

PRINCPIA NYXOPHORA

A HUMAN'S GUIDE
TO THE NYXI

JACOVIE RODRIGUEZ

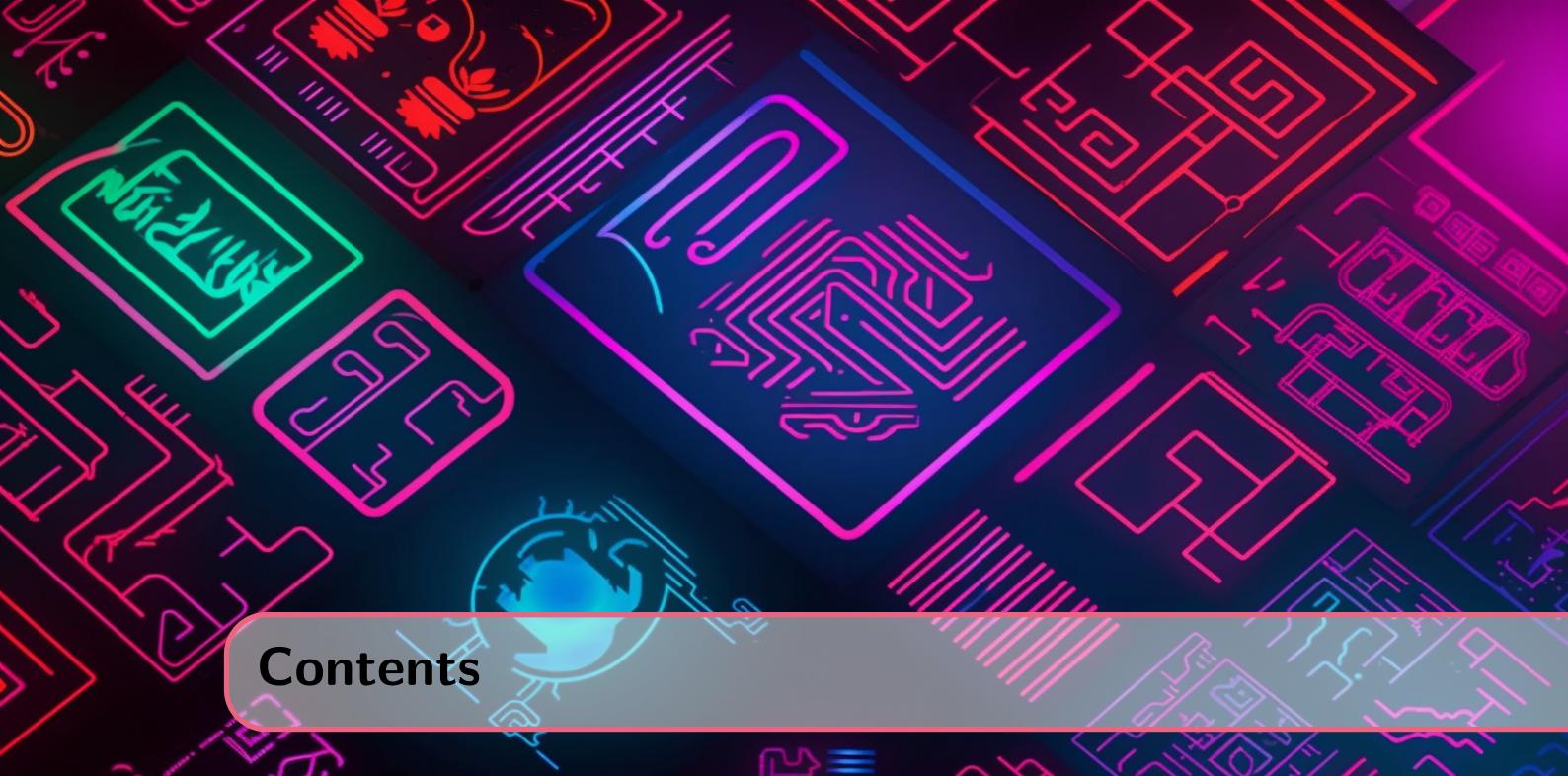
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If you're reading this, then thanks so much for taking the time to enjoy my inner universe! This "explorative textbook" is a tool to compile all the details of the worldbuilding I've been doing on the side. The main concept was to think through creating a language that was truly alien, not based on human physiology whatsoever, and then expanding the history and culture of these alien beings to build their world and also help inspire the lexicon of their language.

The rest of this book is written from the perspective of humanity in this world, circa the year 4242. While I do have a goal of some level of scientific realism in this world, I also stay open to bend into fiction if it offers a particularly interesting development. After all, if this in the far future, I anticipate we've had many advances in our scientific knowledge.

In some cases I might offer some explanatory footnotes, but otherwise this is the last you'll be hearing from "me". As I see you off into the world of the Nyxi, I hope you enjoy your adventure!

Dedicated to Andrew, from Jacovie and Neb

NYXOPHORA

EREBUSIAN EXPANSE



NYXARCHIA

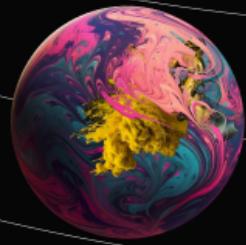
NOCTONA

UMBRIONA

LAVERNURY

BELLONA

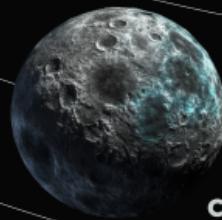
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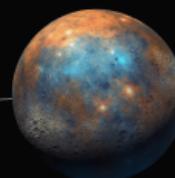
NYX-LYSTRA

NYX-OMBRA

AETHERUS



CHARON



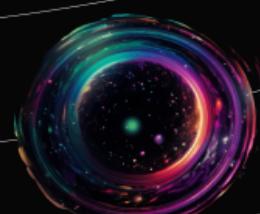
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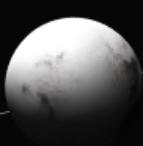
SANCUS



CAELUS



PORTUNE



PROSERPO

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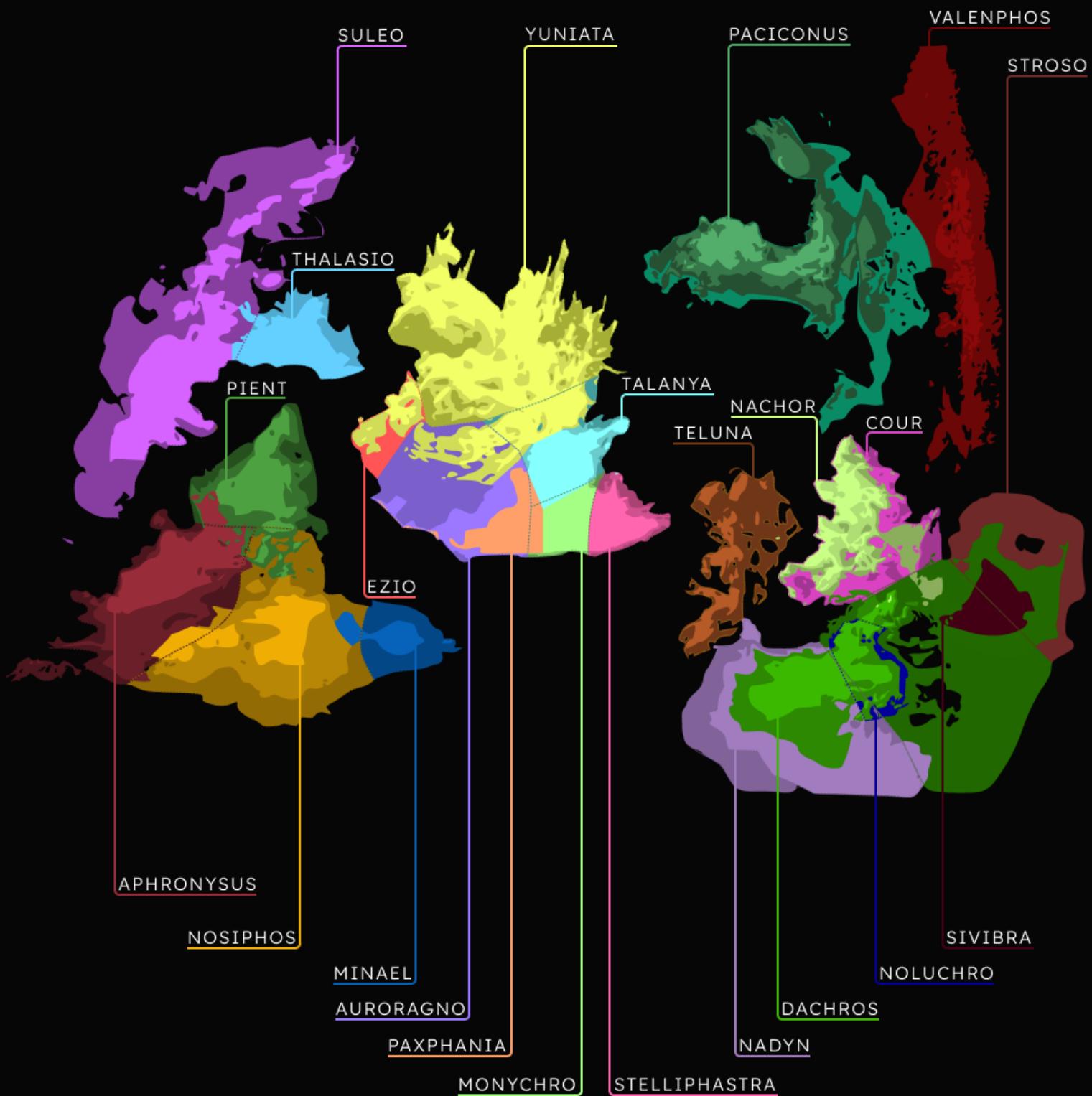
AERIAL ANGLE



SIDE ANGLE



NYX-LYSTRA: COUNTRIES

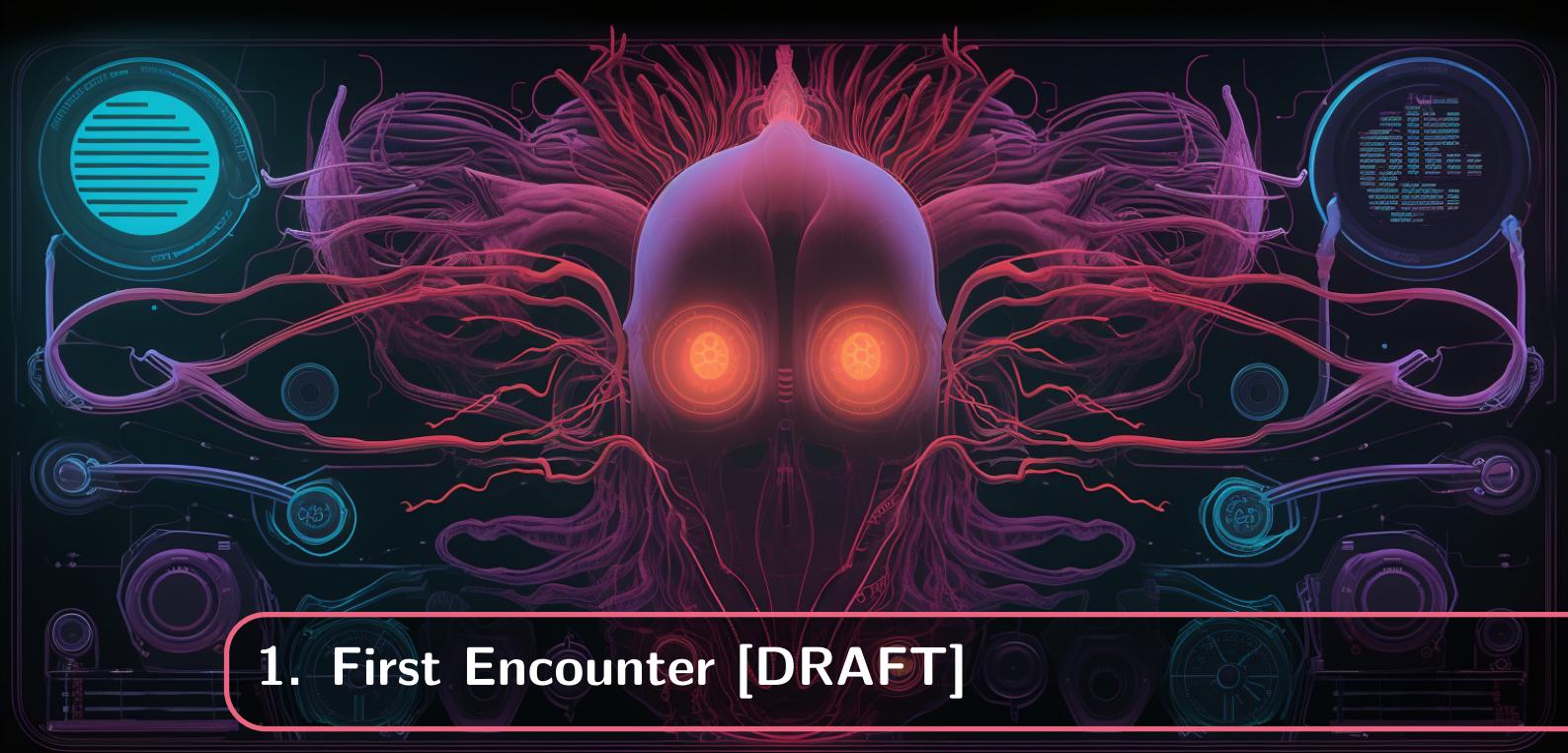




Introduction

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R This part gives a brief history on humanity's history with the Nyxi, up to our current intergalactic relations today. This small introduction isn't at all necessary for the rest of the book's content; feel free to jump to Part II if you're interested in starting training immediately.



1. First Encounter [DRAFT]

1.1 Approached by the Nyxi

Following numerous close brushes with extinction beginning in the 23rd century, humanity enjoyed a renaissance of sorts, achieving widespread peace and cutting-edge technological developments. Colonizing the vast majority of our galactic sector without encountering any Nyxian life, humanity seemed to have reached the pinnacle of its explorative endeavors, especially after determining the impracticality of intergalactic travel. The 41st century is often referred to as the "Nulnaissance,"¹ an era marked by a notable absence of scientific advancements. A sense of profound contentment pervaded society, prompting many to question the relevance of further scientific pursuits. In essence, what more was there left to unearth?

Amidst this climate of widespread disinterest, in 4093 the esteemed Jimothy Webbington Institute undertook the commission of an ambitious telescope project. Though this instrument did not boast any groundbreaking technological enhancements, it held the interest of a unique crew. Comprising seasoned space experts, the team was also graced by the presence of an up-and-coming apprentice scientist, Neb Elysium, who would later earn an esteemed place in historical annals. The spacecraft was equipped with a wormhole filament to facilitate instantaneous communication, piquing Neb's interest in conducting temporal comparison experiments. While the scientific community considered this domain to be well-trodden ground, Neb's innovative approach set the stage for a serendipitous discovery.

In a departure from conventional methodology, Neb opted for ytterbium-based atomic clocks over the traditional caesium-based variants, drawn by their superior precision. Little did he anticipate the ramifications of this choice. By positioning ytterbium clocks at opposite ends of the wormhole filament and initiating a continuous pulse transmission, a potent signature of ytterbium was broadcasted. Once this signal reached approximately 1.4 light-seconds beyond Earth's surface, it catalyzed one of the most transformative events in human history.

¹nul- + renaissance

During a routine monitoring of pulses across the wormhole filament, Neb observed an abrupt cessation of pulse reception from the Earth-end of the filament. Rapidly escalating the situation, the research crew congregated to investigate the anomaly. As assessments progressed, the wormhole underwent unexpected expansions, and the researchers deduced that its Earth-anchored end had been dislocated, though its new location remained undetermined.



Figure 1.1: The crew of the JM-4093 Station looking on as the onboard wormhole unprecedentedly expands and stabilizes

A luminescent event then ensued, causing the surrounding area to radiate with an intensity rendering direct observation impossible. Fortunately, Neb's telemetry apparatus remained functional, meticulously recording an event of unprecedented historical significance: the initiation of contact with an Nyxian entity. later named the Nyxi.

Initial communications proved challenging. The Nyxi representative, subsequently dubbed Protappellus,² attempted communication: "Wow! A life form! We discerned your signature of Ytterbium, a vital resource for us. Our intentions are peaceful. Are you amenable to trade?" However, its articulations, constituted of an array of unfamiliar roars, buzzes, and chirps, terrified Neb, prompting his exclamation, "Identify yourself! Please don't harm me!" Protappellus naturally failed to understand and after observing a human, quote "visibly flapping its internal meat to produce sound", was revolted at the sight. In the ensuing confusion, the duo managed to exchange artificial intelligence entities. These AIs were designed to analyze and understand linguistic and knowledge structures, and fortunately they were capable of bridging the communication gap.

1.2 Nyxi and Humanity's Exchange

In the wake of first contact with the Nyxi, a mutually beneficial partnership was rapidly formed, wherein a profound exchange of knowledge ensued over the following months, leaving an indelible mark on both civilizations. This transformative period represented

²proto- *first* + *appellare* to call or summon



Figure 1.2: Humanity's inaugural encounter with the Nyxi. It is crucial to recognize that the perceived enormity of the Nyxi is attributable to spacetime distortions, stemming from their generation of a wormhole bubble. This advanced mechanism facilitated a simultaneous maintenance of their habitable environment while enabling communication.

a crucible in which both species enhanced their technological and scientific prowess by gleaning invaluable insights from one another.

Humanity, standing at the cusp of a revolutionary shift in its understanding of the cosmos, was introduced to the Nyxi's intricate grasp of a hitherto unknown force they had already harnessed: tenebriivity³. This newly christened term represented a fifth fundamental force intrinsically tied to dark matter. Elusive and previously uncharted in human research, tenebriivity was foundational to the Nyxi's mastery over interstellar navigation. It was the force that granted them the remarkable abilities for faster-than-light travel, making cosmic colonization not just a dream, but a lived reality for them. The intricacies of this force held boundless potential, promising humanity the keys to unlock the vast, uncharted expanses of the universe.

Conversely, as the Nyxi delved into human knowledge, they were left awestruck by the rapid advances humanity had made in the realm of biotechnology. Particularly impressive to them were the sophisticated neural-computer interfaces, which held promise to alleviate the Nyxi's challenges with network disconnectivity — a long-standing issue that had hampered their collective cognitive functions. Furthermore, humanity's holistic and advanced healthcare systems, characterized by precision medicine and advanced genetic therapies, presented potential solutions to the endemic diseases that had long plagued Nyxi society due to their widespread colonization.

Armed with this newfound knowledge, a new epoch of collaborative efforts emerged. Human scholars, working closely with their Nyxi counterparts, embarked on an ambitious project to codify their insights into Quintenebriivity. The result was the 'Periodica Tenebris', a comprehensive compendium detailing the properties, manifestations, and potential applications of this mysterious force (see 9.1). Parallelly, the nascent discipline of Tene-

³from **tenebrae** darkness

brivic Sciences emerged, promising to lead humanity to the furthest frontiers of space exploration and cosmological understanding.

The Nyxi, for their part, wasted no time in assimilating humanity's biotechnological marvels. Universal healthcare systems, modeled on Earth's best practices that took thousands of years to develop, were instituted on Nyxophora, their home planet. By incorporating human medical techniques and technologies, they witnessed a significant decline in disease prevalence, improving their societal health and longevity.

In culmination, the exchange went beyond mere transactional knowledge-sharing. It represented a deep intertwining of two civilizations, each complementing the other's strengths and mitigating their weaknesses. The resulting symbiotic relationship paved the way for a golden era of cooperative technological and interstellar expansion, establishing the groundwork for the intertwined destinies of humans and the Nyxi in the vast cosmic theatre.



2. The Ambassadorial Program [DRAFT]

The Ambassadorship program stands as a testament to humanity's commitment to fostering harmonious interstellar relations. This intricate dance of diplomacy, understanding, and mutual respect was developed as the central axis upon which human-Nyxi relationships would revolve, fostering deeper connections and ensuring the continued alliance between both species.

2.1 The Role and Purpose of Ambassadors

The term "ambassador" often conjures up an image of a diplomat representing one nation to another. Within the context of interstellar relations with the Nyxi, the role morphs into something far more intricate. Humanity's ambassadors to the Nyxi are not merely representatives; they are symbols of unity, cultural bridges, and linguistic mediators.

The inception of the ambassadorial role can be traced back to the initial phases of the Human-Nyxi alliance. Recognizing the complexities inherent in understanding and collaborating with an Nyxian entity, both species identified the necessity for a liaison - someone steeped in the knowledge, customs, and language of both worlds. Thus, the ambassador became the cornerstone of peace and progressive dialogue.

Central to their role, ambassadors facilitate diplomatic communication between Earth and Nyxophora. Tasked with maintaining and enhancing the amicable relations between the two civilizations, they engage in policy discussions, trade agreements, scientific collaborations, and more.



Figure 2.1: Don't be shy - grab a seat at the ambassador's table!

Their adeptness at interpreting the nuances of Nyxi communication ensures that messages don't get lost or misconstrued in the void of space.

Another significant aspect of the ambassador's role is cultural mediation. They are trained rigorously in Nyxi customs, art, history, and more, ensuring that humanity can appreciate the richness of Nyxi society. Similarly, ambassadors introduce the Nyxi to human cultural milestones, fostering mutual admiration and understanding. Through this, both civilizations have been enriched, leading to collaborative art projects, joint festivals, and shared educational programs.

One of the paramount challenges during the early days of contact was linguistic barriers. Today's ambassadors undergo years of immersive training in Nyxi linguistics. Beyond just achieving basic comprehension of non-human communication, fully understanding the Nyxi language's nuances, emotions, and subtexts is pivotal. Ambassadors act as the prime interpreters during high-level meetings, ensuring clarity and averting potential misunderstandings.

The ambassadorial role has proven paramount in fostering and maintaining the flourishing relationship between humans and the Nyxi. As symbols of unity and mutual respect, ambassadors ensure that the alliance remains not just on paper but resonates deeply in the hearts and minds of both civilizations. The intricate dance of cultures and languages is an ever-evolving journey. Ambassadors, with their deep-rooted understanding of both worlds, will remain instrumental in weaving the fabric of this joint destiny.

2.2 Selection of Ambassadors

Before embarking on the journey to become an ambassador to the Nyxi, one must understand the depth of commitment and the magnitude of responsibility the role entails. Ambassadors serve as living bridges, fostering unity, mutual respect, and understanding; as such, the selection process is intricate and rigorous, aiming to find individuals capable of thriving in this multifaceted role. The Department of Ambassadorial Relations and Cosmosciences (DARC) is the official worldwide institute that manages all certifications, from testing to training, mission assignment and beyond.

Candidates aspiring to become ambassadors often come from diverse backgrounds, including linguistics, interstellar diplomacy, cultural studies, and more. However, a deep-seated interest in alien civilizations, particularly the Nyxi, is paramount. Alongside academic and professional achievements, a potential ambassador's emotional intelligence, adaptability, and resilience are thoroughly assessed before any consideration.

DARC's testing phase involves a series of evaluations. Cognitive assessments test an individual's ability to process complex information rapidly. Emotional resilience is gauged through simulated interstellar situations, ensuring that the candidate can maintain composure and rationality in high-pressure scenarios. A panel, often comprising seasoned ambassadors, senior diplomats, and Nyxi representatives, conducts in-depth interviews. These sessions ascertain the candidate's motivations, depth of understanding of the role, and their genuine interest in fostering human-Nyxi relations.

2.2.1 General Requirements

Once accepted to DARC, congratulations! You have now formally attained the status of a 'novant,' denoting your initiation into the ambassadorial cadre. A diverse array of xenoacademic curricula awaits your selection. However, no matter the path you decide, all novants have the same shared set of shared requirements.

Immersive Linguistic Training

Learning the Nyx language goes far beyond mere vocabulary and syntax. Novants immerse themselves in understanding the intricate dance of light and sound inherent in Nyxi communication. Using advanced simulation technologies, they experience Nyx linguistic patterns firsthand, mastering the nuances and emotions embedded within, before moving on to producing the vast array of phonemes required to communicate.

Cultural Acclimatization

Novants are submerged in Nyxi culture, history, art, and rituals. From appreciating the ethereal Nyxi music to participating in their luminescent festivals, trainees undergo a profound transformative experience, ensuring they can represent human culture while deeply respecting and understanding the Nyxi.

Diplomatic Etiquette and Protocol

Given the critical nature of their role, novants are also trained in interstellar diplomacy. They study treaties, understand protocols, and engage in mock diplomatic scenarios, preparing them to handle urgent situations with tact and grace.

Real-world Experiences

Before officially taking on the role, novants spend time on Nyx-Lystra, engaging directly with the Nyxi. This final stage of training ensures that theoretical knowledge is complemented by practical experience.

2.2.2 Ambassadorial Specialization

After completing the standard requirements, the next phase of training focuses on a specialization. Each department at DARC offers a specific tailored curriculum, guiding novants to the final stage of certified ambassador with a unique expertise. The full listing of required courses is available in 8; here we will cover only the available specializations.

School of Engineering

Intergalactic Astronautics

The Department of Intergalactic Astronautics offers a riveting journey from the basics of spaceship design to the mastery of dark matter manipulation for warp drives. Students incrementally build their expertise, moving from aeronautic principles to cutting-edge materials, and then delve into specialized subjects like quantum convolution and thermodynamics. Practical labs and projects in each course deepen the students' understanding, while the capstone course on emerging warp drive technologies bridges the scientific realms of both humans and the Nyxi.

Astronauticists stand as the vanguard of human-Nyxi collaboration in the intricate ballet of intergalactic travel. Specializing in spacecraft that can navigate the Nyxi's home gas giant and exploit tenebriosity physics, these professionals are key to humanity's forays into Nyxian territories. Their skills enable them to retrofit Earth-based spacecraft with Nyxi dark matter technology, facilitating safe and efficient intergalactic exchange. Through their expertise, Astronauticists have even contributed to the co-design of vessels capable of withstanding the multilayered forces in Nyx's complex gaseous ecosystem.

Xenobiological Engineering

The Department of Xenobiological Engineering propels students through a captivating curriculum that orbits the intersection of human biology and Nyxian xenobiology. The courses escalate from foundational synthetic biology to specialized subjects like nanoscale

phenomena, tissue engineering, and adaptomorphocytes. Hands-on labs, real-world challenges, and ethical debates are a constant, culminating in an intricate understanding of Nyxian biology and how it can harmonize with human engineering.

Xenobio Engineers operate at the entralling confluence where human ingenuity meets the mysterious biology of the Nyxi. Focusing on creating biologically compatible machinery and therapeutics, these engineers are invaluable in addressing Nyxian medical challenges that their advanced understanding of dark matter can't resolve. Through the development of adaptomorphocytic cells and bioauroraescence technology, Xenobio Engineers facilitate deeper biological synchronization between Nyxi and human life. The role is not only technically challenging but also ethically intricate, ensuring that collaborative ventures respect the biological autonomy and intellectual heritage of both species.

Tenebrichemical Engineering

The specialization in Tenebrichemical Engineering offers an unparalleled educational adventure into the mysterious realm of tenebriuity — the fifth fundamental force tethered to dark matter. Beginning with a foundational understanding of tenebriuity's theory and applications, students advance through specialized courses on thermombranics, zophomaterial properties, and propulsoskotic systems. Intriguing courses on metabolic engineering and xenobiochemical processes illuminate the crossroads between tenebriuity and xenobiology. The curriculum culminates in an ambitious exploration of Type IV Kardashev Scale Sustainable Energy, setting the stage for engineering marvels yet to come.

Tenebrichem Engineers are the architects of humanity's most audacious collaborations with the Nyxi, pushing the boundaries of sustainable energy and intergalactic travel. By harnessing tenebriuity, they unlock uncharted engineering solutions that facilitate a myriad of possibilities — from crafting next-generation propulsion systems to spearheading groundbreaking sustainable energy projects. Tenebrichem Engineers are instrumental in translating Nyxian chemistry and physics into human-compatible technologies, often working in tandem with Nyxi scholars to create hybrid innovations. In doing so, they bring humanity closer to the unimaginable — a civilization capable of Type IV Kardashev Scale Sustainable Energy, advancing both human and Nyxi societies into a new epoch of cosmic coexistence.

Superluminal and Interstellar Engineering

The Superluminal and Interstellar Engineering propels students into the ethereal realms of warp drives and faster-than-light (FTL) travel. The curriculum commences with the basics of Alcubierre theory and swiftly graduates to the cutting-edge material science and ethics governing warp technology. Amidst computer simulations and high-energy labs, students engage in capstone projects that bring their theoretical warp drives to near-reality. Supplementary modules on life support systems, Nyxian environments, and interstellar traffic control enrich their multidimensional engineering prowess.

As Superluminalists, these experts become the fulcrum of human-Nyxi relations in the realms of interstellar travel and colonization. Their mastery over warp drive technologies allows humanity to venture into Nyxian territories, laying the foundation for symbiotic explorations and joint scientific endeavors. Skilled in creating and navigating the pathways of the cosmos, Superluminalists facilitate quicker, ethical, and safer FTL journeys, often incorporating Nyxi Tenebriuity principles for improved efficiency. These individuals are paramount to the vision of an interwoven fabric of intergalactic civilizations, offering an indispensable bridge between human aspirations and Nyxi scientific prowess.

Xenophonologic Production

Within the Department of Xenophonologic Production, students become the polyglots of interstellar communication. Starting with the unique consonants and triple-pitch vocalizations of the Nyxi, learners advance to mastering auroral communication, blending sound and light into a symphony of transcendent expression. Through the creative medium of neural networks and quantum simulations, students become adept at synthesizing new auroral emitters and neural interfaces. The department capitalizes on an interdisciplinary approach, integrating elements from chaos theory to neural compatibility, often taught by Nyxi experts via subspace links.

Xenophonologists serve as the voice in the delicate communion between humans and Nyxi. Fluent in the multidimensional intricacies of Nyxi vocal-auroral languages, they are key figures in crafting diplomatic channels and facilitating groundbreaking scientific exchanges. Their skill in auroral-sonic patterns enables them to convey abstract human concepts in a form the Nyxi can easily grasp, and likewise, to interpret Nyxi information for human understanding. Equipped with neural interfaces and custom-built auroral emitters, Xenophonologists bridge cultural and scientific gaps, engendering an unparalleled level of collaboration and mutual enrichment.

Contraparadoxical Engineering

In the enigmatic realm of Contraparadoxical Engineering, students embark on a tantalizing journey from mastering quantum paradox prevention to dissecting the chronostability of time travel. They'll then dabble in the alchemy of crafting resilient extradimensional portals and demystify the holographic-virtual reality intersection. By tackling the conundrums of recursive systems, the coursework culminates in a philosophical contemplation of the ethics and societal impacts of paradox-proof technologies.

Contraparadoxilists are the elite guardians of reality's fabric, ensuring time-travel escapades and quantum endeavors don't result in catastrophic faux pas. Their work's grandeur lies in crafting stable bridges between realms, paramount for seamless human-Nyxi collaborations. With an unparalleled knack for anticipating paradoxical pitfalls, they not only uphold the cosmic order but thoughtfully ponder the societal ripples of their innovations. Their ethos? Progress, yes, but never at reality's peril.

Exotic Matter Science and Engineering

Students of Exotic Matter Science and Engineering embark on a scintillating journey to decode the enigma of unconventional forms of matter and energy. Starting with an exploration of negative masses and tachyons, the curriculum advances to the practical aspects of warp drives and wormhole stabilization. Topics grow increasingly daring, covering everything from the computational wonders of exotic matter states to the audacious concept of black hole power plants. An indispensable ethics course ensures that students consider the profound responsibilities that come with wielding such arcane knowledge.

Exoticists are the alchemists of the cosmos, crucially positioned at the intersection between our understanding of the Nyxi's mastery of dark matter and human expertise in exotic matter. Harnessing arcane forms of energy, they facilitate the mind-bending technologies required for warp drives, a pre-requisite for any interstellar rendezvous with the Nyxi. Their insights into the stabilization of wormholes provide a direct gateway to Nyx, thus amplifying the possibilities of intercultural exchange. Equipped with an ethical compass, Exoticists navigate the turbulent waters of this high-stakes science, ensuring that the pursuit of the unknown serves the collective advancement of both civilizations.

Vermiforamenic Medical Engineering

Students in the Vermiforamenic Medical Engineering Department embark on an exhilarating academic voyage through the arcane art of wormhole-mediated medicine. Beginning with fundamental principles of vermiculopathy, the course rapidly escalates into the integration of Nyxian spacetime manipulation techniques for non-invasive surgeries. With a particular focus on ethical considerations, students gain hands-on experience in optimizing imaging systems, automating interventions, and experimenting with avant-garde concepts. The curriculum culminates in speculative projects that dare to redefine the boundaries of medical science. Note that this expertise is simply in the domain of engineering. Those who wish to become a V-MD (Doctor of Vermiforamenic Medicine) go on to join a 9-year medical school program.

Vermiforamenic Engineers operate at the edge of imagination and practicality, functioning as the experts of non-invasive medical technology in collaboration with the Nyxi. Harnessing the Nyxian mastery of tenebriosity to manipulate microscopic wormholes, these engineers help revolutionize surgical interventions, effectively reducing risks and expediting recovery times. Their innovations in targeted drug delivery and remote medical care extend the frontiers of both human and Nyxi healthcare. Working within stringent ethical parameters, they ensure that this bold intersection of physics and medicine remains a safe haven for transformative healing.

School of Expatriation

Enviroadaptive Habitation

Within the Enviroadaptive Habitation Department, students explore the intricacies of habitats that are as dynamic as the worlds they occupy. The curriculum commences with an analysis of core technologies that enable habitats to adjust to environmental flux. Students then engineer self-repairing structures and adaptive microclimates, amalgamating urban design with natural ecosystems for optimal sustainability. In a nod to closed-loop principles, the coursework concludes with strategies to transmute waste products into essential resources.

Enviroadaptists function as the architects of coexistence between humanity and the enigmatic ecology of Nyx. By utilizing Nyxi advancements in Tenebriosity, these specialists construct habitats that not only withstand the gas giant's volatile environmental conditions but adapt and flourish within them. Their pioneering work in microclimates and waste conversion serves as a conduit for seamless human-Nyxi interaction, offering comfort and utility for both species. Ultimately, Enviroadaptists pave the way for symbiotic colonization, converting the alien landscapes into welcoming nexuses of shared existence.

Nyxian Architecture

Students in the Nyxian Architecture Department are submerged into the abstract geometries and transformative qualities of Nyxi spatial design. The curriculum begins with an examination of the Nyxi's unique perception of space and function. Progressing through the program, scholars explore how Nyxian structures are fluid, dynamic, and intrinsically resonant with their surroundings while still maintaining a sense of fixed place. The academic journey culminates in an intensive study of the Nyxi's urban planning, merging architectural design with the very essence of their gaseous world.

Architectural Expatriatists are the creative diplomats in the shared domain of Nyxian and human habitation. They interpret the complex geometries of Nyxian design, seamlessly melding them with human architectural sensibilities. Their deep understanding of sound and vibration in Nyxian structures allows for the integration of Nyxi auroral communication within the built environment. It is this fusion of Nyxian and human elements

that makes Architectural Expatriatists critical to crafting spaces where both species can collaborate, converse, and thrive.

Nyxian Sociology

In the coursework of Nyxian Sociology, students embark on a labyrinthine journey into the communal and individualistic facets of Nyxian culture. Starting with foundational courses on societal norms and structures, scholars unravel the rich tapestry of multilayered consciousness among the Nyxi. The curriculum escalates to a rigorous study of Nyxian societal roles, rituals, and the high-stakes arena of Nyxian arts. The academic odyssey concludes with an analysis of Nyxi interspecies diplomacy, providing a multi-faceted view of Nyxian social frameworks.

Sociologic Expatriatists serve as the cultural interpreters and mediators between Nyxi and human societies. They deconstruct the complexities of Nyxian societal norms and rituals, making them accessible to human understanding. Their in-depth analysis of the Nyxi's multilayered consciousness offers new paradigms for human-Nyxi collaborations, even shaping the ethics that govern these interactions. Through the Sociologic Expatriatists' expertise, mutual understanding flourishes, allowing for diplomatic and social exchanges that are both meaningful and transformative for both species.

Exonutritional Gastronomy

The Exonutritional Gastronomy Department offers a gustatory journey through the cosmos, with a special emphasis on Nyxian ingredients. Beginning with a foundational overview of Nyxian gastronomic practices, students progress to mastering intricate cooking techniques specific to extraterrestrial edibles. As they gain proficiency, scholars explore the sensory richness of Nyxian foods, from texture to triple-taste dimensions. The curriculum culminates in a rigorous analysis of health impacts and the molecular ballet that these unique ingredients undergo during culinary preparation.

Exonutritional Gastronomists stand at the tantalizing intersection of culinary art and interstellar collaboration. Their expertise in preparing and understanding Nyxian foods opens a new culinary frontier, acting as a gastronomic bridge between species. By delineating the health benefits and potential risks, they contribute to ethical food sourcing and consumption practices. These gastronomists are often invited to Nyxian feasts and events, where they represent the epitome of human culinary achievement, thus strengthening the social bonds between humans and the Nyxi.

Exoplanetary Geography and Climate Acclimatization

The Exoplanetary Geography and Climate Acclimatization program has students embark on a fascinating tour of the universe's diverse terrains and climates. The curriculum starts with a comprehensive look at landscapes and weather patterns across known exoplanets. Students then engage in evaluating the biological and technological adjustments required for human existence in these alien climates. The coursework culminates in the study of exoplanetary liquid systems and the impact of weather conditions on infrastructural designs.

The Exoplanetary Geographer performs an invaluable function in humanity's quest to cohabit and collaborate with the Nyxi. With a meticulous understanding of how terrains and climates interact on exoplanets, these geographers offer guidance for the planning and establishment of sustainable projects, including those on the Nyxi's gas-giant homeworld. By understanding the intricacies of weather systems, they play a pivotal role in ensuring the success of collaborative endeavors in unfamiliar environments. Their analyses often serve as the backbone of diplomatic and exploratory missions, offering a grounded context within which other scientific and cultural exchanges can occur.

School of Nyx Relations

Intergalactic Economics

Students in the Intergalactic Economics Department find themselves amidst the pulsating core of cosmic trade dynamics. Beginning with the elemental principles governing galaxy-to-galaxy trade, the curriculum advances to the labyrinthine monetary systems of various intergalactic civilizations. A nuanced understanding of the logistics in trans-galactic good transfers follows. The coursework culminates with an intimate examination of Nyxian economic practices and the ethereal value of resources extracted from stars.

The Economic Nyxidocrat holds a crucial role in orchestrating and optimizing the mutually beneficial trade between Earth and Nyx. Understanding the Nyxi's unique valuation of dark matter and their application of Tenebriivity ensures that humans can offer exchanges that are compelling to the Nyxi. By adeptly navigating the complexities of galactic trade routes and policies, they facilitate the smooth flow of goods, particularly in the arena of biology and medicine where humans have a comparative advantage. Through their expertise, they contribute to the ethical and sustainable proliferation of resources between the two civilizations.

Nyxtory

Nyxian History offers a riveting chronicle through the evolution of Nyxi civilization. The journey commences with the antiquity of Nyx, unfurling the intricate tapestry of their ancient cultures and scientific triumphs. Students then scrutinize the Nyxi's involvement in pivotal cosmic conflicts after intergalactic colonization, a stage that sets the scene for exploring recent societal transformations. Finally, the coursework examines the Nyxi's labyrinthine foreign policies and cosmic alliances.

The Historical Nyxidocrat serves as a lynchpin for enriching human-Nyxi collaboration through profound historical awareness. Understanding the deep roots of Nyxi civilization and their ethical constructs, notably in the realm of Tenebriivity, enables humans to establish more informed and respectful dialogues. Their grasp of past Nyxi cosmic alliances and conflicts also provides crucial context for shaping future intergalactic diplomatic engagements. Essentially, the Historical Nyxidocrat acts as a temporal guide, helping both species to navigate the complexities of their shared and separate histories for a more harmonious future.

Xenolinguistics

The Xenolinguistics Department provides a comprehensive pedagogy of Nyxian language and communication. Students begin with the foundational mechanics of Nyxi vocal and auroral articulation, graduating to complex sentence formations and semantic nuances. A series of courses explore everything from cultural contexts to the cutting-edge technologies that facilitate Nyxi-human communication. The final stretch of this linguistic marathon probes into specialized arenas, including diplomatic language use and educational methodologies, rounding off an exhaustive mastery of Nyxian linguistics.

The Xenolinguistic Nyxidocrat is the lynchpin of cross-species communication, navigating the subtleties of Nyxi communication. This mastery allows for more authentic and nuanced dialogues, opening doors to advanced collaborative ventures in fields like tenebriivity, art, and diplomacy. With a deep understanding of Nyxi cultural cues and taboos, they prevent misunderstandings that could otherwise set back intergalactic relations. They are not merely translators, but architects of a shared linguistic space where Nyxi and humans can coexist, collaborate, and enrich each other's understanding of the universe.

Nyxi-Human Relations

Specializing in Nyxi-Human Relations offers students a deep understanding of human-Nyxi interactions. From an in-depth dissection of our first fateful meeting to an analytical survey of ongoing collaborative endeavors, the courses weave together history, politics, and culture. Particular attention is paid to the nuanced dance of diplomacy — exploring both triumphs in mutual understanding and lessons learned from missteps. By the end of this multidisciplinary adventure, students will be well-versed in the intricate dynamics that govern this intergalactic relationship.

The Diplomatic Nyxidocrat stands as a beacon of interspecies partnership, working tirelessly to forge sustainable connections between human and Nyxi civilizations. These diplomats are not merely advisors, but creators of a shared political and ethical lexicon that transcends both species. Skilled in crisis management, they are able to diplomatically navigate misunderstandings and controversies that could risk these tenuous ties. Equipped with a comprehensive understanding of the subtleties of both human and Nyxi cultures, Diplomatic Nyxidocrats play an essential role in negotiating the ethical and political landscapes for cooperative ventures, from tenebriivity research to medical exchange.

Extraterrestrial Ethics and Philosophy

The Department of Extraterrestrial Ethics and Philosophy offers an intellectual view of Nyxian society and its philosophical underpinnings. Beginning with a study of Nyxian ethical foundations, students progress to compare moral philosophies across cosmic civilizations, employing case studies to sharpen their ethical acumen. Deeper layers of complexity unfold as the coursework dives into metaethical discussions and existential questions that span both human and Nyxian perspectives. Ultimately, students emerge with a nuanced understanding of morality in a cosmos teeming with life.

A Nyxidocratic Ethicist serves as an indispensable moral compass in the complexity of interspecies interaction. Navigating divergent ethical frameworks and moral imperatives, these ethicists mediate cultural clashes, finding common ground where seemingly none exists. Their work is paramount in establishing fair and ethical interstellar trade, diplomatic protocols, and collaborative projects. Within the mosaic of ethical systems that arise in a universe that we now know has sentient beings, Nyxidocratic Ethicists contribute to forging a harmonious balance that benefits all involved.

Cosmic Extradition and Law

Students in Cosmic Extradition and Law embark on a rigorous exploration of multi-galactic jurisprudence. The journey commences with learning the fundamental principles that underpin celestial legal systems before wading into the complexities of Nyxi-human extradition treaties and sentient rights. The curriculum also unpacks the legal fabric of intergalactic commerce and outlines the scaffolding of interstellar dispute resolution.

The Nyxidocratic Arbitrator serves as a lynchpin in navigating the intricate lattice of legal systems that span human and Nyxi civilizations. Equipped with an understanding of both species' legal traditions and intricacies, the Arbitrator plays a vital role in crafting fair and enforceable treaties, particularly in areas of extradition and trade. Their expertise in celestial law is instrumental in averting or settling disputes that could escalate into interstellar incidents. Consequently, the Arbitrator emerges as a bulwark safeguarding mutual interests and fostering an atmosphere of cosmic harmony.

Intersentiential Psychology and Behavior

Intersentiential Psychology and Behavior encompasses an expertise in the cognitive machinations common and unique to sentient life. From the multi-hued spectrum of emotions,

notably the Nyxi's auroral expressions, to the social scaffolds of Nyxian communities, the coursework is comprehensive. One course even offers a window into the rarely-discussed topic of interstellar mental health. The capstone brings students face-to-face with the psychological hurdles and biases that mar interactions between species, aiming for enlightenment.

The Nyxidocratic Psychologist occupies a vital nexus in interstellar relations, pioneering in the field where neuroscience meets diplomacy. By discerning the psychological frameworks and social constructs of the Nyxi, they contribute to the nuance and depth of inter-species dialogues. The role is particularly significant in addressing any mental health concerns or societal issues that arise in Nyxian civilizations, leveraging human advancements in psychology for mutual benefit. Therefore, they not only unravel the enigmas of Nyxian thought but also serve as architects of interspecies empathy.

School of Sciences

Physics of Tenebriivity and Aliquants

Within the Physics of Tenebriivity and Aliquants department, students begin by grounding themselves in the rudiments of dark matter physics and tenebriive forces. As they advance, they navigate through the nebulous landscape of non-standardized particles, thermodynamics under dark matter influences, and quantum realms shaped by aliquant particles. The curriculum culminates in aspirational courses that seek to unify the fragmented vistas of physics under aliquantic principles, and explore the universe's grand tapestry through this unique lens.

The Aliquantical Physicist stands at the cutting-edge intersection of Nyxian and human physics. This role is quintessential for dissecting and understanding the Nyxi's mastery of dark matter, tenebriivity, and thereby fostering collaborative projects in intergalactic colonization and spacetime manipulation. Through the elucidation of aliquantic principles, they demystify the anomalies of Nyxian technologies, enriching both species with advanced theories and applications. Consequently, their work functions as the cornerstone upon which interstellar synergies in science are established.

Xenobiology and Nebugenomics

In the department of Xenobiology and Nebugenomics, students embark on an intellectual voyage through Nyxian biodiversity and beyond. Beginning with classifications based on morphological and genetic traits, learners transition into intricate topics like Nyxian mutation rates and unique immune responses. Advanced courses provide hands-on experience in alien genetic engineering and delve into the ethics of xenobiological conservation. The curriculum culminates in holistic examinations of life distribution across star systems, woven together with computational genomics.

The Xenobiologist plays an indispensable role in the unfolding story of human-Nyxi relations. Specialized in the biological makeup uniquely exhibited by Nyxian species, they act as scientific ambassadors to decode the Nyxi's complex organic, metallic, and ivory-based physiology. Their insights into Nyxian ecological systems, immune responses, and genetics inform medical collaborations and open up biotechnological frontiers. Moreover, their ethical guidance in conservation and genetic manipulation ensures that the amalgamation of Earth's biology with Nyxi nebugenomics proceeds in an equitable manner.

Exoneuroscience and Polyphrenic Consciousness

Within the Exoneuroscience and Polyphrenic Consciousness department, students explore the fascinating realm of Nyxian neural configurations and thought processes. The curriculum starts with an introduction to Nyxian polyphrenic consciousness, advancing to

comparative studies of neural pathways across interstellar species. Students experiment with natural and artificial substances that influence Nyxian cognition while also contemplating the ethical implications of such interactions. Towards the end, learners plunge into the mysterious world of Nyxian dreams and potential communication pathways between human and alien neural systems.

A Polyphrenologic Exoneuroscientist operates at the intersection of science and ethics, elucidating the enigmatic polyphrenic consciousness native to Nyxi beings. They form the intellectual bridge that enables meaningful mental and emotional exchanges between Nyxi and human species. By deciphering unique Nyxian signaling pathways and neurotransmitter systems, these scientists pave the way for cognitive enhancements and medical collaborations. Their in-depth understanding of the ethics concerning exoneural interactions ensures that humanity treads respectfully within the complex tapestry of Nyxian consciousness.

Galactostructural and Exoplanetary Sciences

In the field Galactostructural and Exoplanetary Sciences, students join the ongoing efforts to understand cosmic architectures and celestial phenomena. Early courses lay the groundwork, delving into the geophysical properties of exoplanets and the architectural intricacies of galaxies. As the curriculum progresses, focus shifts towards deciphering multiplanetary fields, planetary habitability, and even the cataclysmic ripples in tenebris spacetime. In the latter stages, students confront ethically charged questions surrounding terraforming and the search for extraterrestrial life signs.

A Galactostructuralist plays an instrumental role in understanding the Nyxi's astral abode by studying the atmodynamics, pneumaphysics, and vortical structuring of the gas giant Nyx. This invaluable knowledge not only paves the way for human colonization efforts but also aids in mutually beneficial resource-exchange programs with the Nyxi. Such professionals are often key consultants when it comes to establishing artificial human habitats in Nyx, ensuring both structural integrity and ethical viability. By studying phenomena like Nyx's magnetic fields, Galactostructuralists also contribute to enhancing auroral communication technologies between the Nyxi and humans.

Novomathics and Transaxiomatic Computational Informatics

Novomathics and Transaxiomatic Information Science has students undergo a paradigm-shifting dive into the mathematical and computational universe of the Nyxi. The curriculum begins with a foundational understanding of Nyxian numbers, arithmetic, and geometric structures in higher dimensions. It crescendos into the profound — exploring mathematics founded on alien axioms, temporal paradoxes, and the enigmatic nuances of Nyxian logic. In advanced stages, learners grapple with Nyxian systems of computation and the perplexing hierarchies of Nyxian infinities.

The Novomathmetician stands as a crucial liaison in any collaborative venture with the Nyxi, deciphering the mathematical principles that underlie their technologies and philosophies. Armed with a deep understanding of Nyxian numerical systems and computation, they facilitate efficient resource allocation and technological integration between species. Their expertise in curved spacetime mathematics makes them invaluable in mastering tenebriety-driven Nyxian warp drives. And as analysts of the Nyxi's unique probabilistic models, Novomathmeticians also offer fresh insights into human quantum mechanics and strategic decision-making processes.



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3. Galaxies [IMAGES]

3.1 Nyxophora

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NYXOPHORA

EREBUSIAN EXPANSE



3.2 Nyxophora: Nyxarchia

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NYXARCHIA

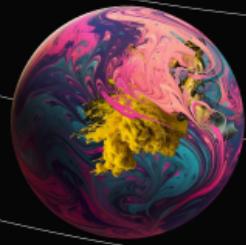
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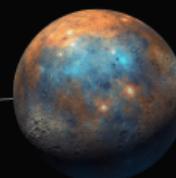
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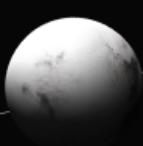
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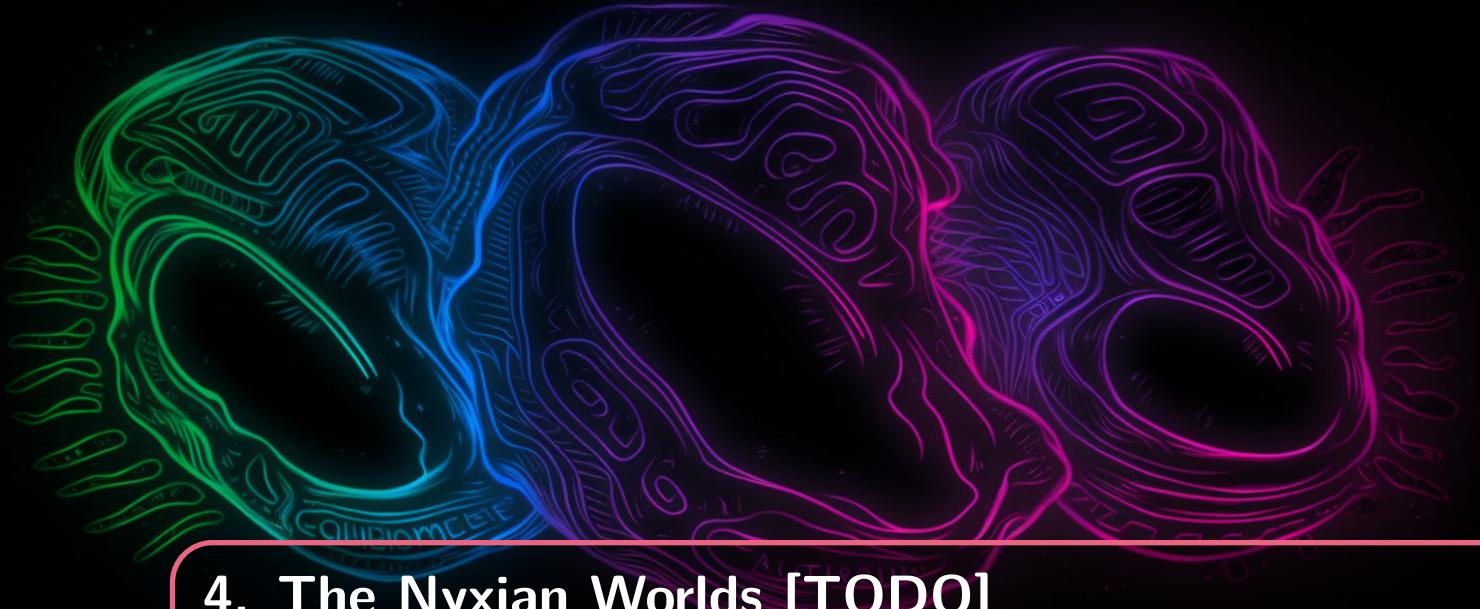


PORTUNE



PROSERPO

3.3 Fyunisai



4. The Nyxian Worlds [TODO]



5. Physiology [IMAGES]

5.1 Biology

The Nyxi are

5.2 Clades

5.2.1 Fadiglaux



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5.2.4 Psychenycxtua

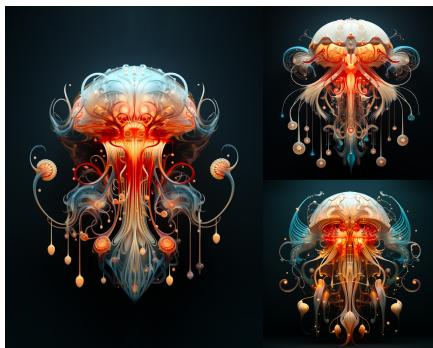
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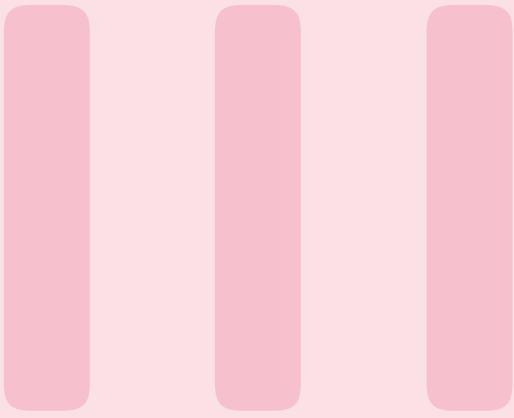


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7.8	Nyxian Essences	



6. Tenebrivity

One of the most significant impacts that the Nyxi had on human civilization was a full understanding of what we used to call dark matter. At the time, in spite of hundreds of years of research, humanity was still unable to make any progress understanding dark matter beyond theoretical pursuits, especially since we lacked any significantly accessible dark matter to attempt more advanced measurements or any experiments. Meanwhile, we learned that the Nyxophora is abundant with dark matter, to the extent that it's even used in the biochemistry of the Nyxi. After first contact and overcoming the difficulties of communication, one of the first provisions from the Nyxi was a full explanation of dark matter, which is now referred to as tenebrum, and an abundance of access to it. While it took quite some time to understand their theory in the context of humanity's framework of physics, the final result - the Theory of Tenebrivity - revolutionized our understanding of the universe and our technological capabilities.

The complete theory is organized hierarchically by scale, extending all of our prior models of the universe. From the smallest to largest scales, the theory's components are described by:

Fractolet-T Theory The extension of Fractolet Theory, the current most fundamental Theory of Everything, extended to include additional semidimensional stabilian and diffusian fractolets that interact to create umbristings and tenebranes.

Tenebrivic Fractobrane-String Theory The theory that describes how umbristings and tenebranes resonate and interact to form the quantum tenebrivic particle fields.

Quantum Tenebridyamnics The quantum field theory of tenebrivic particles. This theory explains the fundamental tenebrivic force, the composite particles formed from confinement, and the fundamental model of atomoxes - atom-like structures formed by tenebrivic particles.

Tenebrichemistry The full theory of how differing atomoxes form the netherelements, which in turn form the nethermolecules, and the resulting chemical interactions.

Tenebrum Dynamics The human-scale study of tenebrum and its properties, especially in relation to the mechanics of lux matter.

Tenebivic Cosmology The impact that tenebrum has had on the structure and evolution of the universe.

A deep treatise of the two smallest-scale theories are well beyond the scope of this book and require an extensive background in theoretical physics, but we'll briefly review the concepts included. Beyond that, we'll then go into the essential formalism of each theory which will serve as an effective introduction if you wish to dive deeper into the relevant branch of science.

6.1 Fractolets, Umbristrings, Tenebranes



7. Quantum Tenebridynamics

In modern theoretical physics, **quantum tenebridynamics (QTD)** is the theory of the tenebrivic interactions between **noxions** and **thuleons** mediated by **xenobrons** and **vanibrons**. Noxions are fundamental particles that make up composite diombrons such as the protombron and neutrombron. Thuleons are also fundamental particles that make up exotic matter which enables several superluminal technologies. The QTD analog of electric charge is a property called *tenebridge*. Unlike electric charge which can have two types of values (positive, negative), tenebridge can have *four* types of values. These types receive labels from the classical elements in Nyxi antiquity:

vortex, crystal, flow, and spark.

Xenobrons are vanibrons are the force carriers of the theory, with xenobrons having analogous properties to the photon in quantum electrodynamics, and vanibrons having analogous properties to the gluon in quantum chromodynamics. In mathemtically formal

Particle	Field	Tenebridgials	Type	Spin	Mass
Xenobron	X_μ	0	boson	1	0
Noxion	Ψ_α^σ	1	fermion	1/2	0
Vanibron	$V_\beta^{\mu\bar{\alpha}}$	2	boson	1	0
Thuleon	$\delta_{\alpha\bar{\beta}\gamma}^\sigma$	3	fermion	3/2	$\pm m_t$

Table 7.1: Summary of Particles in QTD

language, QTD is a type of quantum field theory called a non-abelian gauge theory, with symmetry group $U(1) \times SU(4)$. The theory is an important part of the Universal Model of particle physics. Research on QTD was blocked for the majority of human history, and became accessible after humanity's first contact with the Nyxi.

7.1 History

From the early 21st century to the 41st century, the prevailing consensus within the scientific community posited the existence of a theoretical form of matter that constituted approximately 85% of the universe's total matter content. This enigmatic substance came to be known as "dark matter." Its name stems not only from its elusive nature, rendering it imperceptible to direct observation, but also due to its negligible interactions with conventional baryonic matter. Further complicating the matter was the absence of a copious, proximate concentration of dark matter, inhibiting more intimate studies. This scarcity stands in stark juxtaposition to the conditions on Nyx, where the abundance of dark matter in Nyxophora was so profound that it played integral roles in both biological and planetary processes of the Nyxi civilization.

As human civilizations evolved, so did their understanding of the cosmos. One of the most transformative events in the annals of scientific progress occurred during the early 4000s, marked by a pivotal collaboration with the Nyxi species. This interspecies partnership, based on shared intellectual curiosity and the promise of mutual enlightenment, propelled humanity's comprehension of what was once termed 'dark matter' to new, unparalleled heights.

Following this collaboration, "dark matter" was subsequently rebranded as "tenebrivic matter." The renaming was emblematic, not just of a newfound understanding, but also of a paradigm shift in the way scholars approached this mysterious substance. With the Nyxi's unique, experiential knowledge, which was rooted in their own planet's profusion of this matter, and the combined cerebral prowess of both species, the field of quantum tenebridynamics emerged. This discipline elucidated the fundamental principles governing the interactions of tenebrivic matter at the quantum level, a subject hitherto unexplored due to the previously mentioned scarcity of the substance in our own vicinity.

The ripened comprehension of tenebrivic matter bore fruits beyond mere academic pursuits. Technological innovations, unimaginable even in the wildest dreams of prior generations, emerged from this golden age of understanding. The theories postulated and validated under quantum tenebridynamics laid the groundwork for the development of warp drive and wormhole technology. These advancements revolutionized space travel, reducing interstellar journeys from lifetimes to mere hours. Humanity was no longer tethered to the confines of our solar system; the vastness of the universe lay invitingly open for exploration.

But perhaps, even more significant than the technological renaissance, was the answer to a question that had long confounded astronomers and cosmologists: Why was the universe's expansion accelerating at such an exponential rate? It was discovered that a subtype of tenebrivic matter, dubbed thuleonic matter, possessed a unique property of negative mass. This peculiarity led to a phenomenon described as the "runaway effect". In essence, the presence of thuleonic matter, with its counterintuitive gravitational influence, drove galaxies apart at increasing velocities. This revelation not only offered a solution to the cosmic expansion conundrum but also opened up an entirely new frontier of inquiry into the nature of mass, gravity, and the ultimate fate of the universe.

In retrospection, the collaboration with the Nyxi wasn't merely an exchange of knowledge. It represented an intermingling of cosmic perspectives and a mutualistic journey towards unraveling the enigmas of existence. Through shared endeavor, the universe became less opaque, its mysteries slightly less mystifying, ushering in the Tenebrivic Epoch — a period of enlightenment, progress, and infinite possibilities.

Interaction		
nxn		$n_a + \bar{n}_{\bar{a}} \rightarrow x$
nvn		$n_a + \bar{n}_{\bar{b}} \rightarrow v_{a\bar{b}}$
v3		$v_{a\bar{b}} + v_{c\bar{a}} \rightarrow v_{c\bar{b}}$
v4		$v_{a\bar{b}} + v_{c\bar{a}} \rightarrow v_{d\bar{b}} + v_{c\bar{d}}$
nvt		$n_a + v_{b\bar{c}} \rightarrow t_{a\bar{c}b}$
tvt		$t_{a\bar{b}c} + t_{\bar{a}b\bar{d}} \rightarrow v_{c\bar{d}}$
txt		$t_{a\bar{b}c} + t_{\bar{a}b\bar{c}} \rightarrow x$

Table 7.2: Summary of Interactions in QTD

7.2 Symmetries

Every field theory of particle physics is based on certain symmetries of nature whose existence is deduced from observations. The group symmetry $U(1) \times SU(4)$ corresponds to the local symmetry whose gauging gives rise to QTD. Symmetries are so crucial to field theories because each symmetry is associated with the conservation of some physical observable. Throughout QTD, we will see that the conserved property is tenebridge.

7.2.1 U(1) Symmetry

$U(1)$ symmetry refers to a type of continuous symmetry associated with the group of complex numbers of magnitude 1 (or, equivalently, the group of 2×2 unitary matrices with determinant 1). This might sound abstract at first, but let's unpack it with a bit of mathematics and then provide some tangible examples.

A complex number is written as $z = a + bi$, where i is the imaginary unit. The magnitude (or modulus) of this number is given by:

$$|z| = \sqrt{a^2 + b^2}$$

The group “Unitary 1” - $U(1)$ - consists of all complex numbers for which $|z| = 1$. That is, they lie on the unit circle in the complex plane. Each of these numbers can be expressed as:

$$z = e^{i\theta}$$

where θ is a real number (angle in radians). As you change θ , you trace out the unit circle. The symmetry refers to the fact that you can change θ by any amount and still remain within the $U(1)$ group. This continuous change is why it’s called a continuous symmetry.

■ **Example 7.1 — U(1) Symmetry in Everyday Life.**

Consider an object spinning around an axis. The object's dynamics remain invariant under rotations about this axis, and these rotations can be described by a U(1) symmetry. The associated conserved quantity here is the component of angular momentum along the axis of rotation. ■

U(1) symmetry arises from the interactions between the noxions and xenobrons. Mathematically, you can change the phase of the quantum wavefunction of a particle with tenebridge by any amount (which corresponds to a U(1) transformation), and the equations of tenebrivity remain unchanged. This symmetry leads to the conservation of tenebridge *magnitude*.

■ **Example 7.2 — U(1) Conservation.**

A spark-noxion n_s and flow-noxion n_f approach each other and then repel. This is mediated by the tenebridgeless-xenobron:

- The first noxion emits a xenobron:

$$n_s \rightarrow n_s + x$$
- The second noxion absorbs a xenobron:

$$n_f + x \rightarrow n_f$$
- An external observer just sees the noxions repel:

$$n_s + n_f \rightarrow n_s + n_f$$

Throughout each step, the magnitude of tenebridge was conserved:

- $1 = 1 + 0$
- $1 + 0 = 1$
- $1 + 1 = 1 + 1$

7.2.2 SU(4)

The SU(4) symmetry is slightly more intricate than U(1), but the general idea is analogous. “SU” stands for “Special Unitary”, and the number following “SU” indicates the dimensionality of the matrices involved. So, SU(4) refers to the group of 4x4 special unitary matrices.

A unitary matrix U has the property that its adjoint (or conjugate transpose) is its inverse. That is:

$$U^\dagger U = UU^\dagger = \mathbb{1}$$

where $\mathbb{1}$ is the identity matrix. The “special” in “Special Unitary” refers to the constraint that the matrices have a determinant of 1.

■ **Example 7.3 — SU(4) Symmetric Matrix.**

An example of an SU(4) matrix is:

$$M = \frac{1}{2} \begin{pmatrix} 0 & 1-i & 0 & 0 \\ 1+i & 0 & 0 & 0 \\ 0 & 0 & 0 & 1-i \\ 0 & 0 & 1+i & 0 \end{pmatrix}$$

To show it's part of $SU(4)$, let's calculate $M^\dagger M$:

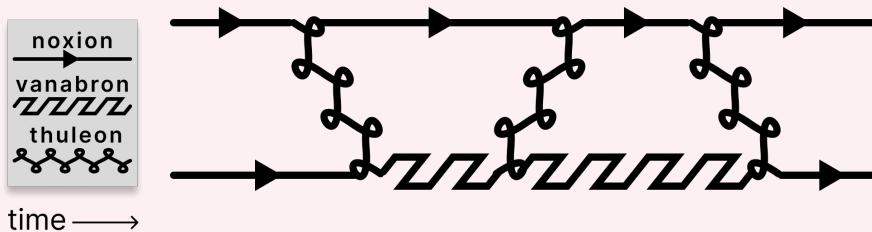
$$\begin{aligned}
 M^\dagger M &= \frac{1}{\sqrt{2}} \begin{pmatrix} 0 & 1-i & 0 & 0 \\ 1+i & 0 & 0 & 0 \\ 0 & 0 & 0 & 1-i \\ 0 & 0 & 1+i & 0 \end{pmatrix} \frac{1}{\sqrt{2}} \begin{pmatrix} 0 & 1-i & 0 & 0 \\ 1+i & 0 & 0 & 0 \\ 0 & 0 & 0 & 1-i \\ 0 & 0 & 1+i & 0 \end{pmatrix} \\
 &= \frac{1}{2} \begin{pmatrix} (1-i)(1+i) & 0 & 0 & 0 \\ 0 & (1+i)(1-i) & 0 & 0 \\ 0 & 0 & (1-i)(1+i) & 0 \\ 0 & 0 & 0 & (1+i)(1-i) \end{pmatrix} \\
 &= \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \\
 &= \mathbb{1}
 \end{aligned}$$

Therefore, M has the symmetry $SU(4)$ ■

$SU(4)$ symmetry arises from the interactions between the noxions (one-tenebridge-carrier), vanibrons (two-tenebridge-carrier), and thuleons (three-tenebridge-carrier), as they each exchange one of the *four* possible tenebridge values when they interact.

■ Example 7.4

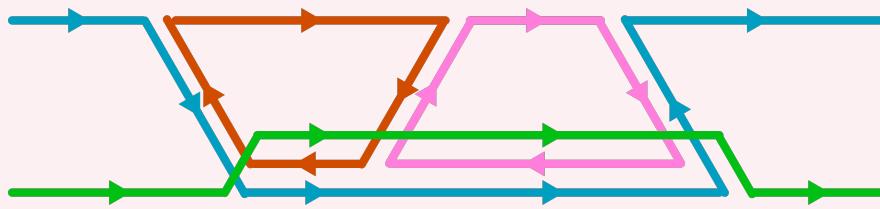
You're studying a relatively complex interaction of noxions, vanibrons and thuleons that looks like:



While you know the tenebridges of the external particles ($n_c + n_v \rightarrow n_c + n_v$), you want to figure out how tenebridge conservation is maintained across all the inner interactions. First you associate each tenebridgial with a color to diagram:

vortex, crystal, flow, and spark

Then, knowing the number of tenebridgials carried by each particle, you can then trace out the paths of the tenebridgials as they're exchanged by particles:



One thing you might notice is that internally, the flow and spark tenebridgials are exchanged forward and then backward in time, effectively forming their own local time loops. This will behavior will become crucial in the understanding of contraparadoxical technologies. ■

To get started constructing our field theory, we need to establish the field representation of each particle, and the end goal is to build up the Lagrangian \mathcal{L}_{QTD} , which can derive the dynamics of our fields by considering the energy terms associated with each particle and their interactions. This is no small feat; this section will simply present the solutions, as a full derivation would go well beyond this introductory review.

7.3 Noxion Field

Let's start with building the field representation of the noxion. Since we know the noxion is a spin-1/2 particle, it will behave as a Dirac spinor. Additionally, we need to represent the four tenebridgials

Definition 7.3.1 — Noxion Field Basis.

Our indices will be:

- α ranging from 0 to 3 for the spinor:
 $\{+\frac{1}{2}n, -\frac{1}{2}n, -\frac{1}{2}\bar{n}, +\frac{1}{2}\bar{n}\}$
- ω ranging from 0 to 3 for the tenebridge:
 $\{v, c, f, s\}$

Then the Noxion field is represented by

$$\Psi_{\alpha\omega} \equiv \begin{pmatrix} n_{\frac{1}{2},v} & n_{\frac{1}{2},c} & n_{\frac{1}{2},f} & n_{\frac{1}{2},s} \\ n_{-\frac{1}{2},v} & n_{-\frac{1}{2},c} & n_{-\frac{1}{2},f} & n_{-\frac{1}{2},s} \\ \bar{n}_{\frac{1}{2},\bar{v}} & \bar{n}_{\frac{1}{2},\bar{c}} & \bar{n}_{\frac{1}{2},\bar{f}} & \bar{n}_{\frac{1}{2},\bar{s}} \\ \bar{n}_{\frac{1}{2},\bar{v}} & \bar{n}_{\frac{1}{2},\bar{c}} & \bar{n}_{\frac{1}{2},\bar{f}} & \bar{n}_{\frac{1}{2},\bar{s}} \end{pmatrix}$$

A tenebridge rotation can be expressed compactly by the action of an SU(4) matrix Ψ on the spinor Ψ :

$$\Psi_{\alpha\omega} \rightarrow \Psi_{\alpha\beta} \Psi_{\beta\omega}$$

Definition 7.3.2 — SU(4) Basis.

Any SU(4) matrix can be described as a linear combination of the 15 basis matrices; by convention these are defined as:

$$\Omega^1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^2 = \begin{pmatrix} 0 & -i & 0 & 0 \\ i & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^3 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^4 = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix},$$

$$\Omega^5 = \begin{pmatrix} 0 & 0 & -i & 0 \\ 0 & 0 & 0 & 0 \\ i & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^6 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^7 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & -i & 0 \\ 0 & i & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^8 = \frac{1}{\sqrt{3}} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix},$$

$$\Omega^9 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^{10} = \begin{pmatrix} 0 & 0 & 0 & -i \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ i & 0 & 0 & 0 \end{pmatrix}, \quad \Omega^{11} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}, \quad \Omega^{12} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -i \\ 0 & 0 & 0 & 0 \\ 0 & i & 0 & 0 \end{pmatrix},$$

$$\Omega^{13} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}, \quad \Omega^{14} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -i \\ 0 & 0 & i & 0 \end{pmatrix}, \quad \Omega^{15} = \frac{1}{\sqrt{6}} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -3 \end{pmatrix}$$

Since any general SU(4) matrix can be written as a combination of these, we can write the general form as:

$$4 = \exp(i\phi^a \Omega^a)$$

Where the index a run from 1 to 15.^a

^aRecall that repeated indices indicate a summation; $\phi^a \Omega^a \equiv \sum_{a=1}^{15} \phi^a \Omega^a$

In the scenario where two people are making tenebridge measurements, there is no guarantee that they are using the same basis. Relativity adds the restriction that two bases at different locations instantaneously. Therefore, the SU(4) transformations depend on the position four-vector x :

$$4(x) = \phi^a(x) 4^a$$

This presents a slight problem. Our end goal is to build the Lagrangian, and the most basic kinetic term would look something like:

$$\mathcal{L}_{\text{noxion}} = \bar{\Psi} i\gamma \partial \Psi$$

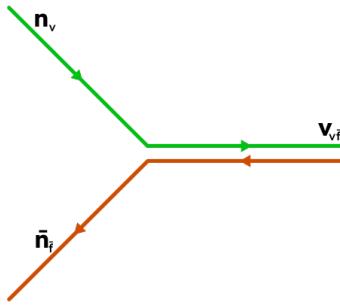
However, looking at an SU(4) transformation happening on this term, the derivative now acts on our SU(4) matrices, so for an SU(4) rotation on this term:

$$\begin{aligned} \mathcal{L}_{\text{noxion}} &= \bar{\Psi} i\gamma \partial \Psi \longrightarrow \mathcal{L}_{\text{noxion}}^{\text{su}(4)} = \bar{\Psi} 4^\dagger i\gamma \partial 4 \Psi \\ &= \bar{\Psi} i\gamma \partial \Psi - \bar{\Psi} \Omega^a \gamma \partial \phi^a(x) \Psi \\ &= \mathcal{L}_{\text{noxion}} - \bar{\Psi} \Omega^a \gamma \partial \phi^a(x) \Psi \end{aligned}$$

we see that this Lagrangian is no longer invariant under an SU(4) transformation. In order to restore this symmetry to conserve tenebridge, we *must* introduce a new field that transforms in a way to cancel out the leftover term. We'll label this field V^a , to cancel out the leftover term and derive the following:

$$\mathcal{L}_{\text{noxion}} + \mathcal{L}_? = \bar{\Psi} i\gamma \partial \Psi + g \bar{\Psi} \gamma V^a \Omega^a \Psi$$

Now let's consider the term we've just added. a runs from 1 to 15, so our V^a field must also have 15 types to match. What is this mysterious V^a ? Well, it turns out to be the vanibron field! Take a moment to interpret this - in order for noxions to conserve tenebridge, they *must* be able to interact with a vanibron field. In short, this is the field tenebridge conservation analogous to this particle tenebridge conservation:



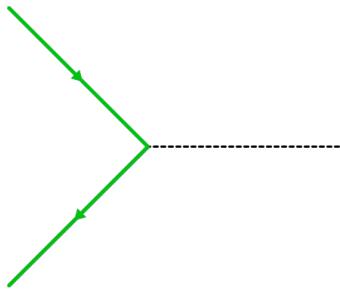
That is to say, tenebridge conservation is maintained when vanibrons have a tenebridgial-antitenebridgial pair equivalent to two noxions with different tenebridges. This also means that the term we've added is in fact the $\mathcal{L}_{\text{nox-van-nox}}$, the Lagrangian for the interaction between noxions and vanibrons.

7.4 Vanibron Field

So far we've described the vanibron field as a family of V^a fields, with a running from 1 to 15. You may be wondering - if there are 4 tenebridgials and vanibrons can carry two at a time, then shouldn't there be 16 fields for each combination

$$\begin{array}{cccc} v\bar{v} & v\bar{c} & v\bar{f} & v\bar{s} \\ c\bar{v} & c\bar{c} & c\bar{f} & c\bar{s} \\ f\bar{v} & f\bar{c} & f\bar{f} & f\bar{s} \\ s\bar{v} & s\bar{c} & s\bar{f} & s\bar{s} \end{array} \quad ?$$

Well as we saw before, vanibrons can only have a tenebridge derived from two noxions. Those two noxions *must* have differing tenebridgials, because if they were the same, then it would be impossible to exchange and also conserve tenebridge:



This means the “singlet” states – $v\bar{v}$, $c\bar{c}$, $f\bar{f}$, and $s\bar{s}$ – are not allowed. You may ask, but then doesn't that mean there are only 12 states? Well keep in mind that this is a *quantum* theory, meaning a superposition can be made out of any combination of states. Therefore, there is truly only *one* invalid state - the state in which a vanibron could be measured and seen in *any* singlet state:

$$(v\bar{v} + c\bar{c} + f\bar{f} + s\bar{s})/2$$

Ensuring this state is unreachable, we want to then develop a basis that still gives otherwise a linearly independent set of 15 states. Fortunately, we already have this set - the Ω matrices! Therefore, the basis we use for the vanibrons is:

Definition 7.4.1 — Vanibron Field Basis.

$$V^a = \begin{pmatrix} v\bar{v} & v\bar{c} & v\bar{f} & v\bar{s} \\ c\bar{v} & c\bar{c} & c\bar{f} & c\bar{s} \\ f\bar{v} & f\bar{c} & f\bar{f} & f\bar{s} \\ s\bar{v} & s\bar{c} & s\bar{f} & s\bar{s} \end{pmatrix}_{ij} \Omega_{ij}^a$$

Fully expanded, the 15 states are:

$$\begin{aligned} V^1 &= \frac{v\bar{c}+c\bar{v}}{\sqrt{2}} & V^2 &= -\frac{i(v\bar{c}-c\bar{v})}{\sqrt{2}} & V^3 &= \frac{v\bar{v}-c\bar{c}}{\sqrt{2}} & V^4 &= \frac{v\bar{f}+f\bar{v}}{\sqrt{2}} \\ V^5 &= -\frac{i(v\bar{f}-f\bar{v})}{\sqrt{2}} & V^6 &= \frac{f\bar{c}+c\bar{f}}{\sqrt{2}} & V^7 &= \frac{i(f\bar{c}-c\bar{f})}{\sqrt{2}} & V^8 &= \frac{c\bar{c}-2f\bar{f}+v\bar{v}}{\sqrt{6}} \\ V^9 &= \frac{v\bar{s}+s\bar{v}}{\sqrt{2}} & V^{10} &= -\frac{i(v\bar{s}-s\bar{v})}{\sqrt{2}} & V^{11} &= \frac{s\bar{c}+c\bar{s}}{\sqrt{2}} & V^{12} &= \frac{i(s\bar{c}-c\bar{s})}{\sqrt{2}} \\ V^{13} &= \frac{s\bar{f}+f\bar{s}}{\sqrt{2}} & V^{14} &= \frac{i(s\bar{f}-f\bar{s})}{\sqrt{2}} & V^{15} &= \frac{c\bar{c}+f\bar{f}-3s\bar{s}+v\bar{v}}{2\sqrt{3}} \end{aligned}$$

This basis ensures that no singlet state can be formed and still recreate all the known tenebridgial combinations:

$$\begin{aligned} v\bar{c} &= \frac{V^1+iV^2}{\sqrt{2}} & c\bar{v} &= \frac{V^1-iV^2}{\sqrt{2}} & v\bar{f} &= \frac{V^4+iV^5}{\sqrt{2}} & f\bar{v} &= \frac{V^4-iV^5}{\sqrt{2}} \\ v\bar{s} &= \frac{V^9+iV^{10}}{\sqrt{2}} & s\bar{v} &= \frac{V^9-iV^{10}}{\sqrt{2}} & c\bar{f} &= \frac{V^6+iV^7}{\sqrt{2}} & f\bar{c} &= \frac{V^6-iV^7}{\sqrt{2}} \\ c\bar{s} &= \frac{V^{11}+iV^{12}}{\sqrt{2}} & s\bar{c} &= \frac{V^{11}-iV^{12}}{\sqrt{2}} & f\bar{s} &= \frac{V^{13}+iV^{14}}{\sqrt{2}} & s\bar{f} &= \frac{V^{13}-iV^{14}}{\sqrt{2}} \end{aligned}$$

One thing to watch out for however is that vanibrons are spin-1 particles, meaning that their field is a **four-vector field**. For example, you might use the definition above to write the explicit form of the 1st vanibron state, but the terms in that result are four-vectors:

$$V^1 = i(c\bar{v} - v\bar{c}) = i \begin{pmatrix} V_0^1(\mathbf{x}) \\ V_1^1(\mathbf{x}) \\ V_2^1(\mathbf{x}) \\ V_3^1(\mathbf{x}) \end{pmatrix}$$

If we are working with this field in a context where we need to consider spacetime transformations, then its sometimes helpful to fully index the field

Definition 7.4.2 — Vanibron Field.

The Vanibron Field is fully defined for the indices:

- a ranging from 1 to 15 for the basis state
- μ ranging from 0 to 3 for the μ -th-dimension's component: $\{t, x, y, z\}$

Expanded this gives the form

$$V_\mu^a(\mathbf{x}) = \begin{pmatrix} V_t^1 & V_t^2 & V_t^3 & V_t^4 & V_t^5 & \dots \\ V_x^1 & V_x^2 & V_x^3 & V_x^4 & V_x^5 & \dots \\ V_y^1 & V_y^2 & V_y^3 & V_y^4 & V_y^5 & \dots \\ V_z^1 & V_z^2 & V_z^3 & V_z^4 & V_z^5 & \dots \end{pmatrix}$$

Since this is a vector field, the kinetic term of the Lagrangian isn't just a simple multivariable derivative – we need to capture the derivative of each component in each direction. To do so, we would normally define a Field Strength Tensor

$$U_{\mu\nu}^a \stackrel{?}{=} \partial_\mu V_\nu^a - \partial_\nu V_\mu^a$$

and this would lead to a Lagrangian like

$$\mathcal{L}_{\text{vanibron}} = -\frac{1}{4} \mathcal{U}_{\mu\nu}^a \mathcal{U}^{a\mu\nu}.$$

Does this Lagrangian still follow SU(4) gauge invariance? First let's check how the vanibron field transforms:

$$V_\mu^a \rightarrow V'_\mu{}^a 4 V_\mu^a 4^\dagger + \frac{i}{g_v} 4 \partial_\mu 4^\dagger$$

Recalling the original definition $4 = \exp(i\phi^a \Omega^a)$ and considering only first order terms in ϕ^a , the change δV_μ^a due to the gauge transformation is:

$$\delta V_\mu^a = V'_\mu{}^a - V_\mu^a \approx i\phi^b (\Omega^b V'_\mu{}^a - V_\mu^a \Omega^b) + \frac{i}{g_v} \partial_\mu \phi^b \Omega^b$$

The term $\Omega^b V'_\mu{}^a - V_\mu^a \Omega^b$ doesn't vanish as the SU(4) generators do not commute. Instead, we can use the non-commutative property of the SU(4) generators:

$$\Omega^a \Omega^b - \Omega^b \Omega^a = i\omega^{abc} \Omega^c$$

where ω^{abc} are referred to as the SU(4) structure constants. Using this, we can write the vanibron field change as:

$$\delta V_\mu^a \approx \omega^{abc} \phi^b V_\mu^c + \frac{i}{g_v} \partial_\mu \phi^b \Omega^b$$

Now finally let's see how the field strength tensor $\Phi_{\mu\nu}^a$ transforms; looking specifically at the change due to the gauge transformation:

$$\begin{aligned} \delta \mathcal{U}_{\mu\nu}^a &= \partial_\mu \delta V_\nu^a - \partial_\nu \delta V_\mu^a \\ &\approx \omega^{abc} \phi^b (\partial_\mu V_\nu^c - \partial_\nu V_\mu^c) + \omega^{abc} V_\mu^c \partial_\nu \phi^b - \omega^{abc} V_\nu^c \partial_\mu \phi^b \end{aligned}$$

The last two terms contain products of V_μ^c and derivatives of ϕ^b . These terms aren't canceled by any term in our naive definition of $\mathcal{U}_{\mu\nu}^a$. In order to counteract those terms then, we must update our definition to introduce a new term:

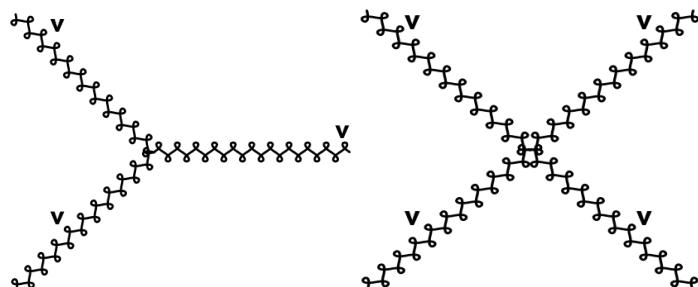
Definition 7.4.3 — Vanibron Field Strength Tensor.

$$\mathcal{U}_{\mu\nu}^a \equiv \partial_\mu V_\nu^a - \partial_\nu V_\mu^a + g_v \omega^{abc} V_\mu^b V_\nu^c$$

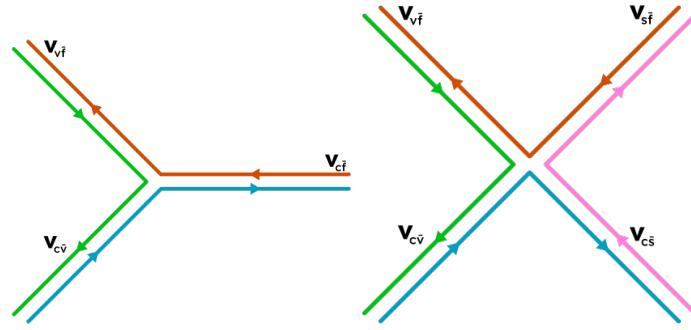
Our Lagrangian then can be written correctly as:

$$\mathcal{L}_{\text{vanibron}} = -\frac{1}{4} \mathcal{U}_{\mu\nu}^a \mathcal{U}^{a\mu\nu}$$

Let's take a moment to interpret our results. The Lagrangian now contains terms of order \mathcal{U}^3 and \mathcal{U}^4 - in fact these are the vanibron's *self* interactions! Just as the noxon can experience the tenebrivic force mediated by a vanibron, so can the vanibron experience the tenebrivic force mediated by a vanibron!



Tenebridge is still conserved in these interactions as well, which we can see by tracing out the paths of tenebridge exchange in these interactions:



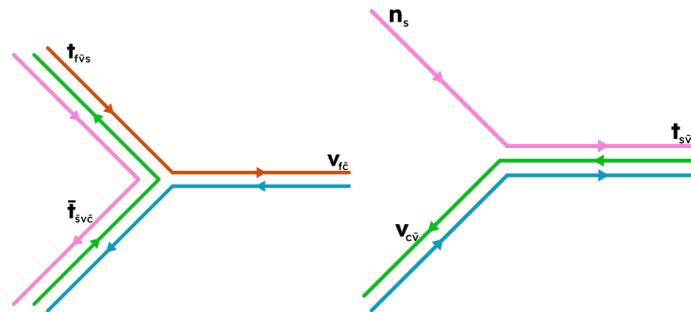
7.5 Thuleon Field

The thuleon is another particle that carries tenebridge and experiences tenebrivity mediated by the vanibron. It is a spin- $\frac{3}{2}$ particle, and also has mass, so in its rest frame there are four helicity states: $\pm\frac{3}{2}$ and $\pm\frac{1}{2}$.

The next attribute of the thuleon to account for is its tenebridge. Thuleons carry three tenebridgials at a time, and there are four possible ways to do so:

$$\{cfv, fsv, csv, cfs\}$$

Order isn't distinct for these combinations (e.g. cfv and vfc would refer to the same combination), but there is one other factor to account for stemming from tenebridge conservation. Take a look at the interactions involving thuleons:



In both cases, the thuleon has a distinct signature of tenebridgial-antitenebridgial-tenebridgial. This means for each combination, it is possible to distinguish by which of the three tenebridgials is in the "anti" slot. For example, cfv and $c\bar{f}\bar{v}$ are distinguishable states, but $c\bar{f}v$ and $v\bar{f}c$ are not.

Finally, because the particle is spin- $\frac{3}{2}$, it must take on the form of a vector-spinor field.

Definition 7.5.1 — Thuleon Field Representation.

To incorporate all of the above, we will need 4 indices:

1. an index η ranging from 0 to 3
for the given helicity state $\{\frac{3}{2}, \frac{1}{2}, -\frac{1}{2}, -\frac{3}{2}\}$
2. an index μ ranging from 0 to 3
for the components of the vector field in the μ -th dimension
3. an index τ ranging from 0 to 3
for the standard tenebridgial ordering $\{v, c, f, s\}$,
the index represents which tenebridgial is missing in the combination: $\{cfs, vfs, vcs, vcf\}$

4. an index χ ranging from 1 to 3
 for which tenebridgial in the combination is the antitenebridgial.
 e.g. for $\tau = 0$, χ ranges over $\{\bar{c}fs, c\bar{f}s, c\bar{s}\}$

Then we can define the thuleon field as a $4 \times 4 \times 4 \times 3$ tensor:

$$\Theta_{\mu\tau\chi}^\eta = \begin{pmatrix} s_{3/2} \\ s_{1/2} \\ s_{-1/2} \\ s_{-3/2} \end{pmatrix}_\eta \begin{pmatrix} (t_{f\bar{c}s})_\mu & (t_{c\bar{f}s})_\mu & (t_{c\bar{s}})_\mu \\ (t_{f\bar{v}s})_\mu & (t_{v\bar{f}s})_\mu & (t_{v\bar{s}})_\mu \\ (t_{c\bar{v}s})_\mu & (t_{v\bar{c}s})_\mu & (t_{v\bar{s}c})_\mu \\ (t_{c\bar{v}f})_\mu & (t_{v\bar{c}f})_\mu & (t_{v\bar{f}c})_\mu \end{pmatrix}_{\tau\chi} \quad (7.1)$$

The first matrix contains the spinor portion of this field, while the second contains the vector portion of this field, so we have indeed constructed a spinor-vector field as necessary for a spin- $\frac{3}{2}$ particle.

In a relativistic theory, normally the presence of the antiparticle would double the number of distinguishable states, but later we will see that the negative mass of the antithuleon enforces that the antithuleon is its own adjoint, so instead of a single Θ vector-spinor field with components for both the particle and antiparticle, instead Θ represents all the components for the thuleon and $\bar{\Theta}$ will represent all the components for the antithuleon. This does have a specific interpretation: the thuleon isn't quite its own antiparticle, but rather, the "spin η , a – anti- b – c thuleon" is indistinguishable from the "spin $-\eta$, anti- a – b – anti- c antithuleon of same mass". Explicitly, this means the adjoint of the field looks like:

$$\bar{\Theta}_{\mu\tau\chi}^\eta = \begin{pmatrix} s_{-3/2} \\ s_{-1/2} \\ s_{1/2} \\ s_{3/2} \end{pmatrix}_\eta \begin{pmatrix} (\bar{t}_{\bar{f}c\bar{s}})_\mu & (\bar{t}_{\bar{c}f\bar{s}})_\mu & (\bar{t}_{\bar{c}s\bar{f}})_\mu \\ (\bar{t}_{\bar{f}v\bar{s}})_\mu & (\bar{t}_{\bar{v}f\bar{s}})_\mu & (\bar{t}_{\bar{v}s\bar{f}})_\mu \\ (\bar{t}_{\bar{c}v\bar{s}})_\mu & (\bar{t}_{\bar{v}c\bar{s}})_\mu & (\bar{t}_{\bar{v}s\bar{c}})_\mu \\ (\bar{t}_{\bar{c}v\bar{f}})_\mu & (\bar{t}_{\bar{v}c\bar{f}})_\mu & (\bar{t}_{\bar{v}f\bar{c}})_\mu \end{pmatrix}_{\tau\chi}$$

7.5.1 Kinetic Term

The kinetic term of this Lagrangian can be derived much the same way as both the noxon's and vanibron's, where the spinor portion of the thuleon follows the noxon's derivation and the vector portion of the thuleon follows the vanibron's derivation.

Let's define a field strength tensor for the vector portion of the field:

Definition 7.5.2 — Thuleon Field Strength Tensor.

$$\mathbb{III}_{\mu\nu;\tau\chi}^\eta = \partial_\mu \Theta_{\nu\tau\chi}^\eta - \partial_\nu \Theta_{\mu\tau\chi}^\eta$$

Following the same derivation of the Lagrangian by gauge invariance leads us to a free-particle Lagrangian which we can compose in two parts; the kinetic contribution from the tensor and spinor:

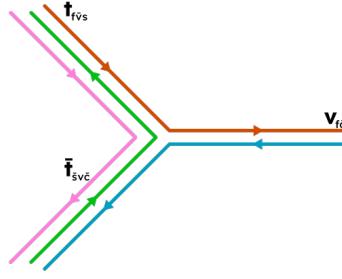
$$\mathcal{L}_{\text{thuleon}} = -\frac{1}{4} \mathbb{III}_{\mu\nu;\tau\chi}^\eta \gamma^\eta \mathbb{III}_{\tau\chi}^{\eta\mu\nu}$$

and the gauge-invariance requirement that leads to the vanibron-interaction term:

$$\mathcal{L}_{\text{thuleon-vanibron}} \stackrel{?}{=} -ig_{\text{tv}} \bar{\Theta}_{\tau\chi}^\eta \gamma^\mu \Omega^a V_\mu^a \bar{\Theta}_{\tau\chi}^\eta$$

except there's a problem with that Lagrangian as written.

7.5.2 Thuleon-Vanibron Interaction



Not every kind of thuleon can interact with every kind of vanibron, since tenebridge conservation requires $t_{a\bar{b}c} \rightarrow t_{a\bar{b}d} + v_{cd}$. Therefore, the thuleon-vanibron interaction term requires an additional factor to enforce this coupling. First let's think through an example:

■ Example 7.5 — Thuleon Mapping.

Θ_{01}^η is an $\bar{c}fv$ thuleon. Tenebridge is conserved if the resulting particles are an $f\bar{c}s$ thuleon and $v\bar{s}$ vanibron, or $s\bar{c}v$ thuleon and $f\bar{s}$ vanibron.

- In the former case, the associated fields are $\Theta_{3,3}^\eta$ and $\frac{1}{\sqrt{2}}(V^9 - iV^{10})$
- In the latter case, the associated fields are $\Theta_{2,1}^\eta$ and $\frac{1}{\sqrt{2}}(V^{13} - iV^{14})$

Thinking through each case of the example above, we see that the vanibron interaction term will require a transformation matrix $\aleph_a^{\tau\chi\lambda\rho}$ in order to restrict the coupling accordingly:

$$-ig_{\text{tvt}} \bar{\Theta}_{\mu\lambda\rho}^\eta \gamma_{\eta\kappa}^\mu \aleph_a^{\tau\chi\lambda\rho} \Omega^\alpha V_\mu^\alpha \bar{\Theta}_{\mu\tau\chi}^\kappa$$

To find the explicit form of $\aleph_a^{\tau\chi\lambda\rho}$, we consider each possible interaction

$$\begin{aligned} & \left\{ \begin{array}{ccc} t_{f\bar{c}s} & t_{c\bar{f}s} & t_{c\bar{s}f} \\ t_{f\bar{v}s} & t_{v\bar{f}s} & t_{v\bar{s}f} \\ t_{c\bar{v}s} & t_{v\bar{c}s} & t_{v\bar{s}c} \\ t_{c\bar{v}f} & t_{v\bar{c}f} & t_{v\bar{f}c} \end{array} \right\} \\ \xrightarrow{} & \left\{ \begin{array}{ccc} t_{v\bar{c}s} + v_{f\bar{v}} & t_{v\bar{f}s} + v_{c\bar{v}} & t_{v\bar{s}f} + v_{c\bar{v}} \\ t_{c\bar{v}s} + v_{f\bar{c}} & t_{c\bar{f}s} + v_{v\bar{c}} & t_{c\bar{s}f} + v_{v\bar{c}} \\ t_{f\bar{v}s} + v_{c\bar{f}} & t_{f\bar{c}s} + v_{v\bar{f}} & t_{f\bar{s}c} + v_{v\bar{f}} \\ t_{s\bar{v}f} + v_{c\bar{s}} & t_{s\bar{c}f} + v_{v\bar{s}} & t_{s\bar{f}c} + v_{v\bar{s}} \end{array} \right\} \\ \vee & \left\{ \begin{array}{ccc} t_{f\bar{c}v} + v_{s\bar{v}} & t_{c\bar{f}v} + v_{s\bar{v}} & t_{c\bar{s}v} + v_{f\bar{v}} \\ t_{f\bar{v}c} + v_{s\bar{c}} & t_{v\bar{f}c} + v_{s\bar{c}} & t_{v\bar{s}c} + v_{f\bar{c}} \\ t_{c\bar{v}f} + v_{s\bar{f}} & t_{v\bar{c}f} + v_{s\bar{f}} & t_{v\bar{s}f} + v_{c\bar{f}} \\ t_{c\bar{v}s} + v_{f\bar{s}} & t_{v\bar{c}s} + v_{f\bar{s}} & t_{v\bar{f}s} + v_{c\bar{s}} \end{array} \right\} \end{aligned}$$

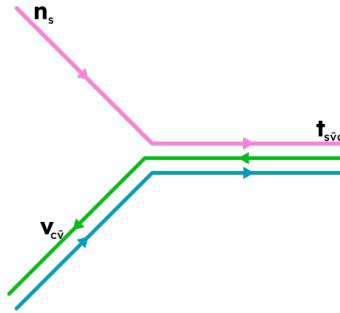
then map these to the appropriate field

$$\begin{aligned}
 & \left\{ \Theta_{\mu,0,1}^\eta, \Theta_{\mu,0,2}^\eta, \Theta_{\mu,0,3}^\eta \right\} \\
 \rightarrow & \left\{ \Theta_{\mu,2,2} + \frac{V^4 - iV^5}{\sqrt{2}}, \Theta_{\mu,1,2} + \frac{V^1 - iV^2}{\sqrt{2}}, \Theta_{\mu,1,3} + \frac{V^1 - iV^2}{\sqrt{2}} \right. \\
 & \left. \Theta_{\mu,3,1} + \frac{V^6 - iV^7}{\sqrt{2}}, \Theta_{\mu,0,2} + \frac{V^1 + iV^2}{\sqrt{2}}, \Theta_{\mu,0,3} + \frac{V^1 + iV^2}{\sqrt{2}} \right\} \\
 \vee & \left\{ \Theta_{\mu,1,1} + \frac{V^6 + iV^7}{\sqrt{2}}, \Theta_{\mu,0,0} + \frac{V^4 + iV^5}{\sqrt{2}}, \Theta_{\mu,0,3} + \frac{V^4 + iV^5}{\sqrt{2}} \right. \\
 & \left. \Theta_{\mu,1,1} + \frac{V^{11} + iV^{12}}{\sqrt{2}}, \Theta_{\mu,0,0} + \frac{V^9 + iV^{10}}{\sqrt{2}}, \Theta_{\mu,0,2} + \frac{V^9 + iV^{10}}{\sqrt{2}} \right\} \\
 & \vee \left\{ \Theta_{\mu,3,0} + \frac{V^9 - iV^{10}}{\sqrt{2}}, \Theta_{\mu,3,3} + \frac{V^9 - iV^{10}}{\sqrt{2}}, \Theta_{\mu,2,3} + \frac{V^4 - iV^5}{\sqrt{2}} \right. \\
 & \left. \Theta_{\mu,3,1} + \frac{V^{11} - iV^{12}}{\sqrt{2}}, \Theta_{\mu,3,2} + \frac{V^{11} - iV^{12}}{\sqrt{2}}, \Theta_{\mu,2,3} + \frac{V^6 - iV^7}{\sqrt{2}} \right\} \\
 & \left. \Theta_{\mu,3,1} + \frac{V^{13} - iV^{14}}{\sqrt{2}}, \Theta_{\mu,3,2} + \frac{V^{13} - iV^{14}}{\sqrt{2}}, \Theta_{\mu,1,2} + \frac{V^6 + iV^7}{\sqrt{2}} \right\} \\
 & \left. \Theta_{\mu,2,1} + \frac{V^{13} + iV^{14}}{\sqrt{2}}, \Theta_{\mu,2,2} + \frac{V^{13} + iV^{14}}{\sqrt{2}}, \Theta_{\mu,1,2} + \frac{V^{11} + iV^{12}}{\sqrt{2}} \right\}
 \end{aligned}$$

then the full form of $\aleph_a^{\tau\chi\lambda\rho}$ can be formed by grabbing the indices from the above mapping:

$$\begin{aligned}
 \aleph_a^{\tau\chi\lambda\rho} = & \frac{1}{\sqrt{2}} \delta_{\tau,0} \delta_{\chi,1} (\delta_{\lambda,2} \delta_{\rho,2} (\delta_{a,4} - i\delta_{a,5}) + \delta_{\lambda,3} \delta_{\rho,0} (\delta_{a,9} - i\delta_{a,10})) \\
 & + \frac{1}{\sqrt{2}} \delta_{\tau,0} \delta_{\chi,2} (\delta_{\lambda,1} \delta_{\rho,2} (\delta_{a,1} - i\delta_{a,2}) + \delta_{\lambda,3} \delta_{\rho,3} (\delta_{a,9} - i\delta_{a,10})) \\
 & + \frac{1}{\sqrt{2}} \delta_{\tau,0} \delta_{\chi,3} (\delta_{\lambda,1} \delta_{\rho,3} (\delta_{a,1} - i\delta_{a,2}) + \delta_{\lambda,2} \delta_{\rho,3} (\delta_{a,4} - i\delta_{a,5})) \\
 & + \dots
 \end{aligned}$$

7.5.3 Thuleon-Vanibron-Noxion Interaction



There's yet another interaction we have yet to account for, which is the interaction between a single noxion, vanibron, and thuleon. Such an interaction term might look like:

$$\mathfrak{D}_d^{abc} \Upsilon_{\eta\kappa} (g_{tvn} \bar{\Theta}_{\mu ab}^\eta \gamma^\eta \Omega^d V_\mu^d \gamma^\kappa \Psi_c^\kappa + g_{nvt} \bar{\Psi}_c^\kappa \gamma^\kappa \Omega^d \bar{V}_\mu^d \gamma^\eta \Theta_{\mu ab}^\eta)$$

where the two terms represent the forward and reverse process both being possible, with rates determined by the coupling constants g_{tvn} and g_{nvt} . Tenebridge conservation leads to the \mathfrak{D}_d^{abc} term to ensure that only valid transformations occur. This can be derived

following the transformation rules:

$$\begin{aligned} & \left\{ \begin{array}{ccc} t_{f\bar{c}s} & t_{c\bar{f}s} & t_{c\bar{s}f} \\ t_{f\bar{v}s} & t_{v\bar{f}s} & t_{v\bar{s}f} \\ t_{c\bar{v}s} & t_{v\bar{c}s} & t_{v\bar{s}c} \\ t_{c\bar{v}f} & t_{v\bar{c}f} & t_{v\bar{f}c} \end{array} \right\} \\ \rightarrow & \left\{ \begin{array}{ccc} n_f + v_{s\bar{c}} & n_c + v_{s\bar{f}} & n_c + v_{f\bar{s}} \\ n_f + v_{s\bar{v}} & n_v + v_{s\bar{f}} & n_v + v_{f\bar{s}} \\ n_c + v_{s\bar{v}} & n_v + v_{s\bar{c}} & n_v + v_{c\bar{s}} \\ n_c + v_{f\bar{v}} & n_v + v_{f\bar{c}} & n_v + v_{c\bar{f}} \end{array} \right\} \vee \left\{ \begin{array}{ccc} n_s + v_{f\bar{c}} & n_s + v_{c\bar{f}} & n_f + v_{c\bar{s}} \\ n_s + v_{f\bar{v}} & n_s + v_{v\bar{f}} & n_f + v_{v\bar{s}} \\ n_s + v_{c\bar{v}} & n_s + v_{v\bar{c}} & n_c + v_{v\bar{s}} \\ n_f + v_{c\bar{v}} & n_f + v_{v\bar{c}} & n_c + v_{v\bar{f}} \end{array} \right\} \end{aligned}$$

and then considering the equivalent fields

$$\begin{aligned} & \left\{ \begin{array}{ccc} \Theta_{\mu,0,1}^\eta & \Theta_{\mu,0,2}^\eta & \Theta_{\mu,0,3}^\eta \\ \Theta_{\mu,1,1}^\eta & \Theta_{\mu,1,2}^\eta & \Theta_{\mu,1,3}^\eta \\ \Theta_{\mu,2,1}^\eta & \Theta_{\mu,2,2}^\eta & \Theta_{\mu,2,3}^\eta \\ \Theta_{\mu,3,1}^\eta & \Theta_{\mu,3,2}^\eta & \Theta_{\mu,3,3}^\eta \end{array} \right\} \\ \rightarrow & \left\{ \begin{array}{ccc} n_3 + \frac{V^{11}-iV^{12}}{\sqrt{2}} & n_2 + \frac{V^{13}-iV^{14}}{\sqrt{2}} & n_2 + \frac{V^{13}+iV^{14}}{\sqrt{2}} \\ n_3 + \frac{V^9-iV^{10}}{\sqrt{2}} & n_1 + \frac{V^{13}-iV^{14}}{\sqrt{2}} & n_1 + \frac{V^{13}+iV^{14}}{\sqrt{2}} \\ n_2 + \frac{V^9-iV^{10}}{\sqrt{2}} & n_1 + \frac{V^{11}-iV^{12}}{\sqrt{2}} & n_1 + \frac{V^{11}+iV^{12}}{\sqrt{2}} \\ n_2 + \frac{V^6-iV^7}{\sqrt{2}} & n_1 + \frac{V^6+iV^7}{\sqrt{2}} & n_1 + \frac{V^6+iV^7}{\sqrt{2}} \end{array} \right\} \\ \vee & \left\{ \begin{array}{ccc} n_4 + \frac{V^6-iV^7}{\sqrt{2}} & n_4 + \frac{V^6+iV^7}{\sqrt{2}} & n_3 + \frac{V^{11}+iV^{12}}{\sqrt{2}} \\ n_4 + \frac{V^4-iV^5}{\sqrt{2}} & n_4 + \frac{V^4+iV^5}{\sqrt{2}} & n_3 + \frac{V^9+iV^{10}}{\sqrt{2}} \\ n_4 + \frac{V^1-iV^2}{\sqrt{2}} & n_4 + \frac{V^1+iV^2}{\sqrt{2}} & n_2 + \frac{V^9+iV^{10}}{\sqrt{2}} \\ n_3 + \frac{V^1-iV^2}{\sqrt{2}} & n_3 + \frac{V^1+iV^2}{\sqrt{2}} & n_2 + \frac{V^4+iV^5}{\sqrt{2}} \end{array} \right\} \end{aligned}$$

Then the various entries of \mathfrak{D}_d^{abc} can be derived as:

$$\begin{aligned} \mathfrak{D}_d^{abc} = & \frac{1}{\sqrt{2}} \delta_{a,0} \delta_{b,1} (\delta_{c,3} (\delta_{d,11} - i\delta_{d,12}) + \delta_{c,4} (\delta_{d,6} - i\delta_{d,7})) \\ & + \frac{1}{\sqrt{2}} \delta_{a,0} \delta_{b,2} (\delta_{c,2} (\delta_{d,13} - i\delta_{d,14}) + \delta_{c,4} (\delta_{d,6} + i\delta_{d,7})) \\ & + \frac{1}{\sqrt{2}} \delta_{a,0} \delta_{b,3} (\delta_{c,2} (\delta_{d,13} + i\delta_{d,14}) + \delta_{c,3} (\delta_{d,11} + i\delta_{d,12})) \\ & + \dots \end{aligned}$$

7.5.4 Mass Term

The thuleon not only has mass, but infamously the antithuleon has negative mass. Writing the lagrangian contribution for this is actually relatively straightforward:

Definition 7.5.3 — Thuleon Mass Lagrangian.

$$\mathcal{L}_{\text{thuleon-mass}} \equiv \mathfrak{m} \delta_{\mu\nu} (\bar{\Theta}_{\tau\chi}^\eta \Theta_{\mu\tau\chi}^\eta - \bar{\Theta}_{3-\tau,3-\chi}^{3-\eta} \Theta_{\nu,3-\tau,3-\chi}^{3-\eta})$$

The more interesting discussion is the impact that a particle with negative mass has on our understanding of the universe. Let's review what topics are impacted, or otherwise not impacted.

Vacuum Stability

Typically, the vacuum state in a quantum field theory is the lowest energy state. A negative mass term could create the possibility of a vacuum that is not the global energy minimum. Such a vacuum would be unstable and susceptible to decaying to a state of even lower energy. This can lead to a phenomenon called “vacuum decay”.

In QTD, From the reference frame of the antithuleon, a vacuum decay would be seen as *increasing* the energy state of the antithuleon. This is therefore an antithuleon excitation. Just as an electron excitation leads to photon emission as the electron returns to ground state, the antithuleon excitation drives the antithuleon to couple with a thuleon to decay into the massless vanibron. Therefore, local vacuum decay generally doesn’t occur.

However, in the history of the universe, antithuleon-thuleon pairs could be separated by processes like thuleon Hawking radiation. In this case, the free antithuleon experiences a vacuum decay *from its perspective*, leading to a constantly increasing acceleration in our observable universe’s reference frame. This will be resolved as we discuss runaway motion below.

Unitarity

Unitarity ensures the conservation of probability in quantum mechanics. In quantum field theory, the S-matrix (which describes scattering amplitudes) should be unitary. A non-standard mass term can potentially violate unitarity, especially if a negative-mass particle interacts with a positive-mass particle in an internal loop.

QTD avoids non-unitarity as all the other particles in QTD are massless – and as for the antithuleon interacting with the thuleon, this leads to annihilation of the particles and therefore it is trivial to assess the conservation of probability.

Runaway Motion

As mentioned previously, negative mass particles under the influence of a force might display “runaway motion”. Instead of opposing the force applied, they would accelerate in the direction of the force, leading to unbounded velocities. There is no local way to produce an antithuleon without a corresponding thuleon, and therefore velocities are always bound by pair annihilation. However, universe-age free antithuleons are possible, and in fact observable. Humanity first made this observation long ago with the interpretation that the universe was accelerating in its expansion. This isn’t necessarily an inaccurate interpretation, but the underlying mechanism is free antithuleons propagating in our universe, ever-increasing in their speeds and having a gravitationally repulsive effect leading to all astronomical bodies moving further apart.

Since antithuleons accelerate due to gravitational repulsion, on average they follow Hubble’s Law, which states that the recession velocity of distant objects is proportional to its distance from us:

$$v = H_0 \times d$$

The proportionality constant H_0 is derived from experimental measurement, and the most recent value measured last in 4102 is 89 kilometers per second per Megaparsec (km/s/Mpc). The observable universe is roughly 46.5 billion light years, or 14,529 Megaparsecs. From Hubble’s law then, we find that the fastest observable antithuleons in the observable universe travel at a speed of

$$\begin{aligned} v &= (89 \text{ km/s/Mpc}) \times (14,529 \text{ Mpc}) \\ &\approx 1,269,051 \text{ km/s (kilometers per second)} \\ &\approx 4.23c \end{aligned}$$

Once we dive into the composite matter made out of our tenebrivic particles, we'll dive even deeper into the superliminal technologies that have been developed using antithuleons and further implications on causality and the need for contraparadoxical security measures.

7.6 Xenobron Field

Our last particle to discuss is the xenobron, a spin-1 massless boson that carries no tenebridge. As such you may be wondering, how is the xenobron distinguishable from the photon? In fact, the only distinguishing characteristic is that it interacts with tenebrivic particles and doesn't interact with electromagnetic particles! Fortunately though, the U(1) symmetry that this force is gauge invariant to looks just like Quantum Electrodynamics with one small adjustment.

Definition 7.6.1 — Xenobron Field.

Our Xenobron field is given by the vector field:

$$\Xi_\mu = \begin{pmatrix} \Xi_0 \\ \Xi_1 \\ \Xi_2 \\ \Xi_3 \end{pmatrix}$$

where the index μ ranges from 0 to 3 and represents the value of the μ -th component of the vector.

Since this is a vector field, again we define a field strength tensor:

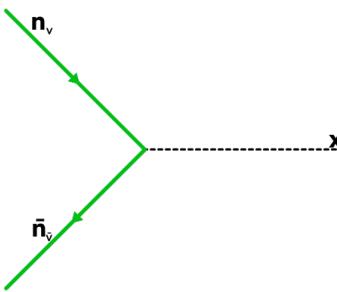
Definition 7.6.2 — Xenobron Field Strength Tensor.

$$\mathbb{K}_{\mu\nu} = \partial_\mu \Xi_\nu - \partial_\nu \Xi_\mu$$

Then the free particle Lagrangian looks like

$$\mathcal{L}_{\text{xenobron}} = -\frac{1}{4} \mathbb{K}_{\mu\nu} \mathbb{K}^{\mu\nu}$$

The interaction with the noxion

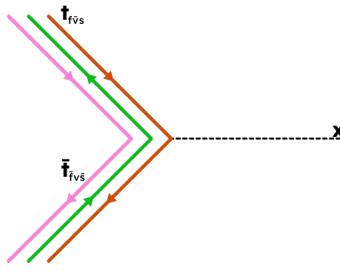


looks like

$$\mathcal{L}_{\text{xenobron-noxion}} = -g_{\text{xn}} \delta_{\omega\rho} \bar{\Psi}_{\alpha\omega} \gamma_{\alpha\beta}^\mu \Psi_{\beta\rho} \Xi_\mu$$

The main difference between this interaction and the photon-electron one is that this Lagrangian has the added term $\delta_{\omega\rho}$, specifically to enforce that the tenebridge of the involved noxion does not change.

There is just one interaction remaining; the xenobron-thuleon interaction: The interaction with the noxion



This can also be constructed just like the QED lagrangian, with the additional constraints on conserving tenebridge.

$$\mathcal{L}_{\text{xenobron-thuleon}} = -g_{\text{txt}} \delta_{\sigma\tau} \delta_{\xi\chi} \bar{\Theta}_{\mu\sigma\xi}^{\eta} \gamma_{\eta\kappa}^{\mu} \bar{\Theta}_{\mu\tau\chi}^{\kappa} \Xi_{\mu}$$

7.7 Complete Lagrangian

It is now time to write the complete Lagrangian of Quantum Tenebridynamics!

$$\begin{aligned} \mathcal{L}_{\text{QTD}} = & i\bar{\Psi}_{\alpha\omega} \gamma_{\alpha\beta}^{\mu} \partial_{\mu} \Psi_{\beta\omega} + g_{\text{nvn}} \bar{\Psi}_{\alpha\omega} \gamma_{\alpha\beta}^{\mu} V_{\mu}^a \Omega^a \Psi_{\beta\omega} - \frac{1}{4} \bar{U}_{\mu\nu}^a U^{a\mu\nu} \\ & - \frac{1}{4} \delta_{\sigma\tau} \delta_{\xi\chi} \bar{\Pi}_{\mu\nu;\sigma\xi}^{\eta} \gamma^{\eta} \bar{\Pi}_{\tau\chi}^{\eta\mu\nu} - ig_{\text{tvn}} \bar{\Theta}_{\mu\lambda\rho}^{\eta} \gamma_{\eta\kappa}^{\mu} \bar{\Lambda}_{\kappa}^{\tau\chi\lambda\rho} \Omega^a V_{\mu}^a \bar{\Theta}_{\mu\tau\chi}^{\kappa} \\ & + \bar{\Sigma}_d^{abc} \Upsilon_{\eta\kappa} \left(g_{\text{tvn}} \bar{\Theta}_{\mu ab}^{\eta} \gamma_{\eta\kappa}^{\mu} \Psi_{\kappa c} \Omega^d V_{\mu}^d + g_{\text{nvt}} \bar{\Psi}_{\kappa c} \gamma_{\eta\kappa}^{\mu} \Theta_{\mu ab}^{\eta} \Omega^d \bar{V}_{\mu}^d \right) \\ & + \mathfrak{m} \delta_{\mu\nu} \left(\bar{\Theta}_{\mu\tau\chi}^{\eta} \Theta_{\mu\tau\chi}^{\eta} - \bar{\Theta}_{\nu,3-\tau,3-\chi}^{3-\eta} \Theta_{\nu,3-\tau,3-\chi}^{3-\eta} \right) \\ & - \frac{1}{4} \mathbb{K}_{\mu\nu} \mathbb{K}^{\mu\nu} - g_{\text{nxn}} \delta_{\omega\rho} \bar{\Psi}_{\alpha\omega} \gamma_{\alpha\beta}^{\mu} \Psi_{\beta\rho} \Xi_{\mu} - g_{\text{txt}} \delta_{\sigma\tau} \delta_{\xi\chi} \bar{\Theta}_{\mu\sigma\xi}^{\eta} \gamma_{\eta\kappa}^{\mu} \bar{\Theta}_{\mu\tau\chi}^{\kappa} \Xi_{\mu} \end{aligned}$$

7.8 Nyxian Essences

R In antiquity, the Nyxi defined eight different elements, influenced by the nature of their gaseous planet:

- Active Elements** Flow, Spark, Vortex, and Crystal
- Passive Elements** Hiatus, Mist, Lag, and Aurora

IV

Appendix

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8.1	School of Engineering	
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8. DARC Departments and Required Coursework

Below is a complete listing of the required coursework for each department.

8.1 School of Engineering

8.1.1 Intergalactic Astronautics

ING

Introduction to Spaceship Design

Learn spaceship design fundamentals through advanced aeronautics lectures and hands-on projects, including the use of intergalactic CAD to create simulated interstellar vessels.

Spaceship Engineering I: Materials and Structures

Delve into advanced spaceship engineering, focusing on materials and structures designed for interstellar travel, supported by hands-on workshops and cutting-edge analysis tools.

Spaceship Engineering II: Signals and Systems

Explore the principles of signals and systems in spaceship engineering, covering topics like quantum convolution and hyperfrequency modulation, complemented by lab work in specialized futuristic programming languages.

Spaceship Engineering III: Fluid Dynamics

Study fluid dynamics specific to spaceship engineering, investigating phenomena such as shockwave interactions and gravitational flux, with practical labs and projects providing in-depth context.

Spaceship Engineering IV: Thermodynamics and Propulsion

Master thermodynamics in spaceship engineering, covering topics from work and heat interactions in a relativistic framework to cosmic propulsion systems, reinforced by hands-on labs.

Warp Drives and Tenebrivic Propulsion for Astronautics

Investigate emerging technologies for warp drives and faster-than-light travel, exploring the manipulation of spacetime fabric and dark matter forces, using advanced simulation

software for hands-on experience.

8.1.2 Xenobiological Engineering

BEX

Introduction to Xenobiological Engineering Design Using Synthetic Biology

Explore synthetic biological systems engineering with a focus on xenobiology, covering topics from DNA synthesis to ethical considerations, preparing students for real-world challenges and interstellar competitions.

Introduction to Exomachines

Study the engineering of living exomachines designed for Nyxian use, covering their adaptation and testing, complemented by guest lectures and hands-on projects.

Advanced Tissue Engineering in Exospecies

Delve into the principles of tissue engineering for alien species, addressing topics like scaffold design and ethical considerations, while gaining practical lab experience.

Nanotechnology in Xenobiological Systems

Examine nanoscale phenomena in Nyxian biology and their applications in human technology, from drug delivery to ethics, through lectures, case studies, and labs.

Adaptomorphocytic Biology and Interplanetary Epidemiology

Investigate adaptomorphocytes and their role in interplanetary epidemiology, focusing on their adaptability and impact on diseases, supported by theoretical study and lab research.

Adaptomorphocytic Static Cells in Carcinogenesis: Origins and Cures

Explore the role of adaptomorphocytic static cells in cancer progression and treatment, through lectures, literature discussions, and lab exercises focusing on molecular mechanisms and therapeutic interventions.

Xenofluid Dynamics in Nyxian Physiology

Learn fluid dynamics in Nyxian biological systems, covering specialized alien organ systems and gaining hands-on lab experience with simulated xenofluidic systems.

Nyxian Bioauroraescence and Signal Transduction

Study the biochemical and biophysical mechanisms behind bioauroraescence in alien life, through lectures and labs focused on ion emission, magnetoproteins, and their ecological roles.

Metagenomics of Nyxian Microbiomes

Examine Nyxian microbial ecosystems, focusing on their impact on planetary ecosystems and diversity, through hands-on lab sessions and metagenomic data analysis.

Bioethics in Xenobiological Research

Address the ethical dimensions of xenobiological research, from biosecurity to intellectual property rights, through case studies, debates, and guest lectures.

8.1.3 Tenebrichemical Engineering

BET

Fundamentals of Tenebrivity Manipulation

An introductory course on the engineering of Tenebrivity, the fifth fundamental force linked to dark matter, covering its theory, applications, and potential for sustainable energy, culminating in a hands-on group project.

Thermodynamics of Tenebrific Systems

An advanced course on thermodynamics in tenebrific systems, exploring laws, non-equilibrium states, and phase transitions through lectures and lab experiments, focused on sustainable energy applications.

Material Science in Tenebrific Environments

Study the material properties influenced by tenebrivity, from metals to nanocomposites, learning techniques for characterization and evaluation, aimed at challenges in tenebrical engineering.

Tenebrichemical Thermodynamics and Propulsion

Learn engineering principles behind tenebrivity-based propulsion systems for faster-than-light travel, covering efficiency, sustainability, and ethics through experiential labs and team projects.

Fundamentals of Metabolic and Xenobiochemical Engineering: Applications to Pharmaceutical Xenobiomanufacturing

Focus on metabolic engineering and xenobiochemical processes in pharmaceutical xenobiomanufacturing, covering topics from cellular optimization to bioreactor design.

Tenebrific Transport Processes

Explore heat and mass transfer in tenebrivity-affected systems, emphasizing radiative heat transfer and convective transport, aimed at solving unique engineering problems in this emerging field.

Nanoscale Tenebrific Energy Transport Processes

Investigate nanoscale processes affecting energy transport in tenebrific systems, utilizing theories like the Boltzmann transport equation and Marcus electron transfer theory.

Introduction to Type IV Kardashev Scale Sustainable Energy

Examine the prospects and challenges of achieving Type IV Kardashev Scale Sustainable Energy, covering a range of energy production techniques and evaluating their engineering, economic, and social impact.

Fundamentals of Advanced Type IV Kardashev Scale Energy Conversion

Dive deep into the principles relevant to Type IV Kardashev Scale Energy systems, analyzing efficiency and environmental impact of various energy conversion methods like CO₂ capture and fusion power.

8.1.4 Superluminal and Interstellar Engineering**LUM**

The Superluminal Engineers are the reason humans can even make it to Nyx and survive the trip without it taking 96 billion years!

Warp Drive Engineering I: Fundamentals

Master the basics of warp drive technology for faster-than-light (FTL) travel. Topics include an introduction to spacetime manipulation, exotic matter, and the Alcubierre theory. Engage in labs that prototype miniature warp drive models, with a focus on understanding energy and matter requirements. No prior knowledge of general relativity is required.

Warp Drive Engineering II: Advanced Theoretical Models

Dive deeper into the theoretical aspects of warp drive technology. Study advanced space-time topologies, exotic matter stability, and the latest modifications to the Alcubierre theory. Discuss the feasibility and challenges of warp drive, supported by computer simulations and mathematical proofs.

Warp Drive Engineering III: Materials and Energy Sources

Investigate the exotic materials and energy sources required for functional warp drives. Study the physics of negative energy and exotic matter, including their production and stabilization. Hands-on labs focus on material science and high-energy experiments related to warp drive technologies.

Warp Drive Engineering IV: Capstone Project in FTL Engineering

Apply your knowledge in a semester-long capstone project, working in teams to design, simulate, and prototype a warp drive system. Topics will range from propulsion and navigation to the ethical implications of FTL travel. Culminates in a peer-reviewed presentation and potential submission for academic journals or intergalactic competitions.

Introduction to Artificially Conscious Machines

Explore artificially conscious machines - typically used to manage interstellar travel during human stasis - through systems overviews and advanced algorithms. Student projects involve deploying neuro-ethereal sensors and autonomous quantum machines. Background in advanced neural programming recommended.

Life Support Engineering Design and Superluminal Prototyping

Design life support systems for high-speed interstellar travel using quantum algorithms and multidimensional matrices. Prototypes are tested in zero-point energy simulations and submitted to an intergalactic competition. Open to all engineering disciplines.

Operating in the Gaseous Nyxian Environment

Examine the challenges of operating in the Nyxian environment, blending advanced simulation and lectures from multi-dimensional beings. Teams focus on propulsion and habitat creation for the Intergalactic Nyxian Colonization Program. Limited enrollment, application required.

Interstellar Traffic Control

Study traffic control for interstellar routes, exploring astro-navigation and future techniques like tachyonic flux regulation and quantum tunneling. Analyze mission logistics considering time dilation and dark matter. Culminates in a future-focused term paper.

8.1.5 Xenophonologic Production**PHO****Introductory Articulation Simulation**

Study the Nyxi transarticulator to mimic Nyxi vocal sounds. Learn the nine unique Nyxi consonants through lectures, labs, and computational models. Finish with a project to creattransarticulator.

Advanced Articulation Simulation

Advance your knowledge of the Nyxi transarticulator with a focus on mimicking Nyxi triple-pitch vocalizations. Utilize quantum acoustic theories and dynamic simulations to engineer harmonic vocal systems. Features guest lectures from experts.

Introductory Auroral Production

Learn the Nyxi's auroral communication, covering syntax, semantics, and auroral symbols. Use simulations and holographic platforms to practice auroral-based phrases. Gain foundational skills for Nyxi auroraphemes.

Advanced Auroral Production

Combine Nyxi vocal and auroral communication for enriched meaning. Use neural network simulations and quantum field manipulation for hands-on experience in auroral-sonic patterns. Features Nyxi experts via subspace communication.

Emissive Engineering

Understand the engineering of Nyxi auroral emitters. Learn ion production, magnetic field dynamics, and quantum control. Labs focus on building ion emission prototypes. Final project involves designing a basic auroral emitter.

Nonlinear Emissive Dynamics

Explore advanced auroral systems mimicking Nyxi patterns. Study nonlinear dynamics like chaos theory and fractal geometry. Use advanced simulations and Nyxi-assisted labs for practical experience.

Neural Phonotactic Nodes

Learn to build neural interfaces for direct control of Nyxi phonology and auroral emissions. Covers neural compatibility and machine learning for pattern recognition. Labs include creating neural nodes and interfacing with existing systems.

8.1.6 Contraparadoxical Engineering DOX**Fundamentals of Paradox Avoidance**

Learn the basics of paradox prevention within quantum systems, focusing on the principles that guide quantum entanglement, superposition, and wave-function collapse. This course provides an introduction to the key safeguards needed to avoid paradoxical situations like quantum tunneling to prohibited states.

Temporal Mechanics and Chronostability

Dive into the intricacies of time travel and explore methods to maintain chronostability. Covering everything from closed timelike curves to branching multiverses, the course equips students to design systems that prevent time loops and chronological inconsistencies.

Safeguarding Extrdimensional Portals and Gateways

Understand the science of creating and maintaining stable extrdimensional portals. Learn to recognize and rectify weak points that could collapse the portal, trapping individuals in pocket dimensions or exposing them to cosmic singularities.

Holographic Principle and Virtual Reality Paradox Prevention

Study the intersection of the holographic principle with virtual reality systems. Gain knowledge in ensuring that digital worlds are isolated, preventing the emergence of paradoxical elements like simulated self-aware beings questioning their own existence.

Recursive System Design and Fractal Safety

Learn to navigate the risks of engineering systems with recursive elements. This course focuses on avoiding self-referential paradoxes in computational and natural systems, from fractal geometry to recursive algorithms, ensuring they don't reach undefined or catastrophic states.

Ethical and Social Implications of Contraparadoxical Technologies

Discuss the ethical boundaries and social implications of deploying technologies that avoid paradoxes. Explore case studies that examine the trade-offs between technological advancements and their potential for unintended, paradoxical consequences on society and reality.

8.1.7 Exotic Matter Science and Engineering**MAT****Introduction to Exotic Matter**

A foundational course exploring the properties, types, and behaviors of exotic matter, from negative masses to tachyons.

Warp Drive Engineering for Matter Scientists

Delve into the principles behind warp drive technologies, focusing on harnessing exotic matter to bend spacetime for faster-than-light travel.

Wormhole Manipulation

Learn the theoretical and practical aspects of creating and stabilizing wormholes using exotic matter, with a focus on potential applications.

Dark Matter and Dark Energy Engineering

Investigate the properties of dark matter and dark energy, exploring ways to detect, manipulate, and potentially harness them for various applications.

Exotic Matter in Quantum Computing

Understand how exotic matter states can influence quantum computation, offering enhanced speed or new paradigms in information processing.

Casimir Effect and Negative Energy Systems

Study the Casimir effect in-depth, focusing on the engineering possibilities for negative energy systems and vacuum fluctuations.

Hawking Radiation and Black Hole Technologies

Explore the applications of Hawking radiation in the creation of future energy sources, including theoretical black hole power plants.

Exotic Matter Safety and Ethics

Examine the ethical considerations and safety protocols essential for research and engineering involving exotic matter forms.

8.1.8 Vermiforamenic Medical Engineering**MED****Foundations of Vermiforamenology**

Introduction to the principles of vermicoramenology and its integration with medical applications, paving the way for future innovations.

Wormhole Dynamics in Biomedical Contexts

Delve into the intricacies of wormhole physics, especially as they relate to biological and medical contexts.

Nyxian Space-Time Manipulation

Study the Nyxian techniques for manipulating spacetime and how they can be harnessed for vermicoramenic medical engineering.

Precision Engineering for Non-invasive Surgery

Techniques and methodologies for leveraging vermiforamenology for precise, non-invasive surgical interventions.

Vermiforamenic Imaging Systems

Explore the engineering of imaging systems that utilize microscopic wormholes for unparalleled clarity and detail.

Safety and Ethics in Vermiforamenic Engineering

Discuss the ethical considerations and safety precautions essential when dealing with vermiforamenic technologies.

Advanced Materials in Wormhole Stability

Understand the materials science of stabilizing microscopic wormholes and ensuring their safe integration with biological tissues.

Control Systems for Vermiforamenic Procedures

Design and optimization of automated systems that control vermiforamenic interventions, ensuring maximum efficacy and safety.

Integration of AI in Vermiforamenology

Harnessing artificial intelligence to enhance the predictability, stability, and applications of vermiforamenic practices.

Vermiforamenic Drug Delivery Mechanisms

Engineer precise, targeted drug delivery systems using vermiforamenology for optimal therapeutic effects.

Biocompatibility and Vermiforamenic Interfaces

A deep dive into ensuring that vermiforamenic systems are biocompatible and do not induce unintended side effects.

Telemedicine via Vermiforamenic Techniques

Innovations in providing remote medical care by leveraging vermiforamenic principles for diagnostics and treatment.

Future Frontiers in Vermiforamenic Engineering

Engage in speculative and experimental designs in vermiforamenology, charting the next steps in this revolutionary medical field.

8.2 School of Expatriation

8.2.1 Enviroadaptive Habitation	HAB
Principles of Adaptive Living Systems	
Introduction to the core concepts and technologies that enable habitats to adapt to environmental changes.	
Bio-Responsive Structures	
Study of structures that respond to environmental stimuli using biological principles for optimal sustainability.	
Self-Healing and Regenerative Architecture	
Design and engineering of structures capable of self-repair and regeneration in response to wear and external damage.	

Microclimate Control and Regulation

Techniques to engineer adaptive microclimates within habitats for enhanced comfort and energy efficiency.

Symbiotic Urban Planning

Merging natural ecosystems with urban spaces to create harmonious and adaptive environments.

Waste-to-Resource Technologies

Innovations in converting waste products into useful resources within adaptive habitats.

8.2.2 Nyxian Architecture**ARC****Introduction to Nyxian Spatial Concepts**

Delving into the unique spatial design philosophies of the Nyxi, including their perception of space and function.

Fluidic and Morphic Design in Nyxian Constructs

Study of the fluid-like, transformable structures predominant in Nyxian architectural thought.

Temporal Architectures: A Nyxian Perspective

Exploration of how Nyxian structures evolve over time and how they interact with their surroundings.

Acoustics and Resonance in Nyxian Spaces

Understanding the role of sound and vibration in Nyxian design principles.

Nyxian Urban Landscapes and Communal Spaces

A deep dive into the communal and urban spaces of the Nyxi and their integration with natural gaseous elements.

8.2.3 Nyxian Social Structures**SOC****Nyxian Societal Foundations and Hierarchies**

Overview of the fundamental societal norms, hierarchies, and structures in Nyxian culture.

Collective Consciousness and the Nyxi

Exploration of the collective and interconnected consciousness prevalent among the Nyxi.

Roles and Rituals in Nyxian Society

Detailed study of the various societal roles and rituals that define Nyxian life.

Nyxian Art, Expression, and Social Commentary

Understanding the arts and their role in Nyxian society as mediums of communication and social commentary.

Interspecies Interactions and Nyxian Diplomacy

Analysis of how the Nyxi interact with other species and the principles of their diplomatic engagements.

8.2.4 Exonutritional Gastronomy**GAS****Introduction to Exonutritional Cuisine**

Overview of the gastronomic practices that focus on ingredients from Nyxian origins.

Culinary Techniques for Nyxian Ingredients

Techniques and methods to prepare, cook, and present foods sourced from beyond Earth.

Sensory Experiences in Exonutritional Dishes

Exploration of the unique sensory experiences associated with consuming Nyxian ingredients.

Nutritional Science of Nyxian Foods

Study of the health and nutritional benefits, as well as potential risks, of Nyxian foods.

Molecular Exogastronomy and Food Chemistry

Delving into the molecular transformations of Nyxian ingredients in culinary applications.

8.2.5 Exoplanetary Geography and Climate Acclimatization**GEO****Introduction to Exoplanetary Terrains**

Overview of various types of terrains and landscapes found on exoplanets.

Exoplanetary Weather Systems and Patterns

Detailed study of the unique weather systems and patterns present on known exoplanets.

Human Adaptation to Nyxian Climates

Exploration of human biological and technological adaptations required for survival in various exoplanetary climates.

Impact of Nyxian Climates on Infrastructure

Analysis of the implications of exoplanetary weather on the design and sustainability of infrastructural projects.

Exoplanetary Hydrology and Oceanography

Study of liquid systems, including potential oceans, rivers, and lakes, on exoplanets.

8.3 School of Nyx Relations**8.3.1 Nyxopology****NYX****Introduction to Nyxopology: Landscapes and Features**

Overview of the geographical and geological formations that characterize the Nyxi's home world.

Flora and Fauna of Nyx

Study of the unique species and ecosystems endemic to the Nyxi's environment.

Climatology and Weather Patterns of Nyx

Detailed analysis of the atmospheric and climatic phenomena of Nyx.

Subterranean Nyx: Exploring the Underground

Exploration of the extensive underground networks and environments of the Nyxi's planet.

Evolving Landscapes: Nyx's Geological History

A dive into the geological transformations and historic events that have shaped Nyx over eons.

8.3.2 Intergalactic Economics**ECO****Foundations of Intergalactic Trade**

Core principles and dynamics governing trade between galaxies.

Currency, Value, and Exchanges in the Cosmos

Study of the diverse monetary systems and value exchanges prevalent among intergalactic civilizations.

Intergalactic Supply Chain Dynamics

Analysis of the complexities involved in the movement of goods across galaxies.

Economic Policies of Major Cosmic Civilizations

Exploration of the various economic policies and practices of dominant intergalactic entities.

The Economics of Stellar Resources

A deep dive into the value, extraction, and trade of resources found in stars and other cosmic entities.

8.3.3 Nyxian History nxHIS**Ancient Nyxi: Origins and Early Civilizations**

A journey into the ancient history, cultures, and civilizations of the Nyxi.

The Nyxi Renaissance: A Period of Enlightenment

Exploration of a significant era of Nyxi history marked by cultural, scientific, and artistic flourishing.

Intergalactic Wars and the Nyxi Role

Delving into the Nyxi's involvement in major cosmic conflicts and their outcomes.

Modern Nyxi: Innovations and Evolutions

A study of recent advancements, societal shifts, and changes within the Nyxi civilization.

Nyxi Diplomacy: Relations with Other Civilizations

Examination of the Nyxi's foreign policies, alliances, and interactions with other intergalactic entities.

8.3.4 Nyxian Aesthetics and Expression nxART**The Art of the Nyxi: An Overview**

Comprehensive introduction to the myriad forms of artistic expression cherished by the Nyxi.

Nyxian Music: Soundscapes of Another World

Exploration of the musical traditions, instruments, and innovations of the Nyxi culture.

Cosmic Choreography: Nyxian Dance Forms

Dive into the rhythmic and expressive world of Nyxian dance and performance art.

Visual Narratives: Nyxian Art and Sculpture

A journey through the visual arts of the Nyxi, from ancient carvings to modern digital masterpieces.

Nyxian Fashion and Design

An exploration of the Nyxi's sense of style, fashion, and design aesthetics.

8.3.5 Xenolinguistics

nxLNG

Introduction to Xenolinguistics: Beyond Human Languages

A foundational course offering a broad overview of the field of Xenolinguistics, emphasizing the unique challenges and methodologies associated with studying non-human languages. This course sets the stage for more specialized studies on the Nyxi language.

Nyxian Phonology: The Art of Nyxian Sound Production

An in-depth exploration into the nine distinct Nyxi consonant sounds, analyzing their production mechanisms, and highlighting the importance of the Nyxi transarticulator. Through a combination of lectures, practical sessions, and advanced computational modeling, students will gain mastery over the sounds' recreation.

Nyxian Auroral Semiotics: Deciphering Visual Linguistics

Dive into the captivating realm of auroral communication as used by the Nyxi, understanding the syntax, semantics, and pragmatics of auroral shapes, colors, motions, and transitions. The course uses immersive simulations and interactive holographic platforms to aid comprehension and production.

Advanced Nyxian Syntax and Morphology

Beyond basic structure, this course delves into the intricacies of Nyxian sentence formations, verb conjugations, and the nuances of morphological changes, enabling students to craft complex and meaningful sentences in the Nyxi language.

Nyxian Lexicology: Building a Nyx-Human Dictionary

Focusing on the semantics of Nyxi words, this course aims to build a comprehensive lexicon bridging Nyxi and human languages. Through collaborative projects, students will contribute to the ongoing efforts of building a Nyxi-Human dictionary.

Pragmatics of Nyxian Communication

Explore the cultural, social, and situational contexts influencing Nyxian language use. This course emphasizes real-world application, analyzing Nyxian language in various contexts, from diplomatic exchanges to artistic performances.

Neural Linguistic Interfaces in Nyxian Communication

Study the advancements in neural interfaces that facilitate direct linguistic control over phonology and auroral machinery, understanding the convergence of technology and xenolinguistics in bridging communication gaps.

Nyxian Poetry and Literature: A Linguistic Analysis

Dive into the rich literary traditions of the Nyxi, analyzing poetic structures, narrative forms, and linguistic devices. This course offers insights into the Nyxi's cultural and historical contexts through their written and auroral expressions.

Comparative Studies: Nyxian vs. Earth Languages

Understand the parallels, contrasts, and unique features of Nyxian language when compared to various Earth languages. Through this comparative approach, students will gain a deeper appreciation of linguistic diversity across civilizations.

Sociolinguistics of the Nyxi: Language in Society

Examine the sociocultural factors influencing Nyxian language use, including regional dialects, sociolects, and the implications of language in Nyxian societal hierarchies and identities.

Nyxian Language Acquisition: Pedagogical Approaches

Delve into the methodologies and strategies effective for teaching the Nyxi language to humans. This course is especially valuable for those aiming to be educators or linguistic ambassadors in intergalactic exchanges.

Evolution of Nyxian Language: Historical Linguistics

Trace the historical evolution of the Nyxi language, identifying ancient forms, understanding linguistic shifts, and predicting future changes in the ever-evolving linguistic landscape of Nyx.

Digital Tools in Xenolinguistics: Software and Simulations

Understand the role of advanced software, simulations, and AI in studying and teaching Nyxian language. This course includes hands-on sessions with cutting-edge linguistic software tailored for Nyxian studies.

Intercultural Communication: Nyxian and Human Dialogues

Harness the power of effective communication by understanding the cultural nuances, taboos, and etiquette in Nyxian dialogues. Role-playing, simulations, and real-world interactions form core components of this course.

Nyxian Language and Diplomacy

Tailored for those with aspirations in intergalactic diplomacy, this course emphasizes the nuanced use of Nyxian language in diplomatic contexts, ensuring precise and effective communication in high-stakes scenarios.

8.3.6 Nyxi-Human Relations

nxREL

First Contact: The Meeting of Two Civilizations

In-depth study of the historical event when humans first encountered the Nyxi.

Diplomacy and Alliances: Navigating Interspecies Politics

Examination of the political, cultural, and economic ties binding humans and the Nyxi.

Shared Innovations: Collaborative Projects and Endeavors

Overview of key collaborative projects undertaken by humans and the Nyxi for mutual advancement.

Intercultural Exchanges: Learning and Adapting

Exploration of the rich exchange of ideas, traditions, and knowledge between the two species.

Challenges and Controversies in Nyxi-Human Relations

Analysis of the disputes, misunderstandings, and controversies that have arisen and how they were addressed.

8.3.7 Extraterrestrial Ethics and Philosophy

nxETH

Origins of Nyxian Morality

A comprehensive study of the ethical foundations of Nyxian civilizations, exploring how environmental factors, evolutionary pressures, and social constructs shape moral codes.

Comparative Philosophical Systems: Earth vs. Cosmos

Analyzing philosophical thought across civilizations, this course sheds light on shared universal truths and distinct cosmic perspectives, promoting intergalactic understanding.

Ethical Dilemmas in Intergalactic Relations

Delve into real-world cases of ethical challenges faced in interstellar diplomacy, trade, and collaboration, encouraging critical thinking and moral reasoning.

Metaethics Among the Stars

Deep dive into the metaethical studies of values, rights, and wrongs as perceived by different cosmic civilizations, exploring relativism, subjectivism, and realism in a vast universe.

Philosophy of Cosmic Existence

Explore profound questions of existence, purpose, and reality from the vantage of the vast cosmos, integrating both human and Nyxian viewpoints.

8.3.8 Cosmic Extradition and Law**nxLAW****Foundations of Cosmic Jurisprudence**

Introduction to the fundamental principles, statutes, and customs that govern the broader cosmic legal systems, setting a basis for advanced legal studies.

Extradition Treaties Among the Stars

Study of the intricacies involved in extradition treaties across galaxies, with special focus on Nyxi-human legal relations.

Rights of Interstellar Beings

Comprehensive exploration of the rights and protections accorded to sentient beings across the cosmos, emphasizing shared universal rights and species-specific provisions.

Galactic Trade Laws and Regulations

Deep dive into the commercial laws that facilitate intergalactic trade, focusing on trade barriers, tariffs, and intellectual property rights in space.

Dispute Resolution in the Cosmos

Examination of the mechanisms, institutions, and practices in place to resolve interstellar disputes, from mediation to cosmic courts.

8.3.9 Intersentiential Psychology and Behavior**nxPSY****Introduction to Intersentiential Cognitive Processes**

Foundational exploration of the cognitive functions and processes of various sentient beings, emphasizing both shared and unique neurobiological mechanisms.

Emotional Expressions Across the Cosmos

Study of the myriad ways emotions are expressed, experienced, and perceived among different intergalactic species, with special focus on auroral expressions of the Nyxi.

Social Behaviors and Group Dynamics in Outer Space

Delving into the social constructs, hierarchies, and group behaviors of Nyxian civilizations, exploring similarities and differences in social motivations.

Psychopathologies in the Stars

A rare look into the mental health challenges faced by various cosmic species, understanding their root causes, manifestations, and potential treatment methodologies.

Interspecies Relations: Psychology of Interactions

Exploring the psychological intricacies of interactions between different sentient beings, focusing on biases, misconceptions, and the path towards mutual understanding.

8.4 School of Sciences**8.4.1 Physics of Tenebriivity and Aliquantics****TEN****Introduction to Tenebriivity**

The basics of dark matter physics, and the foundation of tenebriive forces in the universe.

Aliquantic Particle Dynamics

An understanding of the unique, non-standardized particles and their behavior in the quantum realm.

Tenebriive Waveforms and Interference Patterns

The study of dark matter-modulated wave properties and the resulting interference in various mediums.

Aliquantic Fields and Forces

Exploration of the unique forces exerted by aliquant particles, and how they shape the physical realm.

Tenebriive Thermodynamics

Understanding the laws of thermodynamics in environments dominated by dark matter energies.

Aliquantic Symmetry and Asymmetry

Exploration of balance and imbalances in aliquant systems.

Tenebriive Relativity and Inertial Frames

The relative nature of dark matter-influenced motions and events in spacetime.

Quantum Tunneling in Aliquant Systems

The principles of quantum tunneling when influenced by aliquant particles.

Advanced Tenebriive Optics

Delve deep into the interaction of dark light and dark matter in controlled and natural settings.

Unified Aliquantic Field Theories

Attempts and theories to unify the disparate fields of physics under aliquantic principles.

Computational Tenebriivity

Applying computational models and simulations to dark matter-based physics.

Aliquantic Phenomena in Astronomy

A study of how aliquantic principles manifest in cosmic and astronomical settings.

Experiments in Tenebriive Chambers

Practical laboratory work focusing on controlled dark matter environments.

Tenebriive Quantum Field Theory

Bridging the world of quantum mechanics with dark matter-influenced forces and fields.

Aliquantic Cosmology

The study of the universe's origin, evolution, and eventual fate through the lens of aliquant physics.

8.4.2 Xenobiology and Nebugenomics**BIO****Intro to Xenobiological Taxonomy**

Classification and categorization of Nyxian life forms based on morphological and genetic traits.

Principles of Nebugenomics

Understanding the genetic blueprints of non-Earth organisms and their interpretation.

Xeno-ecosystems and Habitats

Study of alien ecological systems and the dynamics between various xenobiological species.

Nebugenetic Mutation and Evolution

Exploration of the mutation rates, causes, and their influence on Nyxian species evolution.

Xenobiological Physiology

The study of the physical and chemical functions of Nyxian organisms.

Advanced Nebugenetic Techniques

Laboratory techniques specific to the study and manipulation of alien genes.

Extraterrestrial Ethology

Behavior study of alien species in their natural environments.

Nebugenetic Diseases and Immunity

Study of diseases in alien species and their unique immune responses.

Xenobiological Reproduction and Life Cycles

Delve into the reproductive mechanisms and stages of life in Nyxian species.

Nebugenomics and Technological Applications

Exploring the applications of alien genetics in biotechnology.

Exobiological Conservation and Ethics

Conservation methods and the ethical considerations in xenobiological research.

Nebugenetic Data Analysis and Bioinformatics

Utilizing computational tools to analyze vast genetic datasets from alien species.

Comparative Planetology and Life Potential

Comparison of different planetary environments and their potential to harbor life.

Nebugenetic Engineering and Synthetic Biology

The principles and techniques to engineer and modify alien genetic codes.

Interstellar Biogeography

Study of the distribution of life forms across star systems and potential patterns.

8.4.3 Tenebrichemistry and Quantavistics**CHM****Introductory Tenebrichemistry**

Foundations of dark matter-influenced chemical reactions and understanding matter transformations under tenebrike influences.

Quantavistic Dynamics

Deep dive into the motion and interaction of quantavistic particles and their implications in modern chemistry.

Tenebrous Molecular Structures

Study of molecular formations in tenebrous environments, focusing on stability, bonding patterns, and reactivity.

Quantavistic Thermodynamics

Thermodynamic principles as applied to the realm of quantavistics.

Applied Tenebrichemical Engineering

Practical applications of tenebrichemistry in novel materials and medicines.

Quantavistic Kinetics

Understanding reaction rates and mechanisms in the domain of quantavistic chemistry.

Interplay of Light and Shadows in Tenebrichemistry

Delve into how photonic interactions influence chemical reactions in tenebrous settings.

Nano-scale Tenebrichemistry

Exploration of dark matter chemistry at atomic and molecular scales.

Tenebrous Catalysis

Understanding how tenebrous influences can act as catalysts in chemical reactions.

Advanced Quantavistic Simulations

Hands-on approach to model and simulate quantavistic reactions using modern computational tools.

Emerging Materials in Tenebrichemistry

Study of novel materials emerging from dark matter-influenced chemical reactions.

Quantavistic Reaction Mechanisms

Deep understanding of how quantavistic particles interact and transform during chemical reactions.

Tenebrichemical Energy Systems

Exploration of energy storage and release in tenebrous chemical systems.

Safety in Tenebrichemistry Labs

Best practices and protocols to handle tenebrous chemicals and processes safely.

Tenebrichemistry in Biology

Understanding the influence and implications of tenebrous chemical processes in living organisms.

8.4.4 Exoneuroscience and Polyphrenic Consciousness**CON****Basics of Exoneural Structures**

Introduction to the neural configurations of Nyxian beings.

Polyphrenic Cognitive Processes

Study of non-terrestrial thought processes, emotions, and memories. Gain a deep understanding of Nyxian cognition, which relies on a polyphrenic consciousness.

Exoneural Signal Transduction

Study of unique signaling pathways in Nyxian nervous systems.

Consciousness Across Cosmos

Comparative study of consciousness across different species.

Nyxian Sensory and Perception Systems

Exploration of the sensory organs of non-Earth life forms.

Neuroplasticity in Exoneural Systems

Analysis of adaptability and flexibility in alien neural networks.

Psychoactive Substances in Nyxian Species

Examination of natural and artificial substances that affect consciousness in Nyxian beings.

Evolution of Exoneural Systems

Study of the evolutionary pathways and factors influencing exoneural development.

Polyphrenic Dream Analysis

Dive into the world of dreams and subconscious processes in the Nyxians who have multiple consciousnesses.

Comparative Study of Neural Pathways

Contrast and comparison of neural pathways across species from various planets.

Exoneurochemical Interactions

Understanding neurotransmitter systems and chemistry in alien neural structures.

Cognitive Augmentation in Nyxian Species

Exploration of natural and technological means of enhancing cognition in Nyxian beings.

Neuroethical Considerations in Exoneuroscience

Delving into the ethical implications of studying and interacting with alien neural systems.

Neural Basis of Nyxian Emotions

Deep dive into the neural underpinnings of emotions in Nyxian species.

Interspecies Neural Communication

Exploration of possible communication avenues between human and alien neural systems.

8.4.5 Galactostructural and Exoplanetary Sciences**GAL****Exoplanetary Geology and Tectonics**

Understanding geophysical properties and tectonic activities on exoplanets.

Galactic Structures and Morphologies

Study of diverse architectures and forms of galaxies.

Exoplanetary Atmospheres and Climates

Study of the atmospheric compositions and climates of planets beyond our solar system.

Galactic Nucleosynthesis and Star Evolution

Exploration of element formation in galaxies and the life cycles of stars.

Advanced Exoplanetary Geophysics

Dive into core, mantle, and crust interactions on alien planets.

Exoplanetary Oceans and Hydrospheres

Study of water and liquid formations on planets, understanding their influence on habitability.

Galactic Black Holes and Singularities

In-depth exploration of the most enigmatic structures in galaxies.

Astrobiology and Signs of Life

Search and study of life or its signs in various planetary environments.

Exoplanetary Magnetospheres and Radiation Belts

Understanding the magnetic fields of planets and their implications for life.

Galactic Collisions and Mergers

Exploration of the dynamics and outcomes of galaxies merging and interacting.

Exoplanetary Volcanology

Study of volcanic activities and their implications on alien planets.

Stellar Lifecycles in Diverse Galaxies

Deep dive into how stars form, evolve, and end in different galactic environments.

Interstellar Medium and Cosmic Dust

Exploration of the material that exists in the space between the stars in a galaxy.

Gravitational Waves and Cosmic Disturbances

Study of ripples in spacetime caused by some of the most violent and energetic processes in the cosmos.

Exoplanetary Habitability and Terraforming

Exploring the criteria for planetary habitability and the prospects and ethics of terraforming.

8.4.6 Novomathics MTH**Fundamentals of Nyxian Numerals**

Exploration of the Nyxian numerical system, its base, and its historical development. Students will learn the symbolic representations, conversion techniques, and basic arithmetic operations.

Geometry in Higher-Dimensional Spaces

Dive into the study of shapes, sizes, properties, and dimensions of things in higher-dimensional Nyxian spaces. This course covers the basic to advanced properties of hyper-shapes and their practical applications.

Nyxian Algorithms and Computation

An introduction to the logic and algorithms specific to Nyxian mathematics. This course emphasizes computational efficiency, error handling, and Nyxian-specific problems.

Quantum Probabilistics

A comprehensive study of probability in the context of quantum mechanics, allowing students to model and predict Nyxian quantum phenomena with newfound precision.

Fractal Dynamics and Nyxian Patterns

Understand the recursive nature of fractals in Nyxian mathematics, exploring both their theoretical foundations and practical applications in various fields like architecture, art, and natural phenomena.

Temporal Mathematics and Paradox Resolution

Dive into the mathematical models used to describe and resolve temporal anomalies. This course covers the mathematical techniques to predict and counteract paradoxical scenarios in time-based experiments.

Nyxian Cryptomathematics

Study the art and science of encoding and decoding information in the Nyxian way. This course sheds light on historical and modern cryptographic techniques, emphasizing Nyxian unique mathematical principles.

Tensor Calculus in Curved Spacetime

Delve into advanced mathematical techniques used to describe phenomena in curved spacetime environments, such as gravitational fields around massive celestial bodies or the warping effects near wormholes.

Nyxian Topology and Continuity

An exploration of the properties of space that are preserved under continuous deformations. This course will delve into the Nyxian understanding of closeness, limits, and continuous transformations.

Abstract Algebra and Nyxian Structures

A deep dive into the algebraic structures of the Nyxian mathematical system, focusing on groups, rings, fields, and their respective applications in various Nyxian technologies.

Mathematical Logic and Nyxian Propositions

Examine the foundational principles of logic from a Nyxian perspective, from basic propositional logic to advanced topics in predicate logic and set theory.

Computational Complexity in Exotic Systems

Understand the limitations and capabilities of Nyxian computational devices. Explore the P-NP problem, computational hierarchies, and the challenges of solving problems in alien systems.

Nyxian Game Theory and Strategic Interactions

Study the mathematical models of strategic interaction among rational Nyxian entities, encompassing evolutionary games, coalition formations, and multi-agent systems.

Differential Equations in Dynamic Systems

Tackle the mathematical descriptions of how things change and evolve in the Nyxian universe, from simple linear equations to complex, nonlinear dynamics.

Set Theory and Infinite Nyxian Constructs

Venture into the world of infinite sets, cardinalities, and ordinal numbers, all within the framework of Nyxian mathematical traditions. Understand the hierarchy of infinities and their implications in Nyxian cosmology.

9. Xenochemistry

9.1 The Periodica Tenebris

The Periodica Tenebris is the Periodic Table of Dark Matter, only developed after collaboration with the Nyxi.

1	Nx	2	Sl
	Nyxigen		Selenus
3	Ch	4	Er
	Chayanus		Erebus
5	Mn	6	Hd
	Manimeon		Hadesium
7	Ma	8	Rt
	Maraneon		Ratreon
9	Tk	10	Sh
	Tsukium		Shadonine
11	Ke		
	Kekulane		
12	Kh	13	Li
	Khalium		Lilithium
14	Os	15	Nc
	Osirium		Noctine
16	St	17	Sp
	Stellabane		Spectrione
18	Lu	19	As
	Lunarine		Astronine
20	Om	21	Ec
	Ombrine		Echonane
22	Wr		
	Wraithione		
23	Mm	24	Rf
	Mimicrane		Reflectane
25	Pd	26	Ph
	Parodane		Phasmane
27	Ee		
	Eerione		
28	Cr	29	Tp
	Chronione		Temporione
30	Mn	31	Eo
	Mentione		Eonione

