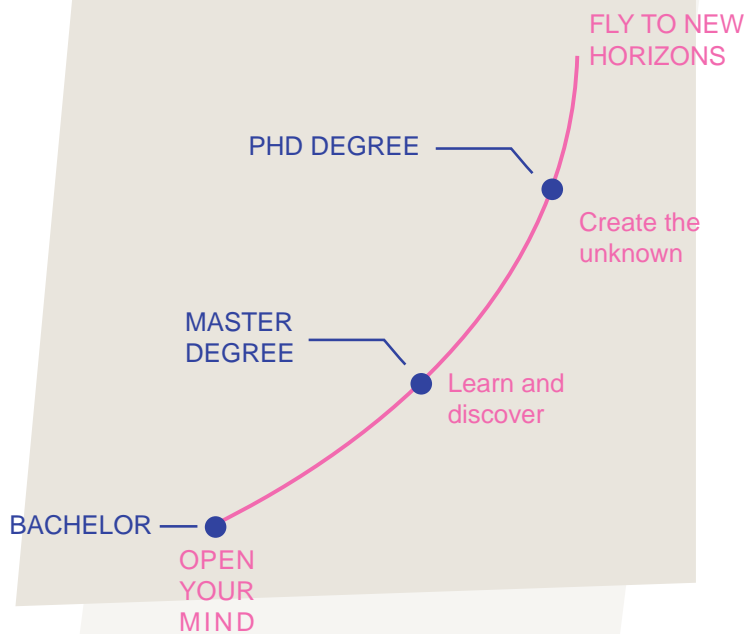
Each EIPHI degree is divided into lectures, practical training and projects activities with a strong majority taught in English. The master degrees propose both disciplinary and interdisciplinary courses as well as broad digital, societal, cultural, environmental, and entrepreneurial skills.

<b>Master</b>	Core sciences courses (including research project 1 day/week in the lab: 6 ECTS)	30
	Interdisciplinary courses	12
	Soft Skills (foreign languages, digital skills, transversal skills, entrepreneurial skills)	6
	Research Project	6
	Year 1 60 ECTS	Research internship or longtime project (full time in a lab during 4-8 weeks - international exchanges)
Year 2 60 ECTS	Specialization courses	18
	Soft Skills	6
	Advanced Research Project	6
<b>PhD</b>	Research Project	30
	Individual Training Program (transferrable soft skills, scientific/technical tools, specific graduate courses, industry courses, laboratory & technology courses, corresponds to 150h of class and/or activities)	15
	Networking (career events, International conferences, International mobility / secondment to a partner, outreach events, alumni association/Student Chapter)	
	Personal supervision activity (Tutor of a M.Sc. Student of UBFC)	



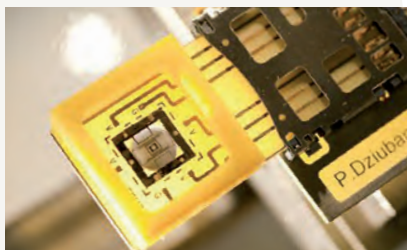
## ★ ★ ★ Top reasons to join EIPHI graduate school

- **Fellowships** for the best bachelor degree students and direct access to the PhD program for successful MSc students
- An **individual supervision** all along your curriculum, combining a personal project/thesis advisor and a mentor, to build a customized high-level training
- **Practical training** on high-tech platforms through internships and research projects in companies and labs supervised by high level scientists.
- **Openness** to cross and pluridisciplinary sciences (physics, chemistry, computer science, engineering, social science ...) a key ability for a successful career
- An inspiring international research environment and many **mobility** opportunities thanks to EIPHI's international network (European projects, several ERC grants...)
- Numerous **networking** opportunities through summer-schools, conferences, technological and industrial seminars



## Excellence in research with world-class research Laboratories

As an EIPHI graduate student, you will be involved in world class research with FEMTO-ST, ICB, IMB and their partners by contributing or initiating pluridisciplinary and innovative projects in close connection with industry. Guided by a personal supervisor, you will be regularly exposed to extensive hands-on-lab experience, get access to cutting-edge technology platforms and work in an international environment.



The EIPHI scientific program is mainly structured around 3 main topics:

### Monitoring & Prediction of complex systems

- Prognostic & Structural health monitoring/management
- Multifunctional sensors & (wireless) networks
- Photonic neuromorphic computing

### (Self)-adaptive architectures

- Active metamaterials & metamaterials
- Active micro-nano-mechatronics
- Programmable matter

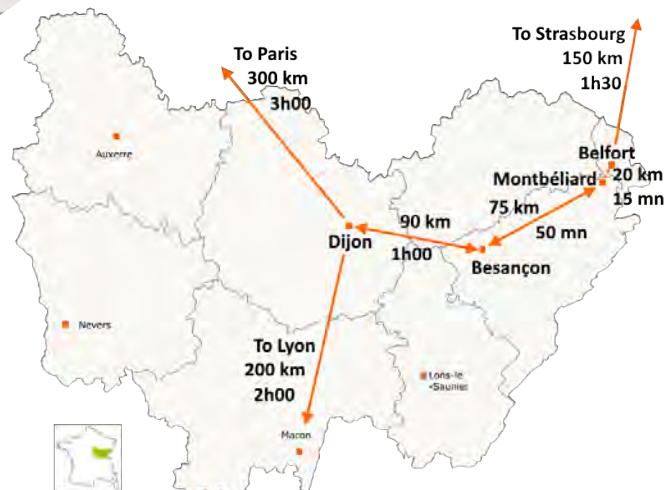
### Compact, active and agile information processing devices

- Integrated micro-nanophotonic and phononic components
- Smart nonlinear and quantum systems at micro-nano-scale
- Ultrafast control
- Time-frequency microdevices



## Life at EIPHI

Bourgogne Franche-Comté, land of Victor Hugo and Louis Pasteur, next to the Swiss and German borders, is a historical area of science, culture, gastronomy, and nature. A wealth of experiences is surrounding you with its unspoiled forests, Jura and Vosges mountains and the famous vineyard landscapes of Burgundy. Home of world heritage sites recognized by Unesco, the region also hosts celebrated hightech French industry centres such as the high-speed train TGV, car industry, and whatchmaker precision manufacturing, jewelry, and medical devices industries. At the heart of an Eco-friendly territory, UBFC sites are hosted in human-sized cities where an active student life is proposed. As an international or national student, you will have access to the full French social security cover for 250€/year. The all included cost of living is between 600 to 800€/month.



## HOW TO APPLY?

The 5 EIPHI research axes are structured around 10 Masters taught in English, and 2 doctoral schools all of which are located in specific cities (Dijon, Besançon, Montbéliard and Belfort).

EIPHI welcomes applications from individuals holding a 3 or 4-year Bachelor Degree or equivalent undergraduate degree. All candidates are admitted as full-time student beginning in September.

Lifelong training is also available.

**Find out more about application forms and deadlines :**

<http://gradschool.eiphi.ubfc.fr>

**Contact :**

[gradschool.eiphi@ubfc.fr](mailto:gradschool.eiphi@ubfc.fr)

## CONTACT US

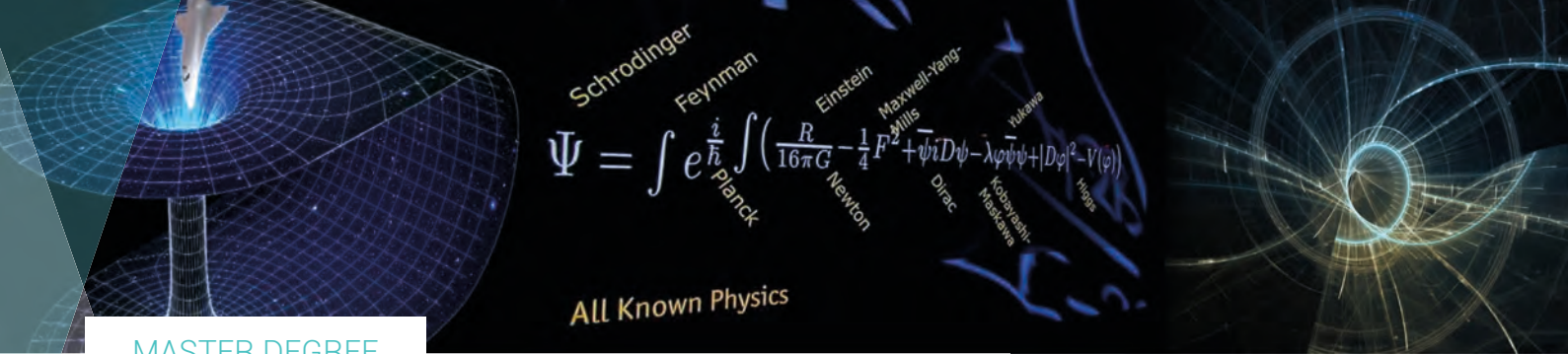
[gradschool.eiphi@ubfc.fr](mailto:gradschool.eiphi@ubfc.fr)  
<http://gradschool.eiphi.ubfc.fr>

Please feel free to get in touch with us, no matter the nature of your inquiry:

- Admissions, tuition fees and scholarships
- Applications and progression
- Thesis examinations
- Accommodation, insurance....
- Specific assistance to international students for housing, visa application, enrolment and Social Security

EIPHI graduate school  
 University Bourgogne Franche-Comté  
 32 avenue de l'observatoire  
 25000 Besançon - France





MASTER DEGREE

# MATHEMATICS FOR PHYSICS

## Math4Phys

### Math4Phys Master Degree Presentation

The Math4Phys master at the EIPHI graduate School addresses the recent progress in several fields of mathematical physics related to high-energy physics, astrophysics, quantum and nonlinear optics as well as condensed matter physics.

Numerous very sophisticated mathematical tools are introduced to analyze complex physical systems such as cold atom gases and black holes.

Specialists with a double competence in different fields of modern Mathematics and Physics address these problems using an original interdisciplinary approach.

The Math4Phys master is coordinated by the IMB laboratory.

### PROGRAM (Dijon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

Core Course List: 42 ECTS

DIFFERENTIAL GEOMETRY ORDINARY DIFFERENTIAL EQUATIONS GROUPS & REPRESENTATIONS RESEARCH PROJECT	FOURIER ANALYSIS PARTIAL DIFFERENTIAL EQUATIONS MATHEMATICAL METHODS OF CLASSICAL MECHANICS
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Cross-disciplinary Course List: 12 ECTS

QUANTUM PHYSICS MATHEMATICAL METHODS OF GRAVITATION MATHEMATICAL METHODS OF QUANTUM PHYSICS...
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Specialized Course List: 24 ECTS

POISSON LIE GROUPS & LIE ALGEBRAS QUANTUM GROUPS RIEMANNIAN GEOMETRY & INTEGRABLE SYSTEMS ADVANCED RESEARCH PROJECT
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Soft Skills Course List: 12 ECTS

FOREIGN LANGUAGE NUMERICAL METHODS TRANSVERSAL SKILLS...
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RESEARCH

**GEOMETRY & DYNAMIC SYSTEMS,  
MATHEMATICAL PHYSICS,  
STATISTICS PROBABILITY OPTIMIZATION & CONTROL**

**7 Research Laboratory**

**Mathematical Physics**

**3 Research Teams**



**INSTITUT DE MATHÉMATIQUES  
DE BOURGOGNE**

**Statistics, Probability, Optimization & Control**

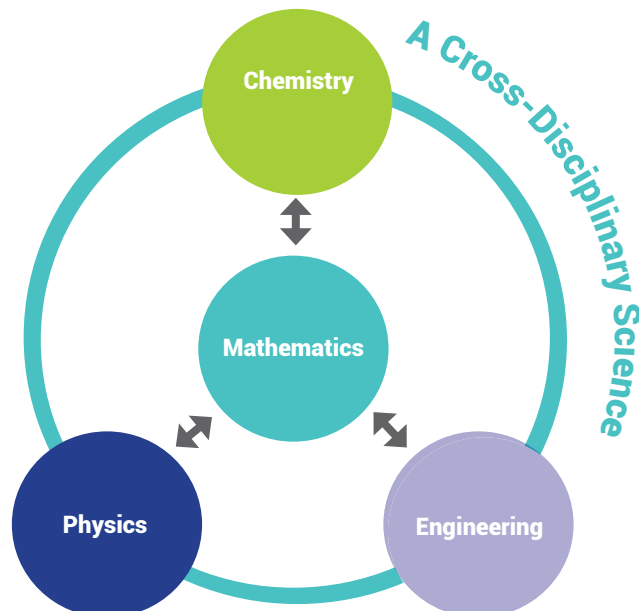
**Geometry & Dynamic Systems**

**Research Domains :**

Algebraic Geometry and Complex Geometry  
Control Theory  
Deformation quantization  
Differential Equations and Diffeomorphisms  
Dynamical Systems  
Geometric Group Theory and Low-Dimensional Topology

General Relativity  
Integrable Systems  
Malliavin Calculus, Stochastic Differential Equations, Mathematical Physics  
Nonlinear Analysis  
Numerical Analysis, Partial Differential Equations

Optimization, Inverse problems, Signal and Image processing, Optimal Transport  
Poisson Groups, Representation Theory & Hopf Algebras, Probability  
Spectral Analysis  
Stochastic Algorithms, Functional Data Analysis, Applied Statistics



MASTER DEGREE

# PHYSICS PHOTONICS NANOTECHNOLOGY PPN

## PPN Master Degree Presentation

The PPN master at EIPHI graduate School addresses modern concepts and state-of-the-art techniques in photonics, optical communications, nanotechnology, laser technology, quantum technologies and spectroscopy. Special emphasis is given to femtosecond laser science, nonlinear fiber optics, nano-optics, quantum control and quantum information, molecular spectroscopy, nanoscale biophysics, nanosensors & nano-characterization.

Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for a career as Researcher or Professor.

The PPN master is strongly supported by the ICB laboratory and the FEMTO-ST institute, two major BFC research institutions with high international recognition in the physical sciences and engineering.

## PROGRAM (Dijon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

<p><b>Core Course List: 42 ECTS</b></p> <p>NON-LINEAR OPTICS SOLID-STATE PHYSICS &amp; SOFT MATTER LASER RESEARCH PROJECTS</p> <p>MICROSCOPIES FIBER COMMUNICATIONS QUANTUM PHYSICS GUIDED OPTICS &amp; OPTO-ELECTRONICS</p>	<p><b>Cross-disciplinary Course List: 12 ECTS</b></p> <p>NUMERICAL METHODS SIGNAL PROCESSING MICRO NANO FABRICATION AND CLEAN ROOM...</p>
<p><b>Specialized Course List: 24 ECTS</b></p> <p>NANO-OPTICS ULTRAFAST OPTICS QUANTUM TECHNOLOGIES ADVANCED RESEARCH PROJECTS</p> <p>ADVANCED PHOTONICS ATOMIC &amp; MOLECULAR DYNAMICS MICRO, NANO-TECHNOLOGIES &amp; NANOFABRICATION</p>	<p><b>Soft Skills Course List: 12 ECTS</b></p> <p>FOREIGN LANGUAGE DIGITAL SKILLS TRANSVERSAL SKILLS ENTREPRENEURIAL SKILLS...</p>



RESEARCH

# Photonics, Nanotechnology, Quantum Technologies

## 2 RESEARCH LABORATORIES



## 6 SCIENTIFIC DEPARTMENTS

### Photonics : Submicron optics and nanosensors



Near-field optics & Nano-photonics  
Femtosecond processes & intense lasers  
Solitons, Lasers and Optical Communication

### Quantum Interaction & Control



Molecular Spectroscopy  
Molecular Spectroscopy  
Collisional Processes  
Quantum & Nonlinear Dynamics  
Quantum Technologies  
Quantum Control & Nonlinear Dynamics

### Nano Sciences : Opto-electronics sensors, Nanodesign, and Characterization



Physics applied to Proteins  
Nanoparticles & Nanostructures

### Optics & Photonics



Nano-Optics  
Nonlinear Optics  
Quantum Information & Systems  
Ultrafast nonlinear dynamics and materials  
Photonic artificial intelligence and applications

### Micro Nano Sciences & Systems

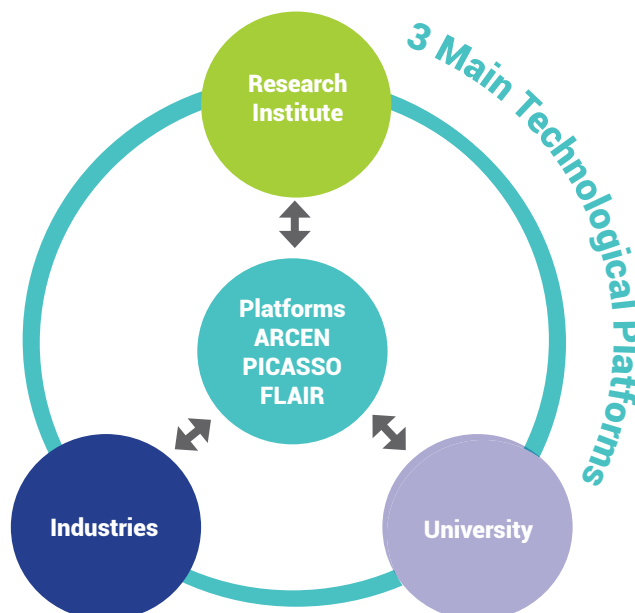


BioMicro Devices  
Phonics  
Micro Nano Materials and Surfaces  
Micro-Opto-Electro Mechanical Systems

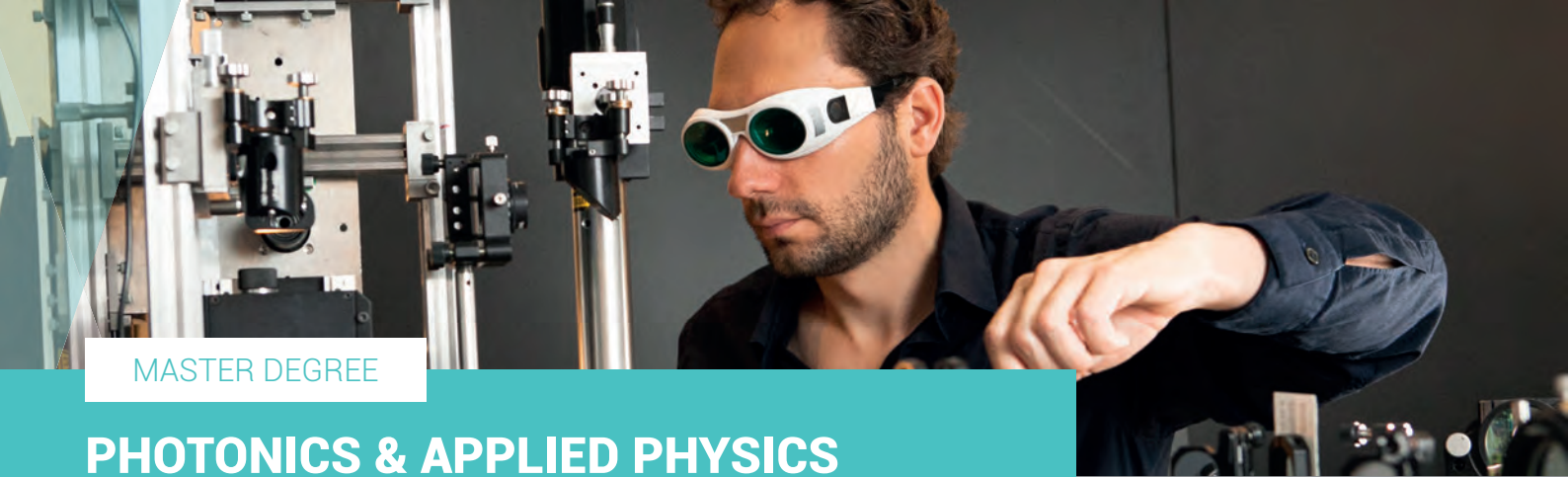
### Time Frequency



Wave, Clocks & Metrological Systems  
Micro-Acoustics Devices  
Acoustics, Electronics & Piezoelectric







MASTER DEGREE

# PHOTONICS & APPLIED PHYSICS PICS

## PICS Master Degree Presentation

The PICS master's at EIPHI graduate School provides a comprehensive program of courses covering theoretical, experimental and engineering aspects of photonics, micro/nano technologies, time-frequency metrology, information theory and complex systems.

Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for a career as Researcher or Professor.

The PICS master's is strongly supported by the FEMTO-ST institute and the ICB laboratory, two major BFC research institutions with high international recognition in the physical sciences and engineering.

## PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

**Core Course List: 42 ECTS**

NON-LINEAR OPTICS SOLID-STATE PHYSICS I QUANTUM PHYSICS LASER PHYSICS FIBER COMMUNICATIONS NOISE DETECTION & CONTROL	QUANTUM OPTICS LIGHT MATTER INTERACTION GUIDED OPTICS & OPTO-ELECTRONICS RESEARCH PROJECTS
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**Cross-disciplinary Course List: 12 ECTS**

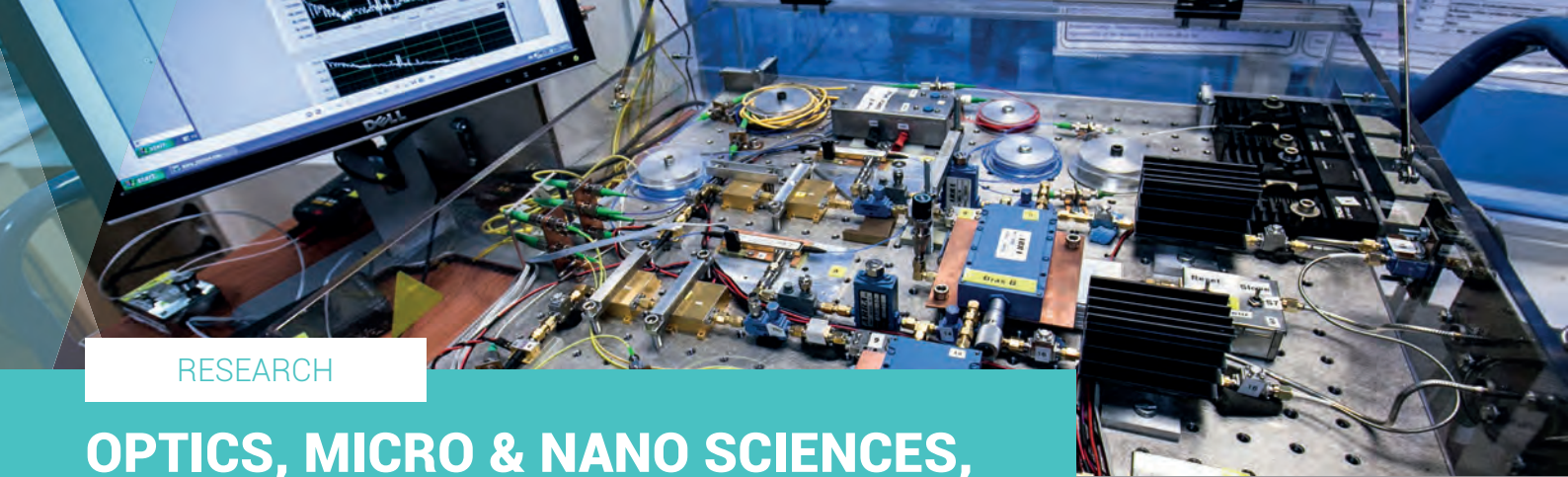
NUMERICAL METHODS  
SIGNAL PROCESSING  
MICRO NANO FABRICATION AND CLEAN ROOM...

**Specialized Course List: 24 ECTS**

NANO-OPTICS ADVANCED NON-LINEAR OPTICS ADVANCED QUANTUM OPTICS ADVANCED INSTRUMENTATION	ADVANCED PHOTONICS ADVANCED NUMERICAL METHODS ADVANCED RESEARCH PROJECTS
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**Soft Skills Course List: 12 ECTS**

FOREIGN LANGUAGE  
DIGITAL SKILLS  
TRANSVERSAL SKILLS  
ENTREPRENEURIAL SKILLS...



RESEARCH

# OPTICS, MICRO & NANO SCIENCES, TIME FREQUENCY METROLOGY

2 RESEARCH LABORATORIES



6 SCIENTIFIC DEPARTMENTS

### Optics & Photonics



Nano-Optics  
Nonlinear Optics  
Quantum Information & Systems  
Ultrafast nonlinear dynamics and materials  
Photonic artificial intelligence and applications

### Quantum Interaction & Control



Molecular Spectroscopy  
Quantum & Nonlinear Dynamics

### Micro Nano Sciences & Systems



BioMicro Devices  
Phononics  
Micro Nano Materials and Surfaces  
Micro-Opto-Electro Mechanical Systems

### Photonics



Near Field Optics  
Intense Laser Femtosecond Processes  
Solitons, Lasers and Optical Communication

### Time Frequency

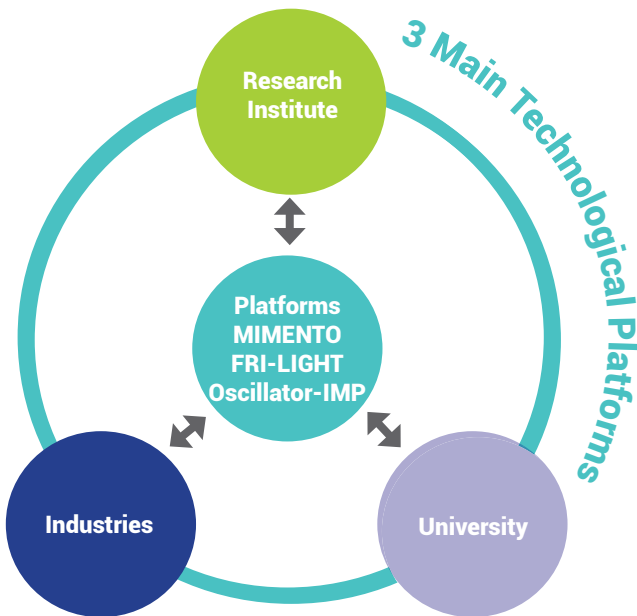


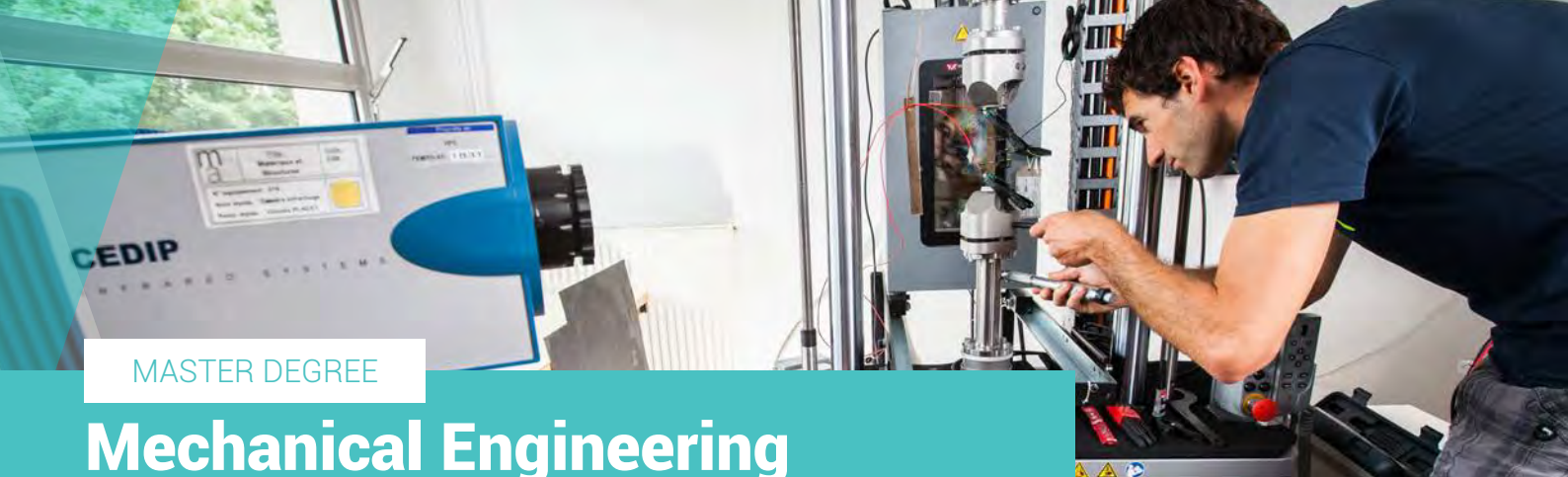
Wave, Clocks & Metrological Systems  
Micro-Acoustics Devices  
Acoustics, Electronics & Piezoelectric

### Nano Sciences



Physics applied to Proteins  
Nanoparticles & Nanostructures





MASTER DEGREE

# Mechanical Engineering SMART MECHANICS

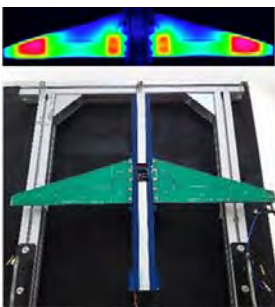
## SMART MECHANICS (formerly Meeting) Master Degree Presentation

Smart Mechanics MSc involves innovative solutions for applications as vibroacoustic control (NVH), Structural Health Monitoring (SHM), Shape Control, or Energy Harvesting for instance. Different strategies can be developed to add such new functionalities to structures as the design of geometrically architected technologies, the integration of smart materials with multiphysic behaviors, or the development of embedded sensors and actuators with their controller. The purpose of the master is to learn students about all these emerging technologies for them to become a R&D engineer in a laboratory or a company for transport, energy, etc. The master's degree also aims to enable the best students to obtain a scholarship to prepare a doctoral thesis.

This MSc degree aims to develop skills in design, modeling, numerical simulation and experiments in the fields of mechanical engineering. As such solutions are likely to involve many physical phenomena (acoustics, heat transfer, electro-magnetics) coupled to mechanical applications, the specialization includes methodologies for mechanical and multiphysic modeling with advanced mathematical, numerical and experimental tools.

## PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



Core Course List: 42 ECTS	
ADVANCED COMPUTATIONAL METHODS CONTINUUM MECHANICS MODELING & SIMULATION EXPERIMENTAL METHODS	VERIFICATION & VALIDATION SIMULATION OPTIMIZATION RESEARCH PROJECT RESEARCH INTERNSHIP

Cross-disciplinary Course List: 12 ECTS
...

Specialized Course List: 24 ECTS	
SMART MATERIALS SMART STRUCTURES MULTIPHYSIC MODELLING & SIMULATION STRUCTURAL DYNAMICS & VIBROACOUSTIC	MICROMECHANICAL SYSTEMS DESIGN ROBUST DESIGN NON LINEAR MECHANICS FOR SMART APPLICATIONS ADVANCED RESEARCH PROJECT

Soft Skills Course List: 12 ECTS
FOREIGN LANGUAGE SCIENTIFIC CULTURE COMMUNICATION PROJECT MANAGEMENT...



RESEARCH

# APPLIED MECHANICS DEPARTMENT

MATERIAL, SURFACES, PROCESSES & STRUCTURE

## 2 Research Fields

### Micromechanics: materials and processes

Pushing back the limits of the small scale:  
 Precision mechanics (clock industries)  
 Microfabrication processes  
 Micrometric devices  
 Thin-film scale effects,  
 Micro-texturing, etc.

Activities situated at the interface between imperceptible nanotechnologies (MIMENTO technology platform) and the visible macroscopic world (MIFHySTO platform).

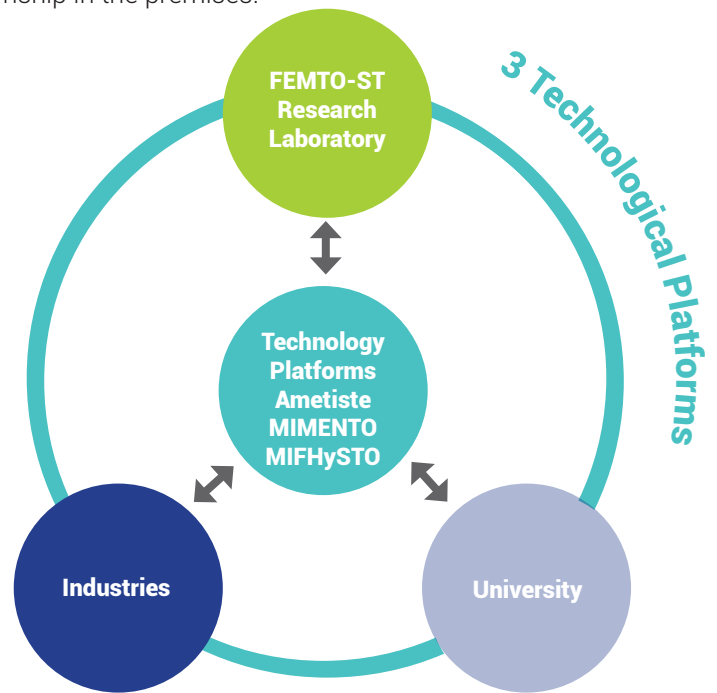
### Structures: integration and functionalization

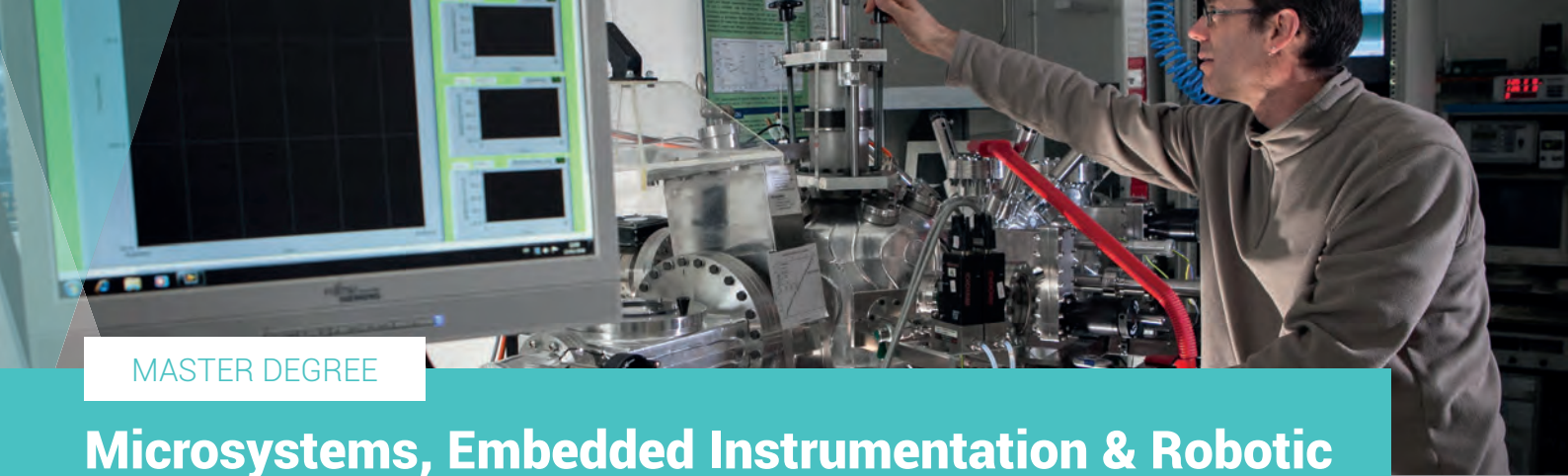
Project "Smart skin" developing new structures able to adapt, interact and take advantage of its environment:

- New composite materials (bio-based ...)
- Integrated transducer networks
- Matter Embedded Energy Harvesters.
- Materials & structures for vibroacoustic applications
- Micro-actuator networks for noise control.

Experimental Activities are supported by the Ametiste Platform.

The Smart Mechanics MSc (formerly Meeting) is associated to the Department of Applied Mechanics of the FEMTO-ST Institute presented hereafter. One specialization of the department is the integration and functionalization of structures. Students work in the research laboratory for their projects, many of their teaching activities, and can carry out their internship in the premises.





MASTER DEGREE

# Microsystems, Embedded Instrumentation & Robotic MIR

## MIR Master Degree Presentation *Embedded Systems track*

MIR is an EIPHI graduate School Master focusing on Research & Innovation in the field of Mechatronic, Micro and Embedded systems.

Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for a career as Researcher or Professor.

For this track, MIR Master Students can pursue their studies with a Ph.D. in the Time Frequency Department (TF) presented thereafter. The Micro Nano Sciences & Systems and the Automatic Control Departments of the FEMTO-ST laboratory can also welcome student from this track.

## PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



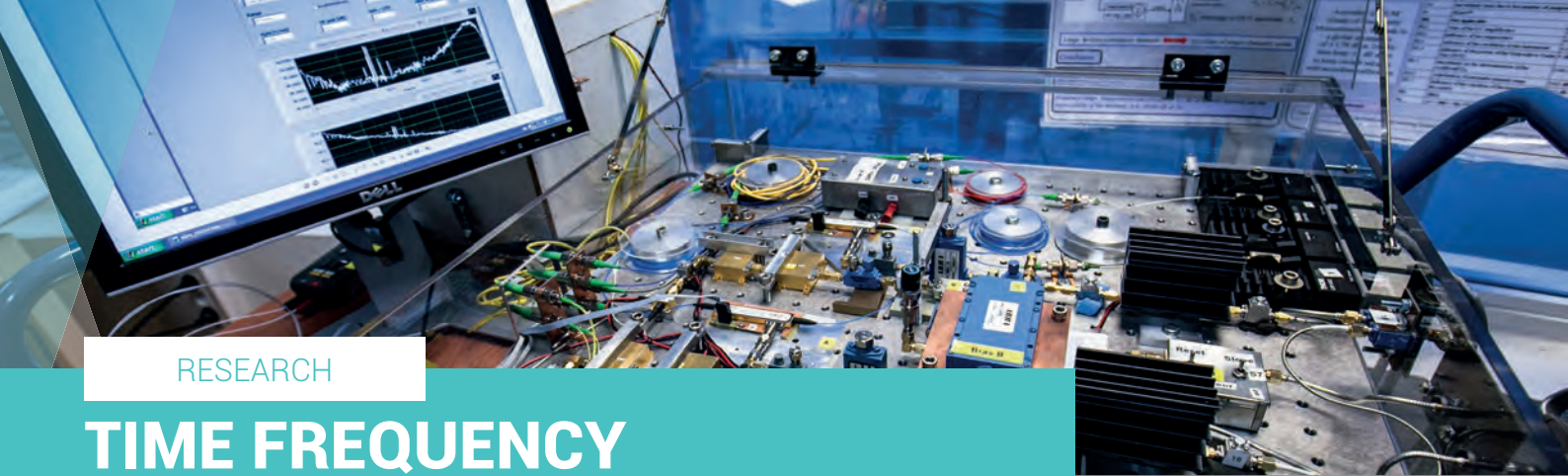
Core Course List: 42 ECTS	
DIGITAL ELECTRONICS INFOTRONICS INSTRUMENTATION INDUSTRIAL NETWORK	DIGITAL CONTROL LINEAR MULTIVARIABLE & CONTROL RESEARCH PROJECTS

Cross-disciplinary Course List: 12 ECTS
MICROTECHNOLOGY MICROMECHATRONICS MICROTRANSDUCERS ROBOTICS...

Specialized Course List: 24 ECTS	
EMBEDDED ELECTRONICS EMBEDDED SYSTEMS DIGITAL COMMUNICATION INSTRUMENTATION AND APPLI- CATION	INSTRUMENTATION SYSTEMS ADVANCED INSTRUMENTATION ADVANCED RESEARCH PRO- JECTS

Soft Skills Course List: 12 ECTS
FOREIGN LANGUAGE METHODOLOGICAL TOOLS INNOVATION...





RESEARCH

# TIME FREQUENCY DEPARTMENT

7 Research Laboratory

**ACEPI**  
ACOUSTICAL  
ELECTRONICS  
&  
PIEZOELECTRICITY

3 Research Teams



**OHMS**  
WAVES  
CLOCKS  
METROLOGY &  
SYSTEMS

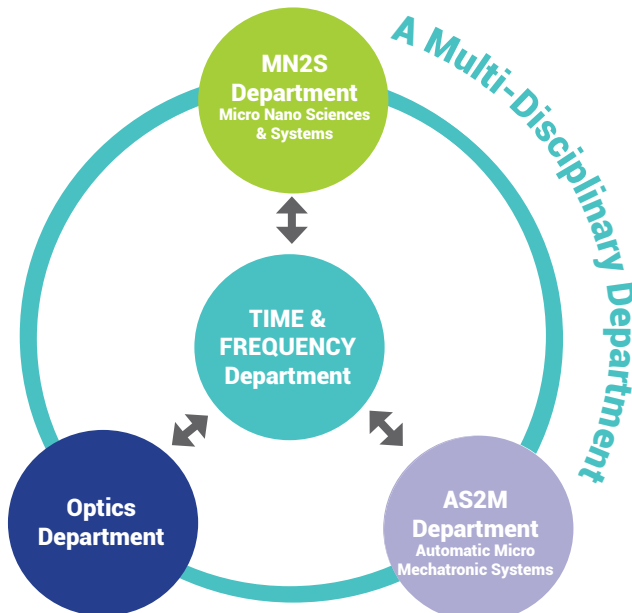
**CoSyMA**  
COMPONENTS &  
MICRO-ACOUSTIC  
SYSTEMS

## Research Domains :

Quartz oscillators  
Piezoelectric resonators  
Study of the origins of acoustic resonator noise  
Resonant sensors  
Characterization of materials for time-frequency devices

SAW, FBAR and HBAR resonators  
MEMSpiezoelectric resonators  
Resonating sensors

Microwave sources  
Atomic oscillators (masers and atomic micro-clocks)  
Microwaves and photonics





MASTER DEGREE

# Microsystems, Embedded Instrumentation & Robotic MIR

## MIR Master Degree Presentation *Robotics & Microrobotics track*

MIR is an EIPHI graduate School Master focusing on Research & Innovation in the field of Mechatronics, Micro and Embedded systems.

Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for a career as Researcher or Professor.

For this track, MIR Master Students can pursue their studies with a Ph.D. in the Automatic Micro-mechatronic systems department presented thereafter. The Time Frequency and the Micro Nano Sciences & Systems (MN2S) Departments of the FEMTO-ST laboratory can also welcome student from this track.

### PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



Core Course List: 42 ECTS	Cross-disciplinary Course List: 12 ECTS
<ul style="list-style-type: none"> <li>DIGITAL CONTROL</li> <li>MICROMECHATRONICS</li> <li>MICROTRANSDUCERS</li> <li>MECHATRONIC SYSTEMS</li> <li>ROBOTICS</li> <li>INSTRUMENTATION</li> </ul>	<ul style="list-style-type: none"> <li>DIGITAL ELECTRONICS</li> <li>INFOTRONICS...</li> </ul>
Specialized Course List: 24 ECTS	Soft Skills Course List: 12 ECTS
<ul style="list-style-type: none"> <li>ROBUST MULTIVARIABLE CONTROL</li> <li>NON LINEAR CONTROL</li> <li>MICROROBOTICS</li> <li>RESEARCH PROJECTS</li> </ul>	<ul style="list-style-type: none"> <li>FOREIGN LANGUAGE</li> <li>METHODOLOGICAL TOOLS</li> <li>INNOVATION...</li> </ul>
<ul style="list-style-type: none"> <li>LINEAR MULTIVARIABLE &amp; CONTROL</li> <li>MICROTECHNOLOGY</li> <li>INDUSTRIAL COMPUTING</li> <li>2D VISION</li> <li>RESEARCH PROJECTS</li> </ul>	
<ul style="list-style-type: none"> <li>3D VISION</li> <li>NUMERICAL MODELING &amp; SIMULATION OF MICROSYSTEMS</li> <li>ADVANCED ROBOTICS</li> </ul>	

RESEARCH

# AS2M DEPARTMENT

AUTOMATIC MICRO-MECHATRONIC SYSTEMS

## 3 Research Themes

### MACS (Methodologies for Automation and for the Design of Mechatronic Systems)

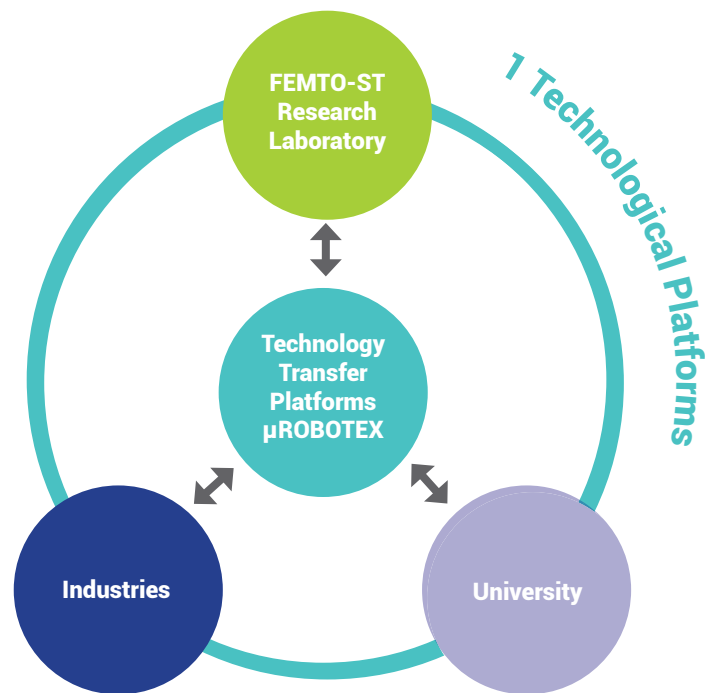
The MACS team deals with the study and development of methodologies of control techniques and of design devoted to mechatronic systems.

### MiNaRoB (Biomedical Microrobotics)

The MiNaRoB team investigates micro nano robotic systems for microsurgery and individualized manipulation of biological cells.

### Nanorobotics (Robotics and mechatronics at small-scales)

The Nanorobotics team studies design, perception, control as well as metrology issues of micro and nanorobotic systems integrating active materials.

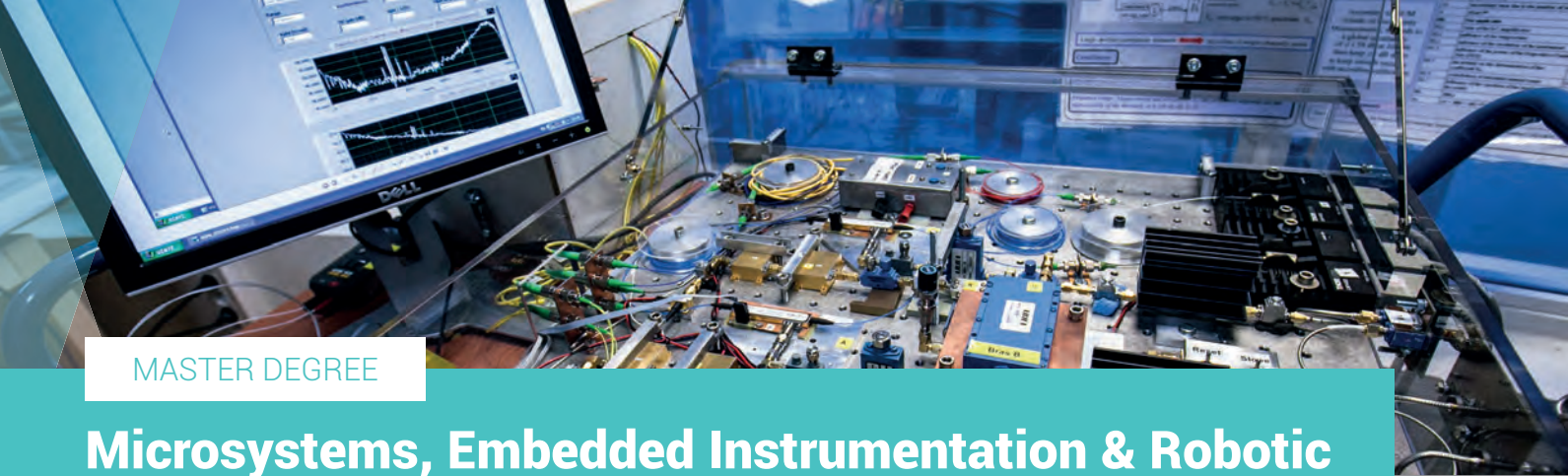


### μROBOTEX

The μROBOTEX platform is a facility dedicated to characterization and micro-assembly of micro and nanosystems whose dimensions are below 10μm. Access to the facility is open to students, academic and industrial partners for their research and/or development projects.







MASTER DEGREE

# Microsystems, Embedded Instrumentation & Robotic MIR

## MIR Master Degree Presentation *Microsystems and Microtechnology track*

MIR is an EIPHI graduate School Master focusing on Research & Innovation in the field of Mechatronic, Micro and Embedded systems.

The Master MIR student will be working in Mimento, the Micro/nanotechnology center of the FEMTO-ST institute, an 865m<sup>2</sup> state-of-the-art cleanroom and one of the 5 cleanrooms in the French technological platforms network. Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for a career as Researcher or Professor.

For this track, MIR Master Students can pursue their studies with a Ph.D. in the Micro Nano Sciences & Systems (MN2S) Department presented thereafter. The Time Frequency and the Automatic Control Departments of the FEMTO-ST laboratory can also welcome student from this track.

### PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



Core Course List: 42 ECTS	
DIGITAL CONTROL MICROMECHATRONICS MICROTRANSDUCERS MECHATRONIC SYSTEMS ROBOTICS INSTRUMENTATION	LINEAR MULTIVARIABLE & CONTROL MICROTECHNOLOGY INDUSTRIAL COMPUTING RESEARCH PROJECTS

Cross-disciplinary Course List: 12 ECTS
DIGITAL ELECTRONICS INFOTRONICS...

Specialized Course List: 24 ECTS	
THIN FILM TECHNOLOGY ACOUSTICAL & BIOMEDICAL MICROSYSTEMS MICROBOTICS	NUMERICAL MODELING & SIMULATION OF MICROSYSTEMS ADVANCED RESEARCH PROJECTS

Soft Skills Course List: 12 ECTS
FOREIGN LANGUAGE METHODOLOGICAL TOOLS INNOVATION...

RESEARCH

# MN2S DEPARTMENT

MICRO NANO SCIENCES & SYSTEMS

## 5 Research Themes

### BioMicroDevices :

Detection, characterization and quantification of biomolecules, cells in fluids for a better knowledge of biological, agrifood and environmental mechanisms.

### MINAMAS Micro-NAno-MAterials and Surfaces:

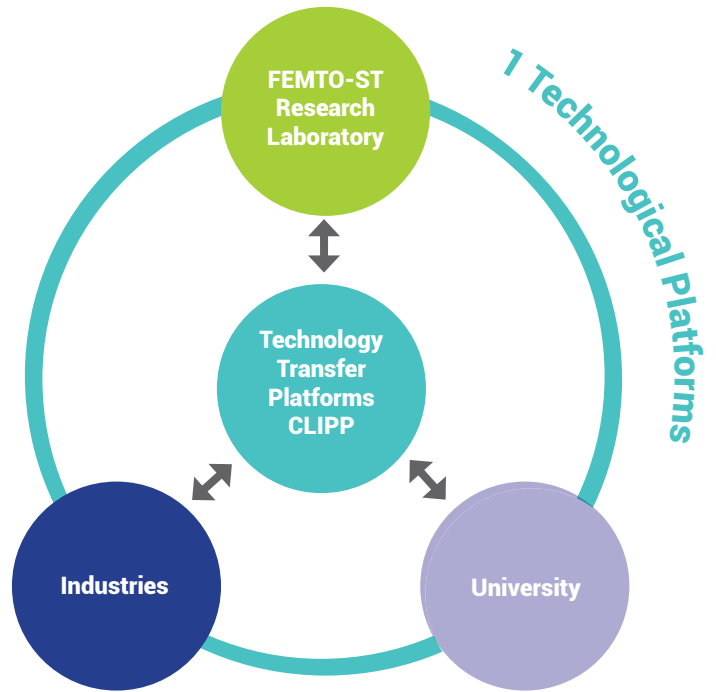
Thin films and nanomaterials, for micro-nano-systems and for production or transduction of energy.

### MOEMS Micro-Opto-Electro Mechanical Systems

Miniaturization of complex optical systems, such as optical microscopes or atomic clocks, thanks to association of silicon batch-fabrication processes, micro-optics and in some cases microactuators.

### Phononics and Microscopy :

Generation and observation of acoustic waves, thermal transport, and coupling with light in structured materials, from macroscopic down to microscopic dimensions.



### Nanosciences

Observation and development of organic and inorganic surfaces and interfaces on a nanometric scale.

Mathematical physics of quantum information.



MASTER DEGREE

# Control for Green Mechatronics GREEM

## GREEM Master Degree Presentation

GREEM is an EIPHI graduate School Master focusing on Research & Innovation within the «Robotics and Control» mention of the French Ministry of Education and which promotes a high-quality educational offer in the area of design and control of mechatronic systems with a particular focus on two points: their functional performances and their energetic efficiency.

Designed for R&D engineer positions in big international companies or smaller High-Tech industries, this degree can also be the springboard for academic or research careers.

GREEM Master Students can pursue their studies with a Ph.D. in the Automatic Micro-Mechatronic Systems (AS2M) Department presented thereafter. The Time Frequency and the Micro Nano Sciences & Systems Departments of the Femto-st laboratory can also welcome student from this track.

## PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

<p><b>Core Course List: 42 ECTS</b></p> <p>DIGITAL CONTROL MICROMECHATRONICS MICROTRANSDUCERS OPTIMIZATION ROBOTICS ADVANCED ROBOTICS GRAPH &amp; LINEAR MODELLING IN MECHATRONIC SYSTEMS</p> <p>LINEAR MULTIVARIABLE &amp; CONTROL NUMERICAL MODELING &amp; SIMULATION OF MICROSYSTEMS INFOTRONICS TECHNOLOGIES IN SYSTEMS CONTROL RESEARCH PROJECTS</p>	<p><b>Cross-disciplinary Course List: 12 ECTS</b></p> <p>SYSTEMS ENGINEERING ENERGY EFFICIENCY MECHATRONIC SYSTEMS DESIGN...</p>
<p><b>Specialized Course List: 24 ECTS</b></p> <p>ROBUST MULTIVARIABLE CONTROL NON LINEAR CONTROL ENERGY MANAGEMENT FUNDAMENTALS INTRODUCTION TO ENERGY BASED CONTROL RESEARCH PROJECTS</p> <p>3D DESIGN &amp; MANUFACTURING OF MECHATRONIC SYSTEMS MICROBOTICS BIOMEDICAL &amp; ACOUSTICAL MICROSYSTEMS ENERGY HARVESTING IN MECHATRONIC SYSTEMS</p>	<p><b>Soft Skills Course List: 12 ECTS</b></p> <p>FOREIGN LANGUAGE METHODOLOGICAL TOOLS INDUSTRIAL COMPUTING SMART GRID...</p>

RESEARCH

# AS2M DEPARTMENT

## AUTOMATIC MICRO-MECHATRONIC SYSTEMS

### 4 Research Themes

#### MACS (Methodologies for Automation and for the Design of Mechatronic Systems)

The MACS team deals with the study and development of methodologies of control techniques and of design devoted to mechatronic systems.

#### MiNaRoB (Biomedical Microrobotics)

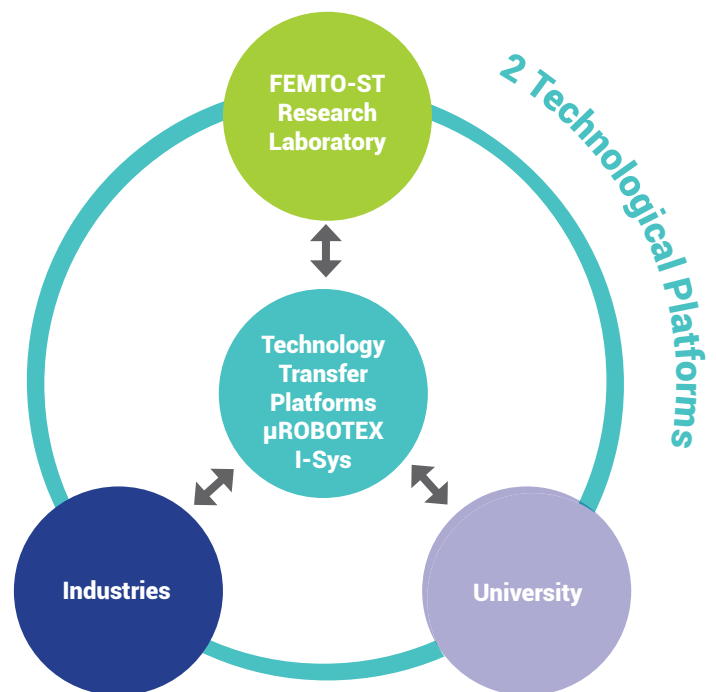
The MiNaRoB team investigates micro nano robotic systems for microsurgery and individualized manipulation of biological cells.

#### PHM (Prognostics and Health Management)

The PHM team is focused on the development of advanced algorithms for classification, prediction and decisions so as to predict the lifetime of complex systems.

#### Nanorobotics (Robotics and mechatronics at small-scales)

The Nanorobotics team studies design, perception, control as well as metrology issues of micro and nanorobotic systems integrating active materials.



Conception: UBFC, Credits: Ludovic Godard, UFC (September 2018)



MASTER DEGREE

# ENERGY

## ENERGY Master Degree Presentation Thermal Energy Engineering Track (ITE)

ENERGY ITE is an EIPHI graduate School Master focusing on Research & Innovation in the field of thermal systems optimization and management. Experimental techniques and numerical simulations of multiphysics systems are at the heart of the program. At the end of the training you obtain an expertise in Heat Transfer, Fluid Mechanics and Thermodynamics of renewable energy systems.

Like all the Master Degree of EIPHI Graduate school, this master is designed for R&D engineer positions in big international companies or smaller High-Tech industries but can also be the springboard for a career as Researcher or Professor.

Energy Master Students can pursue their studies with a Ph.D. in the Energy Department of Femto-St Research Lab or Belfort's Fuel Cell Laboratory FC Lab presented thereafter.

### PROGRAM (Belfort Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



#### Core Course List: 42 ECTS

FLUID DYNAMICS  
HEAT TRANSFER & FLUID FLOW  
THERMAL MACHINES  
ELEMENTARY HYDROGEN ENERGY & ENERGETICAL EFFICIENCY

THERMAL SYSTEMS  
ENERGY PRODUCTION  
THERMAL EFFICIENCY  
RESEARCH PROJECT

#### Cross-disciplinary Course List: 12 ECTS

COMPUTATIONAL TOOLS  
MATHEMATICAL TOOLS  
FOR ENGINEERS ...

#### Specialized Course List: 24 ECTS

FUNDAMENTAL HYDROGEN ENERGY & ENERGETICAL EFFICIENCY  
ADVANCED HYDROGEN ENERGY & ENERGETICAL EFFICIENCY  
ADVANCED THERMAL SYSTEMS  
NUMERICAL SIMULATION  
ADVANCED RESEARCH PROJECTS

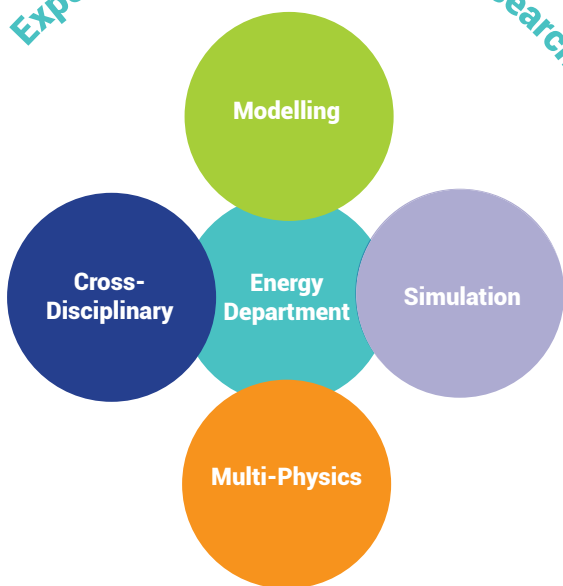
#### Soft Skills Course List: 12 ECTS

ENGLISH,  
ENTREPRENEURSHIP,  
INNOVATION MGT,  
RISK MGT...

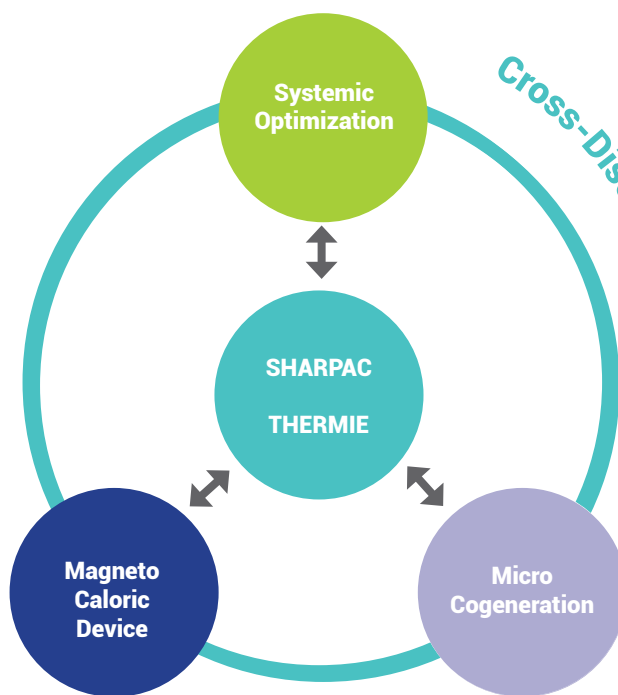
RESEARCH

# ENERGY DEPARTMENT

Experimental & Theoretical Research



Cross-Disciplinary Research



## 2 Research Fields

### THERMIE :

Thermal Science

- Metrology and Instrumentation in Fluidics and Thermal Science
- Thermal Science in energy systems
- Heat engines
- Complex flows

### SHARPAC :

Hybrid electric systems, Electric Actuators, Fuel cell systems

- Static converters
- Fuel cell systems
- PHIL: Power Hardware in the Loop
- Control and Management of Energy
- Electric actuators
- Micro-grids



MASTER DEGREE

# ENERGY

## ENERGY Master Degree Presentation **Electrical Energy Track (EE)**

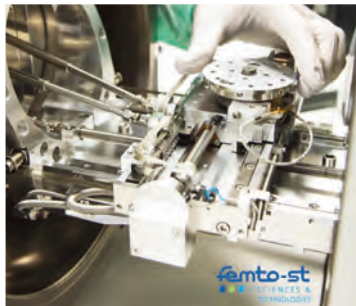
ENERGY EE is an EIPHI graduate School Master focusing on Research & Innovation in the field of Energy production and storage and management. Electrical energy is the main concern of this degree with a focus on hydrogen energy systems.

Like all the Master Degree of EIPHI Graduate school, this master is designed for R&D engineer positions in big international companies or smaller High-Tech industries but can also be the springboard for a career as Researcher or Professor.

Energy Master Students can pursue their studies with a Ph.D. in the Energy Department of Femto-St Research Lab or Belfort's Fuel Cell Laboratory FC Lab presented thereafter.

### PROGRAM (Belfort Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



**FC LAB**  
Research

#### Core Course List: 42 ECTS

ENERGY SYSTEM OPTIMIZATION & MANAGEMENT  
INDUSTRIAL PROGRAMMING  
HYDROGEN & ENERGY STORAGE  
ENERGY SYSTEM MODELLING & CONTROL

ELECTRIC ACTUATORS  
POWER ELECTRONICS  
AUTOMATIC  
ADVANCED MODELLING OF MAGNETIC SYSTEM  
RESEARCH PROJECT

#### Cross-disciplinary Course List: 12 ECTS

COMPUTATIONAL TOOLS  
MATHEMATICAL TOOLS FOR ENGINEERS ...

#### Specialized Course List: 24 ECTS

HYDROGEN ENERGY & ENERIGICAL EFFICIENCY H3E :  
- ELEMENTARY H3E  
- FUNDAMENTAL H3E  
- ADVANCED H3E  
ADVANCED RESEARCH PROJECTS

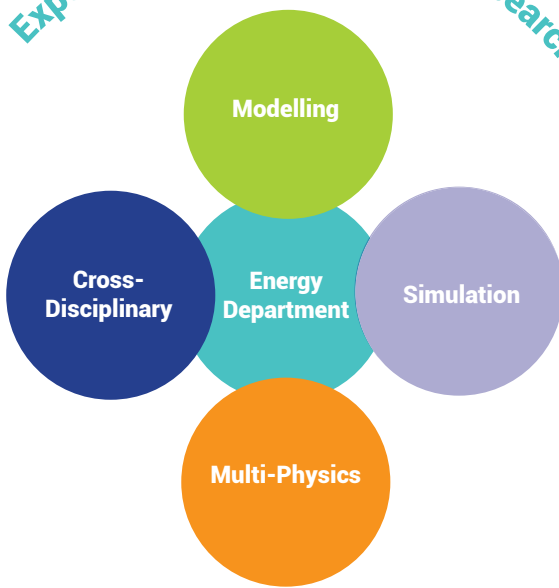
#### Soft Skills Course List: 12 ECTS

ENGLISH,  
ENTREPRENEURSHIP,  
INNOVATION MGT,  
RISK MGT...

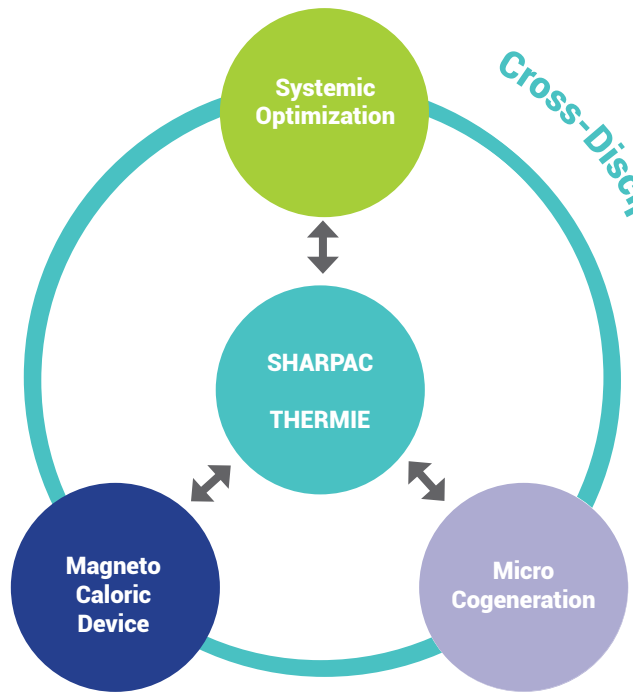
RESEARCH

# ENERGY DEPARTMENT

Experimental & Theoretical Research



Cross-Disciplinary Research



## 2 Research Fields

### THERMIE :

Thermal Science

- Metrology and Instrumentation in Fluidics and Thermal Science
- Thermal Science in energy systems
- Heat engines
- Complex flows

### SHARPAC :

Hybrid electric systems, Electric Actuators, Fuel cell systems

- Static converters
- Fuel cell systems
- PHIL: Power Hardware in the Loop
- Control and Management of Energy
- Electric actuators
- Micro-grids





MASTER DEGREE

# Internet of Things

## IoT Master Degree Presentation

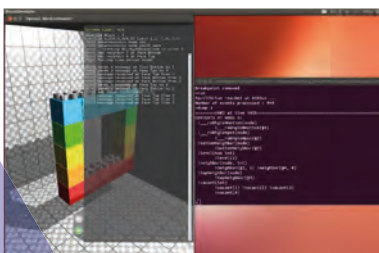
IoT is an EIPHI graduate school Master focusing on Research & Innovation in network of smart devices containing electronics, software or actuators and able to connect, interact and exchange data over the internet.

IoT Master contributes to structure a high-level international offer in computer science in North Bourgogne Franche-Comte. By focusing on the Internet of Things, the IoT master program will offer a whole set of courses aimed at training high-level specialists in embedded distributed computing, network technologies, big data, cloud computing, positioning techniques and development of mobile applications. The program also leaves an important place for complementary courses (management, entrepreneurship...) to prepare students for future careers in either industry or research laboratories.

The IoT master program is strongly supported by the FEMTO-ST Institute and by the CIAD Lab. Students will be immersed in the laboratory environment. The proposed Master's degree will also benefit from strong relationships with local and national industrial partners, relationships forged over many years.

## PROGRAM (Belfort-Montbéliard Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		



### Core Course List: 42 ECTS

ADVANCED ALGORITHMIC MOBILE DEVELOPMENT  
DATA MINING  
INFRASTRUCTURE AND ROUTING FOR CONNECTED OBJECTS  
POSITIONING SYSTEMS: TECHNIQUES AND APPLICATIONS  
CLOUD INFRASTRUCTURE AND VIRTUALIZATION  
RESEARCH PROJECTS

### Cross-disciplinary Course List: 12 ECTS

EMBEDDED SYSTEMS  
RADIO NETWORKS...

### Specialized Course List: 24 ECTS

DEEP LEARNING FOR IOT  
MODULAR ROBOT PROGRAMMING  
AGENT-BASED MODELING AND SIMULATION FOR IOT  
PERCEPTION AND INTERACTIONS FOR IOT  
SECURITY FOR CONNECTED OBJECTS  
MOBILITY IN SMART CITIES  
ADVANCED RESEARCH PROJECTS

### Soft Skills Course List: 12 ECTS

FOREIGN LANGUAGE  
TEAM MANAGEMENT  
INNOVATION & ENTREPRENEURSHIP...

RESEARCH

**MOBILE NETWORKS, DISTRIBUTED SYSTEMS,  
EMBEDDED DEVICES, ARTIFICIAL INTELLIGENCE,  
SMART GRIDS ...**

## 2 RESEARCH DEPARTMENTS



FEMTO-ST DISC Dpt : Computer Science and Complex Systems



CIAD: Distributed Artificial Intelligence & Knowledge (EA 7533)

## 3 RESEARCH TEAMS

### AND

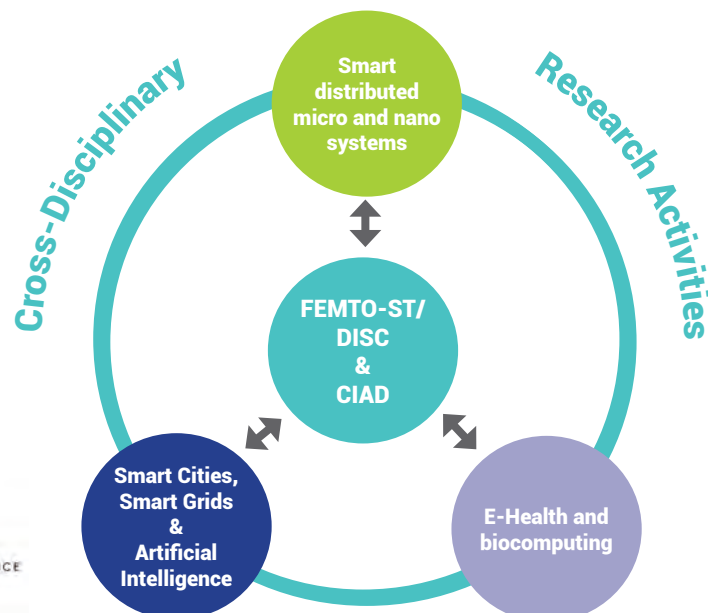
Digital simulation and grid computing  
Sensor networks, chaos and discrete dynamic systems  
Biocomputing

### OMNI

Operation research, Combinatorial Optimization, Mobility  
Modeling and Analysis, Wireless Networks, Mutliscale  
Mobile Networks, Programmable Matter

### CIAD

Artificial intelligence, multi-agent systems, representation and  
modeling of knowledge, semantic modeling, perception of the  
environment, optimization and bio-inspired algorithms, artificial  
learning



MASTER DEGREE

# COMPUTER SCIENCE

## CS Master Degree Presentation

Computer Science is an EIPHI graduate School Master focusing on Research & Innovation in the field of Software and System Engineering.

The department DISC of FEMTO-ST research laboratory is at the origin of several spin-offs by the creation of companies having created numerous R&D engineering jobs. Partnerships in European and national projects with an ecosystem of large groups provide a relevant framework to associate students of the Master's degree in Computer Science with collaborative research projects and to involve them in technological innovation processes.

Computer Science Master Students can pursue their studies with a Ph.D. in the DISC Department of Femto-St Research Lab presented thereafter.

## PROGRAM (Besançon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

The Computer Science Master degree is proposed on a Work-linked basis. For EIPHI it becomes a Research-linked training. The above EIPHI generic training program is thus not representative. The research projects and internship are done in parallel of the course load thanks to a large Distance Learning Database.

### Core Course List: 42 ECTS

COMPILATION  
GRAPH ALGORITHMS &  
COMBINATORICS  
VIRTUAL MACHINE & AGILE  
PROJECT

SOFTWARE ENGINEERING  
CYBER SECURITY  
PROGRAM EVALUATION  
RESEARCH PROJECTS

### Cross-disciplinary Course List: 12 ECTS

EMBEDDED SYSTEMS  
ADVANCED PROGRAMMING  
IOT  
REQUIREMENT ENGINEERING...

### Specialized Course List: 24 ECTS

ADVANCED DATA BASE  
ARTIFICIAL INTELLIGENCE  
FUNCTIONNAL TESTING  
MULTI-TIER ARCHITECTURE PROGRAMMING  
ADVANCED RESEARCH PROJECTS

### Soft Skills Course List: 12 ECTS

FOREIGN LANGUAGE  
TRANSVERSAL SKILLS  
COMPUTER GRAPHICS  
ENTREPRENEURIAL SKILLS...

RESEARCH

# COMPUTER SCIENCE DEPARTMENT (DISC)

MOBILE NETWORKS, DISTRIBUTED SYSTEMS, VERIFICATION AND VALIDATION OF SOFTWARE AND EMBEDDED DEVICES

## 1 RESEARCH LABORATORIES



## 4 RESEARCH TEAMS

### AND Distributed Digital Algorithms

Digital simulation and grid computing  
Sensor networks, chaos and discrete dynamic systems  
Biocomputing

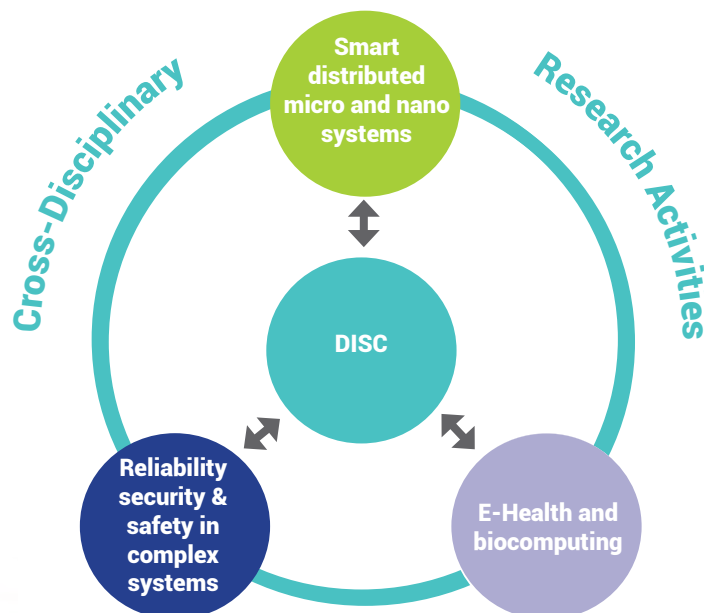
### DEODIS Design, Optimization and evaluation of shared systems

Wireless sensor networks and limited-resource systems  
Distributed algorithmics for synchronous collaborative applications  
Scheduling and optimization

### OMNI Optimization, Mobility, Networking Multiscale mobile networks

### VESONTIO Verification and validation of embedded systems software

Model-based tests; applications for safety and embedded systems  
Algorithmics for finite models; applications for verification



MASTER DEGREE

# Control & Durability of Materials CDM

## CDM Master Degree Presentation

The CDM Master is a EIPHI Master's degree in material science. The Control & Durability of Material field addresses both theoretical and applied research by covering the development, life, fatigue and recycling cycles of materials.

The training covers many industrial fields such as metallurgy, ceramics, microelectronics, nano-technologies, cement industry, glass, etc.

This master's degree is strongly supported by the ICB laboratory, and presents the major scientific breakthrough, at the experimental and industrial level in the field of materials control and characterization.

The industrial sectors is wide, going from metallurgy, nanotechnologies, chemistry, transport (automotive and aeronautics), energy, electronic, robotic, cement industry, archaeology, to restoration of historic buildings.

## PROGRAM (Dijon Campus)

Y E A R  1	Core Courses with Research Project 24 ECTS		Crossdisciplinary Courses 6 ECTS
	Core Courses with Research Project 18 ECTS	Soft Skills Courses 6 ECTS	Crossdisciplinary Courses 6 ECTS
Y E A R  2	Specialized Courses with Research Project 24 ECTS		Soft Skills Courses 6 ECTS
	Research Internship 30 ECTS		

<p><b>Core Course List: 42 ECTS</b></p> <p>SPECTROSCOPIC CHARACTERIZATION OF MATERIALS SPECTROSCOPIES POLYMER &amp; HYBRID MATERIALS LIFE &amp; LAB</p> <p>ELECTROCHEMISTRY MORPHOLOGICAL &amp; STRUCTURAL CHARACTERIZATION OF MATERIALS RESEARCH PROJECTS</p>	<p><b>Cross-disciplinary Course List: 12 ECTS</b></p> <p>PHYSICAL CHEMISTRY OF MATERIALS INORGANIC CHEMISTRY...</p>
<p><b>Specialized Course List: 24 ECTS</b></p> <p>REACTIVITY OF SOLIDS FUNCTIONALITY OF MATERIALS NANO MATERIALS ADVANCED TECHNIQUES ADVANCED RESEARCH PROJECT</p>	<p><b>Soft Skills Course List: 12 ECTS</b></p> <p>FOREIGN LANGUAGE NON-DESTRUCTIVE TESTING &amp; QUALITY PROFESSIONAL WORLD...</p>



RESEARCH

## Processes, Materials, Durability, Metallurgy, Interfaces, Nanosciences Departments

1 Research Laboratory



3 Research Departments

### Research Domains :

Adsorption & desorption processes in porous materials, separation  
Corrosion & anti-corrosion of metals and alloys, electrochemical corrosion, dry corrosion at high temperature  
Surface treatment by laser, functionalization of surfaces, thin films & coatings  
Cement & concrete science, colloids  
Powder metallurgy, sintering, ceramics  
Shaping of pharmaceutical products, hybrid nanoparticles & nanostructures including medical applications  
Development of spectroscopic techniques for surface analyses, surface science

