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ΧΑΡΟΚΟΠΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ
ΣΧΟΛΗ ΨΗΦΙΑΚΗΣ ΤΕΧΝΟΛΟΓΙΑΣ
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ΠΡΟΣΚΛΗΣΗ ΕΚΔΗΛΩΣΗΣ ΕΝΔΙΑΦΕΡΟΝΤΟΣ

ΘΕΣΗ	1 (μία) θέση υποψήφιου/-ας διδάκτορα
ΤΙΤΛΟΣ	**AI/ML for 6G Non-Terrestrial Network (NTN) Integration: Learning-Driven Orchestration of Space–Air–Ground Networks**
ΓΝΩΣΤΙΚΗ ΠΕΡΙΟΧΗ	6G networks, non-terrestrial networks (NTN), space–air–ground integrated networks (SAGIN), LEO satellite communications, machine learning, deep reinforcement learning, multi-agent learning, resource allocation, handover management, beam management, mobility prediction, network optimization, 3GPP standardization, edge intelligence
ΠΕΡΙΓΡΑΦΗ	Motivation ● Sixth-generation (6G) mobile networks are envisioned to deliver ubiquitous, continuous and resilient connectivity that extends well beyond the reach of terrestrial infrastructure, providing service anywhere and anytime [1, 2]. A central enabler of this vision is the convergence of terrestrial networks (TN) with non-terrestrial networks (NTN) — satellites in low-Earth orbit (LEO), medium-Earth orbit (MEO) and geostationary orbit, together with high-altitude platforms (HAPs) and unmanned aerial vehicles (UAVs) — into a unified space–air–ground integrated network (SAGIN) [3, 4]. Driven by mega-constellations such as Starlink, OneWeb and Kuiper, and by the standardisation of NTN within 3GPP, this convergence has moved rapidly from a niche capability toward a fully integrated component of the global mobile ecosystem [5, 6]. ● However, integrating NTN with terrestrial networks introduces challenges that have no direct counterpart in purely terrestrial systems. The high orbital velocity of LEO satellites induces severe Doppler shifts, long and time-varying propagation delays, and extremely frequent handovers, while limited on-board power, spectrum coexistence with terrestrial services, and intricate beam and resource allocation further complicate network operation [3, 4]. The resulting environment is highly dynamic, heterogeneous and only partially observable, which renders classical model-based and static optimisation methods insufficient: they struggle to capture the complex, time-varying correlations among orbital geometry, channel conditions, traffic demand and on-board constraints [4, 7]. ● This motivates a shift toward data-driven, learning-based network intelligence, in which artificial intelligence (AI) and machine learning (ML) — from supervised and self-supervised learning to deep reinforcement learning (DRL) and multi-agent learning — are used to learn, predict and adapt to the NTN environment in near real time [4, 7, 8]. Rather than treating the satellite segment as a passive relay bolted onto a terrestrial core, the emerging paradigm treats TN–NTN integration as a

	single, jointly optimised system whose control decisions (handover, beam, spectrum, routing, offloading) are continuously informed by learned models of network dynamics [6, 9]. Central Aim and Contribution ● This dissertation aims to develop a unified, learning-driven framework for the integration and orchestration of 6G non-terrestrial networks, in which AI/ML methods jointly govern connectivity and resource-management decisions across the space, air and ground segments. The central thesis is that the mobility-, channel- and topology-induced dynamics of TN–NTN systems can be cast as sequential decision-making and prediction problems that are best addressed through adaptive, data-driven control rather than fixed heuristics. The work seeks to formulate these problems rigorously, design ML algorithms that respect the physical and standardisation constraints of NTN, and validate them against realistic, 3GPP-aligned system models so that the proposed methods are both theoretically grounded and deployable in practice [5, 6]. Research objectives ● Intelligent mobility and handover management: Formulate handover and cell/beam (re)selection in LEO–terrestrial systems as a predictive sequential decision problem. The objective is to develop learning-based mobility prediction (e.g., signal-strength and visibility forecasting) and DRL handover policies that minimise handover frequency, access delay and collisions while preserving quality of service under high mobility [9, 10]. ● Learning-based resource allocation and beam management: Cast power, bandwidth, beam and slice allocation across SAGIN as a constrained, often multi-objective optimisation problem, and design (multi-agent) reinforcement-learning and deep-learning schedulers that adapt to time-varying traffic, interference and on-board energy limits, improving spectral and energy efficiency relative to static baselines [11, 12, 13]. ● Channel estimation, prediction and interference management: Develop data-driven methods for channel and Doppler estimation, signal-quality prediction and interference-aware coordination that remain robust under the long delays and outdated channel state information characteristic of NTN links [8, 12]. ● Distributed and communication-efficient learning over NTN: Investigate distributed, federated and edge-intelligence schemes that exploit on-board and ground compute while accounting for intermittent connectivity, limited backhaul and energy constraints, enabling models to be trained and updated across the constellation without prohibitive communication cost [14]. ● Standards-aligned modelling, evaluation and validation: Establish the empirical foundations of the proposed methods through large-scale, system-level evaluation using 3GPP NTN channel models and constellation simulators, characterising performance–complexity trade-offs and the gap between simulation and realistic deployment, and aligning the study with the trajectory of 3GPP Releases 17–19 and the emerging 6G work [5, 6]. Expected results ● Overall, on top of its central contribution, the dissertation is expected to result in: ● Predictive mobility-management algorithms: learning-based handover and beam-selection policies that reduce handover rate, latency and signalling overhead in integrated LEO–terrestrial networks for high-mobility users [9, 10]. ● Adaptive resource-orchestration methods: (multi-agent) DRL and deep-learning schedulers for joint power, bandwidth, beam and slice allocation that improve spectral and energy efficiency under realistic SAGIN dynamics [11, 12, 13]. ● Robust learning-based physical-layer techniques: channel/Doppler estimation, prediction and interference-management models resilient to long propagation delays and outdated channel information [8, 12].

	● Communication-efficient distributed learning schemes: federated and edge-intelligence approaches tailored to the connectivity and energy constraints of constellations, enabling scalable on-network learning [14]. ● A standards-aligned evaluation methodology and toolkit: reproducible, 3GPP-compliant simulation pipelines and benchmarks that characterise performance–complexity trade-offs and quantify the simulation-to-deployment gap for AI-enabled NTN [5, 6]. ● Collectively, these contributions are intended to provide a coherent, learning-centric perspective on 6G TN–NTN integration, in which mobility, resource allocation, the physical layer and distributed computation are treated within a common AI-driven framework and validated against realistic, standards-aligned system models. Indicative structure ● Introduction & Motivation: Outline the role of NTN in the 6G vision, the convergence toward space–air–ground integrated networks, and the limitations of classical methods that motivate AI/ML-driven integration. ● Background & Related Work: Review NTN architectures and 3GPP standardisation (Releases 17–19 and the path to 6G), the key integration challenges, and existing AI/ML approaches for satellite and SAGIN networks, identifying open gaps. ● Problem Formulation & Methods: Formulate mobility management, resource allocation, physical-layer learning and distributed learning as well-posed (sequential / constrained / multi-objective) optimisation problems, and design the corresponding ML and reinforcement-learning algorithms with their constraints and objectives. ● System Implementation & Evaluation Platform: Develop a 3GPP-aligned, system-level simulation and benchmarking environment (constellation modelling, channel models, traffic and mobility) for reproducible evaluation of the proposed methods. ● Experiments & Analysis: Validate the methods through large-scale experiments across representative NTN scenarios (LEO direct-to-device, IoT/NB-IoT, emergency and remote-coverage use cases), analysing performance–complexity and energy trade-offs. ● Discussion & Limitations: Interpret the findings, assess robustness and the simulation-to-deployment gap, and discuss scalability and standardisation implications. ● Conclusion & Future Outlook: Summarise the contributions and outline next steps toward fully autonomous, AI-native 6G non-terrestrial networks.
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ΕΞΕΙΔΙΚΕΥΜΕΝΑ ΠΡΟΣΟΝΤΑ	Επιθυμητή η ερευνητική εμπειρία σχετική με το αντικείμενο της διατριβής.

ΚΑΤΑΛΗΚΤΙΚΗ ΗΜΕΡΟΜΗΝΙΑ ΥΠΟΒΟΛΗΣ ΑΙΤΗΣΕΩΝ	28/08/2026

ΔΙΚΑΙΟΛΟΓΗΤΙΚΑ	• Αίτηση (ειδικό έντυπο) με στοιχεία επικοινωνίας και αναφορά στο θέμα, στην προτεινόμενη γλώσσα εκπόνησης και τον/την προτεινόμενο/-η Επιβλέποντα/-ουσα • Προσχέδιο της πρότασης της διδακτορικής διατριβής • Αντίγραφο Αστυνομικής Ταυτότητας • Αντίγραφα των προπτυχιακών και μεταπτυχιακών τίτλων σπουδών, με τον αντίστοιχο γενικό βαθμό, καθώς επίσης της βαθμολογίας σε κάθε μάθημα των προπτυχιακών και μεταπτυχιακών σπουδών και της επίδοσης στην πτυχιακή ή διπλωματική εργασία, όπου προβλέπεται αυτή σε προπτυχιακό ή μεταπτυχιακό επίπεδο. Στις περιπτώσεις πτυχιούχων πανεπιστημίων της αλλοδαπής, τα ιδρύματα και οι τίτλοι θα πρέπει να ανήκουν στα μητρώα αναγνώρισης του ΔΟΑΤΑΠ σύμφωνα με τις ισχύουσες διατάξεις. • Αναλυτικό Βιογραφικό Σημείωμα στο οποίο θα αναφέρονται αναλυτικά οι σπουδές, η διδακτική, ερευνητική ή/και επαγγελματική εμπειρία του/της υποψηφίου/-ιας. • Αντίτυπα επιστημονικών δημοσιεύσεων, άρθρων, κλπ (αν υπάρχουν)

	• Πιστοποιητικό γνώσης της Αγγλικής Γλώσσας, και για τους/τις αλλοδαπούς/-ές, επιπλέον, για την πολύ καλή γνώση της ελληνικής γλώσσας. • (Προαιρετικά) Συστατικές Επιστολές (με το ονοματεπώνυμο, τον τίτλο, τη θέση, τη δ/νση, το τηλέφωνο και την διεύθυνση ηλεκτρονικού ταχυδρομείου του/της συντάξαντος/-σας). • Βεβαιώσεις για την επαγγελματική του/της εμπειρίας σε πεδία συναφή με το προτεινόμενο αντικείμενο της διδακτορικής διατριβής (αν υπάρχουν). • Αποδεικτικά στοιχεία για την ύπαρξη, από διάφορους φορείς, υποτροφίας ή οικονομικής κάλυψης της διδακτορικής διατριβής (αν υπάρχουν). • Κάθε άλλο συμπληρωματικό στοιχείο χρήσιμο για την αξιολόγηση του/της υποψηφίου/-ιας. • Δήλωση του Ν. 1599/86 ότι δεν είναι εγγεγραμμένος/-η ως Υποψήφιος/-α Διδάκτορας άλλου Τμήματος.

Αναλυτικές οδηγίες για την υποβολή αιτήσεων θα βρείτε εδώ: Οδηγίες για την υποβολή της αίτησης σας
Για περισσότερες πληροφορίες μπορείτε να απευθυνθείτε στη Γραμματεία του Τμήματος (τηλ. 210-9549440, itphdsec@hua.gr),καθώς και στον/στην Υπεύθυνο/-η Καθηγητή/-τρια σχετικά με το αντικείμενο της συγκεκριμένης θέσης.

Ο Κοσμήτορας της Σχολής
& Εκτελών χρέη Προέδρου του Τμήματος
(υπογραφή)*

Δημήτριος Μιχαήλ
Καθηγητής

**Η υπογραφή έχει τεθεί στο πρωτότυπο που παραμένει στο αρχείο του φορέα.*