SCHOLARSHIPS FUNDED THROUGH THE EUREKA PROGRAM

	Research topic description
1	Green economy, Domotics, Fashion and Design, Biotechnology, Sea district, Turism and cultural assets

SCHOLARSHIP FUNDED THROUGH THE PARTNERSHIP AGREEMENT BETWEEN ANTWERPEN AND CAMERINO

	Research topic description	Area of Research and PhD Curriculum	Supervisor
1	**Multiband superfluidity and strongly correlated ground states in novel ultrathin materials.** The electrons in graphene promise new opportunities to access strong many-body electronic correlations. High quality two-dimensional electron layers and quasi-one-dimensional nanoribbons should exhibit new many-body phenomena in the range of parameters where the average Coulomb repulsions between electrons dominate over their Fermi energies. In graphene nanoribbons of few nanometres width, quantum size effects and van Hove singularities enhance electron correlations. For graphene multilayers or nanoribbons in a double unit electron-hole geometry, many-body electron-hole correlations can be made strong enough to stabilise high-temperature electron-hole superfluidity.	Science and Technology - Theoretical and experimental Physics	Neilson, Perali, Peeters

SCHOLARSHIP FUNDED THROUGH THE PARTNERSHIP AGREEMENT BETWEEN DSCHANG AND CAMERINO

	Research topic description	Area of Research and PhD Curriculum	Supervisor
1	**Identification and in vivo validation of medicinal plants traditionally used by pregnant women for prevention and cure of malaria in Cameroon** Ethnobotanical studies have allowed to identify a few hundreds of plant species traditionally employed in malaria endemic areas for the prevention and cure of the disease. However, information on which plant remedies are used in particular by women during pregnancy is extremely scarce. Identification of such plants and their validation for anti-plasmodial activity in the murine malaria model are essential first steps in view of developing effective and safe anti-malarial herbal preparations for women during pregnancy**.**	Life and Health Sciences - One Health	Annette Habluetzel, Martin Sozbe

SCHOLARSHIP IN MEMORY OF ROSANNA ALIPRANDI

	Research topic description	Area of Research and PhD Curriculum
1	**Investigation of endometrial cancer**	Life and Health Sciences - Molecular Biology and Callular Biotechnology

TWO POSITIONS reserved for the people working with or within FHNW for carrying on researches on BUSINESS INFORMATION SYSTEMS in the context of the AGREEMENT between UNIVERSITY OF CAMERINO and UNIVERSITY OF APPLIED SCIENCES AND ARTS, Nortwestern Switzerland, FHNW School of Business .

	Research topic description	Area of Research and PhD Curriculum	Supervisor
1	**Business-driven demand side management in energy market.** The power grid is challenged by the imminent changes in the energy market through an increasing share of new actors like prosumers. Prosumers does not only consume but also produce energy with help of local energy production facilities. The goal of this research is to mitigate the challenges and risks through an active, business-driven involvement of all actors in a power grid, i.e. business-driven demand side management. The system to be developed uses signals, among others price signals or flexibility signals to motivate consumers and prosumers to not only improve their own but also the surplus of the all parties.	Science and Technology - Computer science	Wache Holger
2	**Business Information Systems.** The topic aims at integrating management concepts and information technology (IT). This results in a combination of expertises which is a prerequisite to successfully develop IT solutions for business and to provide information products and services	Science and Technology - Computer science	Knut Hinkelman

RESEARCH TOPICS LIST

	Research topic description	Area of Research and PhD Curriculum	Supervisor
1	**Xenobiotics and compounds of abuse as potential causes of neurodegeneration.** The aim of the project is to dissect cellular pathways that may be affected by the assumption of xenobiotics, drugs of abuse and alcohol. Reasonably, protein quality control systems undergo a change in their functionality not only due to the fact that the level of oxidative stress increases but also because their key components may be directly altered by these molecules. Neuroinflammation needs to be explored because those compounds have been demonstrated to enhance the responsiveness of immunocompetent cells. The study will be conducted in cellular and animal models.	Life and Health Sciences - Molecular Biology and Cellular Biotechnology	Eleuteri, Ciccocioppo
2	**Advanced bioinformatics for genome and metagenome analyses with discovery of novel biocatalysts from extremophiles: implications for improving industrial bioprocesses**. Characterization of new enzymes and other molecules for industrial applications, from prokaryotic and eukaryotic microorganisms using also genomics and bioinformatics. Characterization of metabolic pathways from extremophiles, in particular Antarctic ciliates and bacteria. The PhD candidate will learn the molecular biology of ciliates and also how to use bioinformatics tools for genome and transcriptome analysis	Life and Health Sciences - Molecular Biology and Cellular Biotechnology	Sandra Pucciarelli
3	The complex cell structure of ciliated protozoa, dimorphic nuclei and fast division rate have made them very useful model organisms. Marine ciliates, particularly of the genus Euplotes, have been studied for over a hundred years and have provided significant insights into microbial ecology, endosymbiont biology, and long-term cold adaptation. Furthermore, thier unusual genome organization (e.g., a macronucleus containing single gene chromosomes amplified to thousands of copies), has been beneficial in elucidating universal principles in the biology of telomeres, transposons, chromatin and small RNAs. For the psychrophilic Antarctic species E. focardii and the mesophilic E. crassus, we plan to develop approaches of functional and comparative genomics to understand the molecular mechanisms of stress response (e.g. temperature and oxidative stress).	Life and Health Sciences - Molecular Biology and Cellular Biotechnology	Cristina Miceli
4	**Biotech-pesticides based on yeast in the control of malaria and other vector-borne diseases**. Microbial communities in arthropods have been up today discovered. Characterization of new symbionts results in important basic knowledge and suitable biotechnological applications. The objectives of the research topic are the application of molecular methods for studying microbial communities and their possible use to interfere with the development of pathogens within the insect vectors. Engineering of symbiotic yeasts to combat the malaria parasites in the mosquito can be considered as a very intriguing paradigm for vector-borne disease control. The aims of upcoming information are the development of molecular methods applicable for in field based on innovative symbiotic control strategies as paratrangenesis.	Life and Health Sciences - Molecular Biology and Cellular Biotechnology	Irene Ricci

5	**Molecular epidemiology and genetic characterization of bacteria and viruses relevant to human and animal health at the interface of domestic animals and wildlife.** The aim of the project is to investigate the molecular epidemiology and to type genetically the main bacteria and viruses infecting wild animals, game animals, and free-range animals. Results will contribute to the risk assessment of animal-to animal and animal-to-human transmission of infectious diseases at the interface of domestic animals and wildlife.	Life and Health Sciences - One Health	Silvia Preziuso
6	**Innovative diagnostic and therapeutic approaches in veterinary clinic**	Life and Health Sciences - One Health	Andrea Spaterna
7	**Re-evaluation of neurotransmission-enhancing strategies for treating adult-onset cognitive disorders.** Adult-onset cognitive disorders are characterized by impairment of several neurotransmission systems. Older approaches for treating these disorders were represented by strategies for enhancing deficient neurotransmitter systems, but the results obtained were not always positive. The project intends to re-evaluate strategies for enhancing neurotransmitter systems in adult-onset cognitive disorders using microanatomical, neuropsychological and neuroimaging techniques.	Life and Health Sciences - One Health	Francesco Amenta
8	**ICT solutions for improving the quality of care to remote patients.** Medical assistance of people living in remote and/or poorly served areas represents a challenge for medicine. The project intends to develop innovative ICT and telemedicine solutions for improving the quality of assistance of people living in isolated and/or poorly served areas. Development of electronic health records, identification of innovative technological solutions and standardization of approaches of delivery medical/health assistance in favour or remote patients will represent the core of the project.	Life and Health Sciences - One Health	Francesco Amenta
9	**Intestinal microbiome of poultry and its interaction with host, diet, and pathology.** The aim is to verify the role of the chicken's microbiome to modulate the immune response influencing TLRs expression, T regulatory cells stimulation and metabolic profile (NEFA production and liver metabolism) in healthy animals and affected by bacterial and parasitic chronic diseases**.**	Life and Health Sciences - One Health	Giacomo Rossi
10	**Design of anti-malarial, transmission blocking drug combinations based on limonoid molecules isolated from Azadirachta indica and currently used artemisinin based combination therapies.** The currently employed artemisinin combination therapies (ACT) are highly effective against the asexual blood forms of Plasmodium spp, but their action on the sexual stages responsible for parasite transmission to the mosquito vector is limited. Based on the knowledge available regarding the effects of specific limonoid molecules on gametocytes and early sporogonic stages, the development of limonoid-ACTs exhibiting improved transmission blocking activity appears feasible. Combinations, including molecules with different activity profiles allow to reduce the risk of P. falciparum strains developing resistance to artemisinin.	Life and Health Sciences - One Health	Habluetzel, Christophides

11	**Characterization of limbic system activity associated with maladaptive neuronal response following protracted exposure to drugs of abuse** The research of our laboratory is mainly focused on the study of the neurobiological basis of abnormal behavioral and brain functions relevant to human psychopathology with emphasis on drug addiction and eating disorders. The majority of this work is directed at the understanding the neurological mechanisms responsible for these aberrant behaviours and at identifying innovative pharmacological targets to aid the development of new more effective treatments. Attention is also dedicated to the study of neurocircuitry and molecular mechanisms controlling emotional and cognitive disturbances associated with protracted exposure to drugs of abuse or chronic stress.We utilize rodents self-administration assays to assess the reinforcing, motivational and drug-seeking effects of psychostimulats, opioids and alcohol, molecular biology and immunohistochemical techniques to assess cellular effects. We also aim to use Designer Receptors Exclusively Activated by Designer Drugs (DREADD) to explore at neurocircuitry level the consequence of protracted exposure to drugs of abuse and to study how manipulation of circuitries involved in the regulation of motivated behavior and emotion modulates seeking and taking responses for drugs of abuse as compared to natural reinforcers. We are seeking a highly motivated candidate, experience in in vitro electrophysiology although not required is highly appreciated.	Chemical and Pharmaceutical Sciences - Pharmaceutical Sciences	Roberto Ciccocioppo
12	**Development of biodegradable NPs as vaccine adjuvants and delivery systems.** Objectives: To optimise the PLGA platform by modification of hydrophobic / hydrophilic properties, charge density, biodegradation rate and molecular weight. Expected Results: Optimised PLGA NPs made functional as a vaccine adjuvant.	Chemical and Pharmaceutical Sciences - Pharmaceutical Sciences	Di Martino (MSC H2020 Grant)
13	**Espresso Coffee preparation: analytical study to improve quality of the product**. The activity of PhD candidate will be related mainly to analysis of constituents of Espresso Coffee (EC), to set up new or improved methods of EC preparation with the Espresso Machine, with the aim at improving quality and taste of EC. This will be performed through the use of analytical instruments, like GC-MS, HPLC-DAD-MS, etc	Chemical and Pharmaceutical Sciences - Pharmaceutical Sciences	Sauro Vittori
14	**Synthesis and characterization of the impurities as unwanted chemicals that remain in the active pharmaceutical ingredients (APIs)** The connections between organic chemistry and the study, the research and the development of APIs are very important and fundamental for the present and the future of the pharmaceutical industries. In fact, the targets for the innovations will be not only the discover of new molecules, but also the improvement, like in the purity, of the just existent drugs, to give in the market products with the most possible high quality. In these fields the organic chemistry and the future of organic chemist will be necessary and fundamental. Clearly this is a very difficult task, sometimes more difficult than the synthesis of the main component being the impurity by nature a by-product of an inefficient process relative to the API.	Chemical and Pharmaceutical Sciences - Chemical Sciences	Enrico Marcantoni
15	**Mesoporous Silica Nanoparticles as Smart Vehicles for Antitumoral Target Therapy**	Chemical and Pharmaceutical Sciences - Chemical Sciences	Maura Pellei
16	**New therapeutic approaches for treatment of Gliomas: metal-based drugs in association with conventional drugs and innovative radiant therapies. Study in vitro and in vivo**	Chemical and Pharmaceutical Sciences - Chemical Sciences	Carlo Santini
17	**Mantle dynamics in the Red Sea ï Afar region** This research program has the objective of constructing a new upper mantle circulation model for the Red Sea ï Afar zone, which incorporates plate kinematics constraints, a realistic lithosphereï astenosphere boundary, and geological/geochemical data. The PhD candidate should have a strong background in physics or mathematics and some skills in geochemistry and petrology.	Science and Technology - Physical and chemical processes in Earth systems	Antonio Schettino

18	**Geomorphological analysis and use of numerical models for characterizing the hydrological properties of cultivated soils and the short-term/long-term evolution of agricultural catchments.** The goal of this research topic is to analyze the evolutionary trend (soil erosion, runoff, water consumption) in small catchments characterized by intense agricultural practices. It aims at: - evaluating past erosion rates and changes in the geomorphological dynamics of the slopes occurred over the past 50 years; - evaluating, also through numerical models, current erosion rates and assuming future evolutive scenarios; - evaluate, by means of in situ measurements and indirect methods, the infiltration capacity of cultivated soils; - evaluating the role of different cultivation techniques and different crops in the progressive soil sealing observed in recent decades; - checking the efficiency of traditional remedial interventions on the slopes; - proposing alternative intervention aimed at soil conservation and at the rational use of water resources; - proposing measures aimed at reduction of the hydrogeological hazard on the slopes and along the river beds. The project will focus on the investigation of neurobiological mechanisms responsible for development of drug abuse combining approaches from various disciplines, including behavioral pharmacology, molecular biology and electrophysiology. The candidate will explore, at preclinical level, new mechanisms for development of innovative pharmacotherapeutic approaches to drug abuse.	Science and Technology - Physical and chemical processes in Earth systems	Marco Materazzi
19	**Archaeogeophysics of Roman and Hellenistic sites around the Adriatic Sea.** This topic requires nearï surface geophysical prospecting of archaeological sites, as well as data analysis and interpretation in terms of urban organization of the seattlements. In particular the PhD student will perform magnetic, electromagnetic, and magnetic susceptibility prospections and will use advanced software tools for the analysis of the raw data (e.g., Oasis Montaj and GPRï Slice). He/she will also perform postï excavation stratigraphic analyses and a study of the geological background of the study areas.	Science and Technology - Physical and chemical processes in Earth systems	Pietro Paolo Pierantoni
20	**Espresso Coffee preparation: set-up of an algorithm to predict the quality of Espresso Coffee changing Espresso machine parameters**. The activity of PhD candidate will be related mainly to study and assemble different parameters (analytical, physical, mechanical) of Espresso Coffee (EC) and Espresso machine, to set up an algorithm able to predict the quality of EC when those parameters are changed	Science and Technology - Theoretical and experimental physics	Marini Bettolo, Gunnella
21	**Polarized Fermi gases throughout the BCS-BEC crossover.** Polarized Fermi gases are of wide interest in different branches of physics, ranging from elementary particles to condensed matter. Interest in polarized Fermi gases has been revived recently by experiments with ultra-cold Fermi gases. Goal of the present Ph.D. project will be the calculation of the phase diagram (temperature vs polarization) of a polarized Fermi gas throughout the BCS-BEC crossovers and the comparison of the theoretical results with the experimental data obtained with ultra-cold Fermi atoms.	Science and Technology - Theoretical and experimental physics	Calvanese Strinati, Pieri
22	**Interactive simulations for Physics education.** The project is related to the work of the PLS ï Progetto Nazionale di Fisica, a network of 35 Italian universities led by the University of Catania. The overall aim of the project is to design, develop and validate a range of new interactive simulations in modern physics (quantum mechanics, atomic physics, é). The simulations will integrate and support more traditional teaching approaches at the university level, but may also serve for training of perspective and in service high school teachers. The PhD studentship will be based at the Physics Division of the University of Camerino, in Camerino (Italy).	Science and Technology - Theoretical and experimental physics	Irene Marzoli

23	**Phase transitions in amorphous and liquid systems at high pressure and temperature.** The behavior of polymorphic materials under pressure is a field of research having strong implications in basic and applied science. Unusual and interesting phenomena, such as pressure-induced polyamorphism, pressure-induced amorphization or nucleation of crystalline seeds, existence of low and high-density glasses (insulating and metallic), and the dynamics of pressure-induced crystallization/amorphization are not fully understood. Goal of the present Ph.D. project is to study with in-situ synchrotron radiation and optical techniques (Raman) a class of polymorphic systems where the interplay between covalent and metallic bonding is particularly important.	Science and Technology - Theoretical and experimental physics	Andrea Di Cicco, Francois Baudelet
24	**Advanced and formal techniques for development of smart, software-intensive and distributed systems**	Science and Technology - Computer science	Flavio Corradini
25	**RNA as a complex system machinery**	Science and Technology - Computer science	Merelli, Pettini (Aix Marseille Univ.)
26	**Design and implementation of energy efficient of Internet of Things applications**	Science and Technology - Computer science	Leonardo Mostarda
27	**Design and implementation of collaborative platform**. Study of the architecture of a flexible, adaptable, collaborative and interoperable SW platform, to be used for the realization of various control systems and industrial applications	Science and Technology - Computer science	Andrea Polini
28	**Methods and languages for the development of smart, software-intensive, complex and distributed systems.** **Methods and formal languages for complex systems**; Main research objectives : 1. Define methods and languages , data-driven , for the iden□fica□on of emerging phenomena 2. Define linguistic abstractions for domain applications 3. Using the computational and algebraic topology for the definition of a language of forms. **Analysis and verification of distributed systems** Main research objectives : 1. Define a methodology for the development and verification of distributed pervasive systems , in particular sensor networks 2. Provide analysis tools and languages for developing control policies 3. Define testing techniques for service-oriented systems 4. Development of network protocols with the possible application of security techniques	Science and Technology - Computer science	Flavio Corradini (Related projects: PACO (PRIN), CINA (PRIN 2010) , RITMARE (IT-FLAGSHIP), TOPDRIM (EU-FP7-FET_PROACTIVE), SINERGY (L.I.L.T), Action IC1405-Reversible (EU-COST) and : LITBIO (FIRB), OCP(SmartCities) , JADE (EU-FP7-ICT), Choreos (EU-FP7-ICT), PRESTO (ARTEMIS), AALISABETH (Marche Region), PASS (Marche Region)

29	**Knowledge Representation and Reasoning in Security and Argumentation fields.** Knowledge Representation is a wide area inside Artificial Intelligence. The proposed research activity plan to use Argumentation technologies to cover aspect of economics, security and computational challenges. In particular some problem we aim to investigate will be: • Computational models of Abstract Argumentation: This field has acquired more and more importance in the last years. Solvers performance depends on many different factors, also related to the topology of the considered Abstract Argumentation Framework. The work of the Ph.D. candidate will be oriented to designing and coding novel heuristics to tackle the complexity of different problems related to Argumentation, as the enumeration of extensions or checking the credulous/skeptical acceptance of single arguments. The new heuristics, for instance exploiting the symmetries in solutions, will be embedded into an already existing constraint-based tool, or will require the development of a brand-new tool. • Robustness in Abstract Argumentation: we consider it as the property of an argumentation graph to withstand changes in terms of classical extension-based semantics. The robustness of a graph, with respect to a given semantics, is measured by computing the number of changes (e.g., the number of attacks to be removed/added) needed to change an extension. The resistance to change will be analysed and compared with the resistance to change in belief revision, and the "unchangeable" sub-graphs of the frameworks will be characterised with the purpose to identify the strong "clusters" of a debate. All the obtained results will be implemented in a tool. • Argumentation tools for bitcoins transactions visualization: In 2008 Satoshi Nakamoto released the white paper describing Bitcoin, an open-source and peer-to-peer digital currency. The Bitcoin network is completely decentralised: buyers and sellers interact directly, even if their real identities are encrypted. All the transactions are recorded in a public ledger: the "block-chain". The goal of this research topic is to investigate the flow of transactions by mining the block-chain. Such search will be focused on discovering MixNets, which are services that are used to confuse the trail back to the transactions original source. MixNets can also be used to hide the transactions related to illegal activities (e.g., purchase of drugs or weapons).	Science and Technology - Computer science	Flavio Corradini
30	**New and old Issues of Intellectual Property and Copyright.** The work deals with the legal problems of trademarks and signs on several fronts, from historical perspectives to nowadays issues of Copyright and Intellectual property	Legal and Social Sciences - Fundamental Rights in the Global Society	Carlotta Latini
31	**Training, Job Market and Human Rights.** 1) Human Rights 2) Non-profit organizations. Social Inclusion and Job Market 3) The Welfare System between Public and Private-social Sector	Legal and Social Sciences - Fundamental Rights in the Global Society	Paolo Bianchi, Sara Spuntarelli
32	**Criminal justice and Human Rights.** Global developments of criminal law and criminal procedure	Legal and Social Sciences - Fundamental Rights in the Global Society	Maria Lucia Di Bitonto
33	**Constitutional Norms and Civil Law Relationships.** The main aims of this research is to re-read the civil code and statutes in the light of the Italian Constitution and to make private relationships functional to the values that mould the whole legal system. The Republican Constitution introduce a new kind of legality which is direct to respect also European and International Principles. The research covers all areas of Civil Law such as contracts, torts, property, family law, rights of Succession and analyses domestic, European and International test cases or doctrines. The central issue of the research is to demonstrate that the free development of the human person is superior to any concurrent economic interest. A very special interest will be in research focused on the human rights in the Market Place.	Legal and Social Sciences - Civil Law and Constitutional Legality	Lucia Ruggeri

34	**Freedom of Contract and Alternative Disputes Resolution.** The aim of this research is to analyses how the freedom of contract is useful to resolve a civil disputes. The UE implemented several kinds of Alternative Disputes Resolutions (ADR) in every field of Civil Law. Nowadays professionals and consumers are free to select an ADR techniques and this freedom will be studied in the light of domestic, European and International rules. A specific issue of this research is to study terms and conditions used in ADR or On Line Disputes procedures.	Legal and Social Sciences - Civil Law and Constitutional Legality	Rocco Favale
35	**Structural dynamics and control.** The topic concerns methods and tools for the control of the dynamic response of engineering structural systems, with a special attention to the structural behaviour under extreme events involving dynamic actions, e.g. earthquakes, hurricanes and so on. Investigations may be focused on analytical formulations of the problems, numerical methods and computational issues, applicative results and design methods. The knowledge of the structural mechanics fundamentals is required.	Science and Technology - Computer science	Andrea Dall'Asta
36	**Field approaches in Malaria and Zika Symbiotic Control** - The objective of the research topic is the transfer of lab practices to filed application of symbiont-based approaches to contrast malaria and Zika infections. The research work will be partially performed in Italy and partially in Brazil to investigate the mosquito community and its associated microbiota through molecular methods with particular reference to Next Generation Sequencing. Further, the isolation of paratransgenic candidate(s) and their proper manipulation, in field test to validate symbiont(s) transmission routes can be performed in selected area in Brasil.	Life and Health Sciences - One Health	Favia, Ricci, Ribolla
37	**Design, synthesis and characterization of new ligands of receptors involved in neuroinflammation and neurodegeneration.** This research topic is focused on the design, synthesis and characterization of new ligands, which behave as agonists and antagonists of various class of receptors, involved in neuroinflammation and neurodegeneration. The new molecules will be evaluated in in vitro and ex vivo studies at receptors expressed by specific cell lines or present in animal tissues	Chemical and Pharmaceutical Sciences - Pharmaceutical Sciences	Volpini, Marucci
38	**Design, synthesis and characterization of nucleosides, nucleotides and heterocyclic molecules antitumor and antibacterial drugs and enzyme inhibitors**.The project concerns the design, synthesis and characterization of nucleosides, nucleotides and heterocyclic molecules as potential antitumor and antibacterial drugs and enzyme inhibitors. Moreover, molecular modelling studies will allow the molecular analysis of the targets, simulation of ligand-target interaction, design and optimization of ligands, and finally in vitro and ex vivo studies for the biological evaluation of synthesized compounds.	Chemical and Pharmaceutical Sciences - Pharmaceutical Sciences	Volpini, Cappellacci, Quaglia
39	**Environmentally friend tanning technologies.** Currently the tanning techniques for leather destined to the footwear industry are based on the use of salts of chromium (III). Any subsequent oxidation to Cr(VI) can determine the non-utilization of the skin. In addition, the consumer perceives the chromium negatively. Currently alternative tanning processes are available, based on natural products or on synthesis chromium-free; unfortunately, to date, the skins produced in this way do not have mechanical characteristics suitable for their use in the manufacture of shoes. We intend to study the whole tanning process, from raw hide to wet blue, trying to replace the chromium with metals more "green" or, hopefully, be able to obtain a tanning "metal-free" with a final product that has mechanical properties such as to be suitable for the footwear industry.	Chemical and Pharmaceutical Sciences - Chemical Sciences	Silvia Zamponi

40	**Agent-Based Macroeconomics: Nonlinearities and Learning**. Economic behavior of communities of mutually interacting agents endowed with bounded rationality is a current research subject, hoped to help overcome the limitations of the currently used neoclassical paradigm, in which agents are assumed to be perfectly rational and possessing unbounded computation ability. A main feature of the neoclassical paradigm is the existence of economic equilibria, on which price theories can be built. Such a paradigm is often used in financial economics to study financial markets, where agents model trading entities, or banking systems in which banks interact with each other and with a central bank, or bank-firm credit systems. Yet, solely using the neoclassical paradigm it is very difficult to explain macro and otherwise aggregated phenomena like crises, herding behavior, financial contagion, firm credit fragility, or even situations in which equilibrium is not reached at all. And, without explanation capacity, it is impossible to govern real world financial and economic systems. Possible approaches alternative to the neoclassical frame are 1) that of directly using nonlinear dynamical system theory, deterministic or stochastic, to directly model macroeconomic quantities (an approach started in the '30s); or 2) that of using dynamic network theory (a very recent, open research topic); or 3) that of using a frame in which agents are modeled as highly structured interacting decisors, which decide using decision theory algorithms like neural networks or other machine learning devices, in order to mime human higher cognitive features like bounded rationality, attention, memory, instincts and emotion. In the second and third case, emerging behavior (i.e. the often unexpected macro outcomes of the assumed micro dynamics) and calibration (i.e. the quantitative problem of matching real world phenomenology with system mathematical parameters) are crucial issues, difficult to study. The application of these three approaches to some selected economic systems (for example equity, bond, derivative, structured finance or commodity markets, banking systems, credit systems, energy systems) is the core of this proposed PhD project, in which sophisticated mathematics and complex numeric techniques are applied to the fields of finance and economics, in relation with contemporary and compelling research issues of broad and deep social interest.	Science and Technology - Mathematics	Carlo Lucheroni