Winter Doctoral Day Preliminary Program – 13th February 2026
Morning Session

Date and time: 8:50. Friday 13th February.
Venue: Facultad de Matemáticas. Sala de Grados. 2ª Planta

08:50-09:00 - Welcome

Antonio Prados Montaño, Academic Program Coordinator, Universidad de Sevilla

09:00-10:00 Opening Talk. Dr. Anders Olof Möller. Manager for R&D within the DEKRA Cybersecurity Hub (Málaga)

Presenting: Iluminada Baturone, Dept. Electrónica y Electromagnetismo.

10:00-14.20. – Students talks

Anders Olof Möller
Manager for R&D within the DEKRA Cybersecurity Hub (Málaga)

How to develop a lab for cybersecurity evaluations of chips?

Abstract:

In this talk we will explore how a PhD can serve to provide possibilities to a career with interesting research positions in industry and beyond academic research, based on my own experiences. The main focus of the talk will concern my latest challenge, developing a laboratory for cybersecurity testing of chips.

We will present the context of cybersecurity for chips, what is special about this technical domain, and why it has become so important for security in a larger context. Cybersecurity of chips is by nature multidisciplinary, including required expertise in the areas of cybersecurity, microelectronics, embedded systems, but also telecommunications, physics and mathematics. This is reflected in the required testing capabilities, that include of attack types ranging from logical software attacks, the usage of laser and electromagnetic pulses to induce faults affecting critical security operations (fault injection attacks), sensitive measurements of emanations to exploit leakage of sensitive assets (side-channel attacks), and applying physical attacks for reading or modifying the internal information of the chip.

Different challenges and experiences of this unique project will be explored and related to the experience and importance of doctorate training, continuous learning, interdisciplinary teams, collaboration and the practical application of academic research to solve real-world problems.

Anders Olof Möller, short CV:

Anders Olof Möller, PhD, is a senior security specialist and R&D manager in the Global DEKRA Cybersecurity Hub, based in Málaga, Spain. He received a master´s degree in applied physics and electrical engineering from Linköping University, Sweden, during which he spent one year at the Technische Universität München, Germany, and one at ETSIT Polytechnical University of Madrid, Spain. He completed his master thesis with honors and received the best student award. After graduating, he continued at KTH Royal Institute of Technology, Stockholm, Sweden, with a PhD in applied mathematics, specializing in optimization and systems theory and with a thesis on power control of wireless networks in collaboration with Ericsson.

After finishing his PhD, he worked ten years as a security specialist and manager in the Swedish Armed Forces and Swedish National Communication Security Authority. In 2022, he joined DEKRA, where he is leading the operations and development of a new cybersecurity laboratory for evaluations of semiconductors, which in short time has become one of the main laboratories globally for security evaluations of chips in the automotive and IoT domain and the first laboratory to evaluate up to the highest security level of this domain. Anders has a broad expertise in several security topics, including security evaluation of communication systems and of integrated circuits, side-channel analysis, fault-injection attacks and cryptography. He presents regularly at main cybersecurity conferences in the area of certification, such as Mobile World Congress, ICCC, CyberSec, EU Cyber Acts and participates in several technical working groups of security and certification.

Morning session

Venue: Facultad de Matemáticas. Sala de Grados. 2ª Planta

8:50 – 9:00	Welcome Opening talk
9:00 – 10:00	Anders Olof Möller
	STUDENTS PRESENTATION
10:00 – 10:20	Ceballos Caceres, Joaquin
10:20 – 10:40	Lyu, Yanjin
10:40 – 11:00	Navarro Torrero, Pablo
11:00 – 11:20	Nuñez Valdes, Juan
11:20 – 11:40	Rodriguez Sanchez, Juan Manuel
11:40 – 12:10	COFFEE BREAK
12:10 – 12:30	Chamorro Burgos, Miguel Angel
12:30 – 12:50	Auñon Fernandez, Gabriel
12:50 – 13:10	Delgado Lozano, Ignacio Maria
13:10 – 13:30	Hidalgo Zamora, Francisco Javier
13:30 – 13:50	Pinheiro Carneiro, Brenda
13:50 – 14:10	*FLASH TALKS*

Abstracts Students' presentations

LONG TALKS

10:00 – 10:20 **Ceballos Caceres, Joaquin**

ASICs for the Measurement of the Martian Wind

In this talk, we will present the architecture of the mixed-signal front-end integrated circuit designed and fabricated in CMOS technology for the wind sensor on NASA's Mars Rover, Perseverance. A brief overview of the sensors and operating principles of the measurement system will be given. We will also describe the strategies implemented to meet the mission's temperature range requirements and the Radiation-Hard By Design (RHBD) techniques used. The presentation will cover the formal steps required for a design to meet the quality standards of NASA's Jet Propulsion Laboratory, the organisation responsible for the mission. Finally, we will summarise the lessons learned during the mission development.

10:20 – 10:40 **Lyu, Yanjin**

A 91.4-dB SNDR 2-MS/s 18-bit SAR ADC with Enhanced Optimal-Combination-Algorithm-Based Calibration

I am going to present a 2-MS/s 18-bit successive-approximation-register analog-to-digital converter (ADC). A capacitor digital-to-analog converter (CDAC) and a resistor digital-to-analog converter (RDAC) are cascaded to avoid the linearity limitation caused by parasitic capacitors on the bridge capacitor between the CDAC and the RDAC. An optimal-combination-algorithm (OCA)-based calibration is adopted to improve the linearity of the CDAC and the matching between CDAC and the bridge capacitor, and a least significant bit (LSB)-side dynamic element matching (DEM) strategy is applied to further improve the CDAC linearity. As for the RDAC, this work makes it calibration free by combining the parallel R-unit and R-2R topology. Measurement results show that the proposed ADC can achieve 91.4-dB signal-to-noise and distortion ratio (SNDR), 12.0-parts-per-million (ppm) (3.1-LSB) integral non-linearity (INL), and 174.0-dB FOM (including the power consumed by the calibration logic), and the worst-case INL across 25 dies improves from 72.5 ppm (19.0 LSB) to 18.8 ppm (4.9 LSB) after the OCA-based calibration and the LSB-side DEM. To the best of my knowledge, this is the first high-precision (resolution ≥ 16 bit) data converter adopting OCA-based calibration

10:40 – 11:00 **Navarro Torrero, Pablo**

Hardware Optimizations for Elliptic Curve Cryptography

Elliptic Curve Cryptography (ECC) is a fundamental pillar of modern information security, offering high security with reduced key sizes. This talk provides a deep dive into the mathematical foundations and hardware implementation strategies required for high-performance ECC. We begin by defining the underlying mathematics, including curve parameters, group operations, and isogenies, explaining how the Discrete Logarithm Problem (DLP) underpins cryptographic security. Special attention is given to the implementation of the widely adopted curve Ed25519. The presentation is structured around the arithmetic hierarchy of ECC, moving from low-level finite field operations, modular multiplication, exponentiation, and inversion, to high-level functions such as point addition and scalar multiplication. For each conceptual layer, specific hardware optimizations are examined to reduce latency and area usage while maximizing throughput. By bridging the gap between abstract algebra and physical circuit design, this talk illustrates how theoretical mathematics is effectively realized to secure our digital world.

11:00 – 11:20 **Nuñez Valdes, Juan**

Contributions to physics of the first Spanish female graduates

This talk shows a brief summary of the doctoral thesis that the doctoral candidate wishes to submit to obtain a PhD in Physics from the University of Seville. This thesis has two main objectives. The first is to present to society comprehensive biographies of women who have marked a milestone in the history of Spanish physics since its beginnings, contributing through their professional work, primarily focused on teaching and research, to the remarkable development of this discipline today. The second objective is to also contribute to current efforts in society to promote gender equality by showcasing these women as role models for others. The methodology employed involved gathering information on pioneering women in Spanish physics from oral and written sources. The thesis aims to present the biographies of between 100 and 150 Spanish female physicists who, as mentioned above, along with their male colleagues, laid the foundations for the remarkable development of Spanish physics today.

11:20 – 11:40 **Rodriguez Sanchez, Juan Manuel**

Design Challenges in Deep Submicron CMOS for High-Speed Data Converters

As CMOS technology scales into deep-submicron regimes, the design of high-speed analog and mixed-signal circuits becomes increasingly complex. This presentation examines the implications of technology scaling on the realization of high-performance analog-to-digital converters (ADCs), with emphasis on SAR-pipelined architectures for multi-gigabit communication systems. While advanced CMOS nodes enable higher speed and integration density, they also introduce major challenges, including reduced intrinsic gain, increased device mismatch, lower supply voltages, and overall degradation of analog performance. These limitations complicate the design of key ADC building blocks such as comparators, reference buffers, and capacitor arrays, which are critical for achieving high resolution and sampling rates. In addition, tighter timing requirements and clock distribution issues arise at high operating speeds, particularly in time-interleaved ADCs for direct RF sampling. The talk discusses how these technology-driven constraints affect system-level architectural decisions and necessitate careful trade-offs among speed, power consumption, linearity, and area to meet the demands of next-generation high-data-rate standards.

Coffee break

12:10 – 12:30 **Chamorro Burgos, Miguel Angel**

Capilar multipole particle rotation inside an interface

This work is a theory-experiment collaboration between the statistical mechanics group of FAMN department of US and the Soft Materials and Interfaces of the ETH Zürich. The shape of a fluid interface depends on how it pins at the boundary of a particle trapped inside it. When the interface shape is distorted externally, the particle rotates and migrates as the interface looks for an energy minimum. We are able to characterize particles with different pinning patterns by measuring interfacial height. Then, as we prove that rotation motion happens on a much quicker timescale than migration in our system, our model can predict the angular evolution after the external distortion, which we successfully compare with experimental tracking of the particle rotation.

12:30 – 12:50 **Auñon Fernandez, Gabriel**

"Neutrons from (α,n) reactions are crucial for astrophysics, dark-matter searches, and nuclear-material analysis, yet existing cross-section and yield data remain scarce and uncertain. To address this, the Spanish nuclear physics community has launched the MANY Collaboration (Measurement of Alpha Neutron Yields). At CNA, the 3 MV tandem accelerator delivers alpha beams up to 9 MeV: in continuous mode (up to 500 nA with the ALPHATROSS source) for activation and neutron counting, or in pulsed mode (2% duty cycle) for time-of-flight studies. Major upgrades at the CNA-HiSPANoS neutron beam line are enhancing its capabilities. A newly installed buncher improves the pulsed-beam time structure, enabling more precise time-of-flight measurements. A high-intensity He^{2+} ion source (NEC-TORVIS) has been acquired and is expected to boost beam current by an order of magnitude. In addition, a new EJ-309 fast-neutron detector array will increase detection efficiency and angular coverage.
An innovative method for beam-current determination in non-conductive or gaseous targets uses aluminum alloys: with an AlN target, the 14N(α,n) reaction can be measured relative to the well-known 27Al(α,n)30P reaction, allowing reliable Thick Target Yield measurements.
This contribution will present final 27Al(α,n) results, preliminary 14N(α,n) data, and commissioning of the new buncher, along with upcoming upgrades".

12:50 – 13:10 **Delgado Lozano, Ignacio Maria**

A microstrip filtenna design and its application to the design of a linear dual-polarized diplexing antenna

This talk describes the design procedure of a "filtenna" (filtering antenna). The "filtenna" is conceived as a third order filter consisting of two open ring resonators which are coupled to a resonant radiating patch through an aperture. The radiating patch behaves as the third resonator of the filter. The "filtenna" is used as the building block of a dual-polarization diplexing antenna. In particular, four pairs of coupled open ring resonators are connected to two radiating microstrip patches. Two of the pairs of coupled rings excite the radiation of the two patches in horizontal linear polarization at two different bands, while the other two pairs excite the vertical linear polarization at those bands. One of the patches radiates at a center frequency of 5.5 GHz, while the other patch radiates at a center frequency of 3.5 GHz. The diplexing antenna shows a fractional bandwidth of roughly 6.5% in both bands for both polarizations with sharp frequency selectivity, gain values larger than 7 dBi and cross-polar radiation levels below -18 dB

13:10 – 13:30 **Hidalgo Zamora, Francisco Javier**

Design of a Dual-Band Polarization Selective Surface

This work introduces a procedure to design a novel third-order dual-band polarization selective surface (PSS). The PSS is a multilayered structure consisting of five metallic layers alternating with four dielectric layers in which periodic arrays of metallic patches and apertures alternate. In the lower band, the designed PSS enables the transmission of only the polarization along the x axis while rejecting the orthogonal linear polarization. In the upper band, the polarization along the y axis is the only one being transmitted. First, the dimensions of the PSS along each axis are adjusted independently by using two separate third order filtering equivalent circuits. Secondly, a joint optimization polishes the FSSs response simultaneously in both bands. A final design is presented in which the lower band for the polarization along the x axis has a center frequency of 7 GHz with a bandwidth of 20 %, and the upper band for the polarization along the y axis has a center frequency of 12.6 GHz with a bandwidth of 31 %, the minimum polarization isolation being of 20 dB. The response of the PSS in both bands is stable for incidence angles up to 30 degrees with respect to the normal incidence direction

13:30 – 13:50 **Pinheiro Carneiro, Brenda**

Unusual cluster structure in 6Li+

The nucleus 6Li is commonly described as a 4He+2H cluster system, although alternative configurations such as 3H+3He have been proposed. In this work, we investigate the relevance of the 3H+3He component in 6Li through transfer reaction calculations for the 6Li+89Y system. The results show that this cluster component has a negligible impact on the transfer observables for the 6Li+89Y system. In contrast, preliminary calculations for the 6Li+16O system suggest that the 3H+3He configuration may become more relevant in reactions involving lighter targets.

FLASH TALKS

13:50 – 13:55 **Pliego Padilla, Mario**

Bridging the Analog World and Digital Intelligence: Optimizing A/D and D/A Converter Trade-offs

Real life is analog: sound, light, biomedical signals, and radio waves are all continuous-time, continuous-amplitude phenomena. Yet the most powerful processing (compression, machine learning, control, communication, and calibration) happens in the digital domain. A/D and D/A converters are the essential interface that makes this connection possible, translating between physical reality and digital intelligence. In this flash talk, I will motivate why data converters are not "just a sub-block," but often the performance bottleneck (and the enabler) of complete systems. Their design is defined by trade-offs: some applications demand high resolution and low distortion (e.g., instrumentation), others demand extreme speed and bandwidth (e.g., wireless and high-speed links). At the same time, practical constraints such as area, power consumption, noise, linearity, and robustness limit what can be achieved. My Ph.D. research focuses on understanding and mitigating these limiting effects to push the best possible balance among resolution, speed, power, distortion, and size, so that the converter is optimized for the system requirements rather than becoming the system constraint.

13:55 – 14:00 **de la Calle Martos, Antonio**

Design of a Low-Power, Low-Noise and High Dynamic Range Event-Based CMOS Image Sensor

This talk presents the design of a bio-inspired event-based vision sensor, optimized for low noise, low power consumption and high dynamic range. The core of this work consists of the adaptation and integration of a specialized pixel topology, originally conceived by the National Tsing Hua University (NTHU) in Taiwan, into the Asynchronous Event Representation (AER) framework. By interfacing NTHU's low power and HDR pixel design with the AER protocol—the communication standard first described by Misha Mahowald in 1992 and further evolved at the Institute of Neuroinformatics (INI) in Zürich. The practical optimization and architectural bridging of this infrastructure have been spearheaded by the Institute of Microelectronics of Seville (IMSE-CNM), leveraging their position as global leaders in AER technology.

14:00 – 14:05 **Torres Muñoz, Carmen**

Determination of the Relative Defect Density in Semiconductors Using SPA-TCT and TPA-TCT Method

This work was carried out during a three-month research stay at CERN and focuses on the study of radiation-induced defects in silicon detectors. The devices were irradiated in Seville to introduce controlled damage, and subsequently characterized at CERN using laser-based techniques. The results show that these methods are sensitive to defect density variations above certain thresholds and provide complementary information, demonstrating their suitability for the characterization of irradiated semiconductor detectors.

14:05 - 14:10 **Reyner Viñolas, Alex**

Modulation of fast-ion losses by external magnetic perturbation fields in the ASDEX Upgrade tokamak

Fast ions (FI), whether generated by fusion reactions or through auxiliary heating systems, play a key role in magnetically confined plasma devices. Their confinement is essential, as lost fast ions cease to contribute to plasma heating and may cause damage upon striking the vessel wall and plasma facing components. Understanding the interaction of the fast ion populations with plasma instabilities to ensure the FI confinement is critical for long and maintained operation in a future fusion power plant.
Experiments involving external magnetic perturbation fields (RMPs), which help mitigate Edge Localized modes (ELMs) are being performed to develop control techniques of fast ions to improve their confinement. Results show a huge impact of RMPs over ICRH fast-ions and plasma instabilities such as Alfven eigenmodes. In this presentation, an overview of the latest experiments in this topic in the ASDEX Upgrade tokamak will be presented.

14:10 - 14:15 **Sojo Lopez, Antonio de la Misericordia**

Floquet Theory applied to Lindbladian Open Quantum Systems

Floquet theory is a general method that allows one to treat linear systems of differential equations with periodic generators. It decomposes the propagator associated with the dynamical evolution into two parts: one associated with the micromotion within a period, and another corresponding to the effective stroboscopic propagation after each period. This framework is widely used in closed quantum systems, where the unitarity of time evolution ensures that the effective stroboscopic part is always generated by an effective Hamiltonian. This property has given rise to a new branch of quantum physics: Floquet engineering. However, when the theory is applied to Lindbladian open quantum systems, specific particularities arise. This talk will address these issues

14:15 - 14:20 **Cortés Parejo, María del Carmen**

Numerical modelling of radionuclide uptake by migratory fish after a nuclear accident in the marine environment

In the aftermath of the Fukushima Daiichi nuclear disaster, numerical models simulating radionuclide dispersion in marine environments have become essential for nuclear emergency preparedness, particularly within initiatives coordinated by the International Atomic Energy Agency. A key component of these models is the representation of marine organisms, or biota, through which radionuclides accumulate and transfer along the food chain. Most existing approaches assume biota remain fixed in space, overlooking the potential influence of migration on radionuclide uptake. This PhD thesis overcomes this limitation by explicitly modeling bioaccumulation in highly migratory species. The Atlantic bluefin tuna was selected due to its ecological and commercial importance and the availability of high-resolution electronic tagging data. Cesium-137 (^{137}Cs) was chosen for its mobility and accumulation in muscle tissue. A Lagrangian particle-tracking framework, forced by the HYCOM, simulates three-dimensional transport, sediment interactions, and trophic transfer along actual tuna migration routes. Mediterranean simulations demonstrate that accounting for migration substantially reduces predicted contamination compared with static-biota assumptions.

Ongoing work extends the framework to the Atlantic Ocean, a second major spawning and nursery area, and incorporates radioactive decay chains to provide a comprehensive assessment of long-term radionuclide dynamics and ecosystem impacts.

Attendees (not presenting)

- Alejandro Vegas Díaz
- Alvaro López Rodríguez
- Alvaro Saiz Castillo
- Antonio De La Calle Martos
- Antonio Ordoñez Aguilera
- Carlos López Jiménez
- Carlos Ríos Monje
- Daniel Jiménez Flores
- Daniil Kabirov Leontieva
- David Del Carmen Peña Arévalo
- Gabriel Auñon Fernández
- Joaquin Ceballos Caceres
- Joel François Tsoplefack
- José Antonio Pavón Rodríguez
- José Luis García León
- Juan Manuel Ordóñez Jiménez
- Julia Pérez González
- Lucas Garrido Gómez
- Manuel Martínez Rojas
- Manuel Mayo León
- María Carmen Cortes Parejo
- Mateo Ruíz Martín
- Miguel Galocha Oliva
- Natalia Ruíz Pino
- Patrick Campbell Quigley
- Pedro Punta De La Herrán
- Ramon López Cansino
- Roberto José Méndez Romero
- Laura Olivera Atenzo
- Demetrio Saucedo Cuberes