

Winter Doctoral Day Preliminary Program – 6th February 2026

Morning Session

Date and time: 8:50. Friday 6th February.

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

08:50-09:00 - Welcome

Antonio Prados Montaña, 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.

10:00-14.40. - Students talks

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 Sevilla. 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

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

12:30 - 12:50

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

12:50 - 13:10**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.

13:10 - 13:30**Auñon Fernandez, Gabriel***New equipment and methodologies for (α, n) measurements within MANY at CNA HiSPANoS*

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 $^{14}\text{N}(\alpha, n)$ reaction can be measured relative to the well-known $^{27}\text{Al}(\alpha, n)^{30}\text{P}$ reaction, allowing reliable Thick Target Yield measurements.

This contribution will present final $^{27}\text{Al}(\alpha,n)$ results, preliminary $^{14}\text{N}(\alpha,n)$ data, and commissioning of the new buncher, along with upcoming upgrades

13:30 - 13:50

Pinheiro Carneiro, Brenda

Unusual cluster structure in ^6Li

The nucleus ^6Li is commonly described as a $4\text{He}+2\text{H}$ cluster system, although alternative configurations such as $3\text{H}+3\text{He}$ have been proposed. In this work, we investigate the relevance of the $3\text{H}+3\text{He}$ component in ^6Li through transfer reaction calculations for the $^6\text{Li}+^{89}\text{Y}$ system. The results show that this cluster component has a negligible impact on the transfer observables for the $^6\text{Li}+^{89}\text{Y}$ system. In contrast, preliminary calculations for the $^6\text{Li}+^{16}\text{O}$ system suggest that the $3\text{H}+3\text{He}$ 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 Alfvén eigenmodes. In this presentation, an overview of the latest experiments in this topic in the ASDEX Upgrade tokamak will be presented.

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