

2023 University Research Symposium

Oral Presentation Abstracts

PHYSICS

THE BIRTH PLACE OF ELEMENTARY PARTICLES?

Presenter: Czajka, Brendan
Undergraduate, Physics

Mentor: Prof. Rainer Grobe

Co-mentor: Prof. Q. Su

When enough energy is gathered by focusing laser beams such that the corresponding electromagnetic field reaches a sufficiently large field strength, called supercritical, it is possible to break down the quantum vacuum. When the vacuum breakdown occurs, energy of light photons may be converted into particle pairs in the form of electrons and positrons. While the theoretical predication of created particle pairs may be obtained through the newly developed procedure called computational quantum field theory, the detailed mechanisms inside the interaction zone are not fully explored up to now. The challenge may be traced back to the very definition of what constitutes an electron or positron inside the supercritical fields. In this work we outline a first attempt to resolve such a challenge and offer for the first time an algorithm to define particles and trace them during the creation process.

DISTILLATION OF ^{56}Fe IN ULTRAMASSIVE O-NE WHITE DWARFS

Presenter: Freeman, Ian
Undergraduate, Physics

Mentor: Prof. Matt Caplan

When white dwarfs freeze the plasma mixtures inside them undergo separation processes which can produce radical changes in the composition profile of the star. The abundance of neutron rich elements, such as ^{22}Ne or ^{56}Fe , determines whether or not the first crystals are more or less dense than the surrounding fluid and thus whether they sink or float. These processes have now been studied for C-O-Ne and C-O-Fe mixtures, finding that distillation and precipitation processes are possible in white dwarfs. In this work, we calculate the phase diagram of more complicated O-Ne-Fe mixtures and make predictions for the internal structure of the separated white dwarf. There are two possible outcomes determined by a complicated interplay between the Ne abundance, the ^{22}Ne fraction, and the ^{56}Fe abundance. Either Fe distills to form an inner core because the first O-Ne solids are buoyant, or an O-Ne inner core forms and Fe accumulates in the liquid until Fe distillation begins and forms a Fe shell. In the case of an Fe shell, a Rayleigh-Taylor instability may arise and overturn the core. In either case, Fe distillation may only produce a cooling delay of order 0.1 Gyr as these processes occur early at high white dwarf luminosities. Fe inner cores and shells may be detectable through asteroseismology and could enhance the yield of neutron rich elements such as ^{55}Mn and ^{58}Ni in supernovae.

SYMBOLIC REGRESSION AND ITS USE IN ITERATIVE MAPS

Presenter: Furcoiu, Alex
Undergraduate, Physics

Mentor: Prof. Rainer Grobe

Co-mentor: Prof. Q. Su

Physical processes such as spring-mass motion may be described in terms of continuous variation of relevant quantities such position or momentum with respect to time. The same process may also be described in terms of maps that relate quantity such as position or momentum at a time with position or momentum of a fixed interval in the past. It turns out only in very limited number of cases the construction of such maps may be obtained. In the case of a linear spring, the position is a linear combination of position and momentum one time step in the past. However, when force and spring compression are nonlinearly related, the corresponding map becomes nontrivial. In this work, we employ the symbolic regression technique to systematically obtain a map that describes a nonlinear spring-mass system with better and better accuracy. Such an approach may help us to speed up the construction of maps of complicated non-linear interactions.

COLLISION RATE OF SOLAR SYSTEM BODIES WITH PRIMORDIAL BLACK HOLES

Presenter: Santarelli, Andy
Undergraduate, Physics

Mentor: Prof. Matt Caplan

Primordial black holes (PBH), which may have formed in the early universe, are a dark matter (DM) candidate. If PBHs have low masses (10^{17} to 10^{19} g) comparable to asteroids, they would be abundant in the solar system and could strike bodies like the earth and moon. In this work, we calculate the DM flux through solar system bodies from both the galactic halo and dark disk models to determine the rate and probability of PBH encounters.

SUBSTRUCTURE AT PHASE BOUNDARIES IN O/NE/FE COULOMB CRYSTALS

Presenter: Smith, Nevin
 Undergraduate, Physics

Mentor: Prof. Matt Caplan

At high densities in the cores of white dwarf stars, plasma mixtures freeze. This crystallization process is known to involve complex separation of in mixtures, where heavy and light nuclei (with large and small charges respectively) separate into distinct solid and liquid phases. Molecular dynamics simulations of oxygen-neon-iron mixtures in white dwarfs find that the interfaces between these solids and liquids are especially complex, with a thin film forming between the solid and liquid. This talk will discuss these simulations and our calculations to characterize these interfaces as well as their implications for white dwarf astrophysics.

THEATRE AND DANCE

PERFORMATIVE LIVING OF HOLLY GOLIGHTLY, "REAL PHONY"

Presenter: Denning, Jessie
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Jessie Denning

The character of Holly Golightly, specifically within the film-story world of *Breakfast at Tiffany's*, lives a remarkably performative lifestyle. This is important because many studies on *Breakfast at Tiffany's* focus on the actors' performances (especially that of Audrey Hepburn's), on comparing the film to the original novel by Truman Capote, or on other elements that went into the movie-making (or book-writing) process. Few scholars seem to be bringing in the lens of performance studies for their related analyses, and even fewer seem to specially address this iconic woman with her classic black dress running around New York City going by the name of Holly Golightly. This addition to the field of performance studies is relevant because exploring dynamics of performative selves through a key pop culture example such as Miss Golightly will assist in filling gaps not only from performance studies to identity presentations, but also from academic theories to practical, every-day understandings of the self. Learning to analyze one's own 'character' or others in the outside world through first analyzing a character like Holly is likely to make the entire process more accessible to scholars, artists, and audiences alike.

COLOR THEORY, CHAKRAS, AND CHARACTER DEVELOPMENT

Presenter: Feger, Ashleigh Rae-Lynn
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

This research will discuss the basics of color theory and color auras and how they can be implemented into the world of meditation and chakras, to look at a new step in theatre methodology pertaining to the actor, that is already being used in the industry through lighting design.

This strategy will help to combine the physical and psychological elements in techniques developed by Stanislavski, Strasberg, Meisner, and Laban that can have negative implications pertaining to mental health and trauma or physical injury when not trained in the craft properly or the appropriate research has not been done.

The idea for this strategy stems from work as a community theatre and high school director and working with untrained actors. This new methodology is being researched and developed as an educational tool and building block to assist in creating an authentic and strong actor and character.

'NO PAGE IN PETTY-COAT': WOMEN AS PART OF THE RESTORATION STAGE

Presenter: Genardo, Gillian
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

The late seventeenth century brought forth a significant change that would forever alter theatre from that point forward—the inclusion of women in both writing and performing drama in England. With the reinstatement of the monarchy, came not only the lifting of the theatrical ban but the emergence of women making a living off of theatre. Finally, more agency for women...possibly. My paper seeks to understand the precarious position that women of the Restoration Era found themselves in regarding theatre. On one hand, women's voices were finally allowed in English theatre prompting an evolution of female characters both in script and on stage. On the other hand, sex sells. Were English actresses really allowed personal and economic agency through this new profession or were they merely meant to exist for the sexual pleasure of men? In Restoration England, women were inferior, so having the ability to become commercially successful in the theatre brings merit to the notion of a more equitable industry during this time. However, in all the supposed good happening, women were still majorly seen as merely sexual images on stage, and rape scenes and breeches roles became increasingly popular. Ultimately, through an analysis of the sexualization of the Restoration actress, my paper examines whether or not women in Restoration era theatre actually had the agency that history may lead one to believe they had.

SEEING THE IMPOSSIBLE SEAMS: FINDING THE STRINGS THAT CONNECT PUPPET ARTISTRY AND DRAG PERFORMANCE WITH THE LENS OF THE FOOL ARCHETYPE

Presenter: Graves, Michael
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

This presentation will discuss the several ways that drag performance and puppet artistry are connected in approach, in performance, and in audience perception. These connections are even more visible when seen through the lens of the Fool Archetype. One perspective of this presentation will be to understand how the archetype of the Fool has moved across history and into modern theatre as both a truth-telling device to the audience and a form of self-expression for the artist. Peering through this lens at drag performances in modern theatre and media, this presentation will also explore the impact of various approaches to creation of their identity when embodying a persona, and how performers set their own boundaries when donning the role. I will also expose those connective strings of performance psychology with a drag performer and of a puppetry artist. In summary, I believe that there is correlation between puppetry, performance art psychology, and comedic drag personas that are tied together with impossibly visible strings that are all related to the Fool archetype. This presentation will show historical and analytical research to support my idea of where the many tiers of perceived humor are in modern theatre and various media, how they are methodically approached to bridge together these similarities within the lens of the Fool archetype.

BILLIE EILISH'S "HAPPIER THAN EVER" AS A CONCEPT ALBUM AND THE USAGE OF "OLD HOLLYWOOD" TO PROMOTE ITS THEMES

Presenter: Guedes, Gustavo Nery Dutra
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Gustavo Nery Dutra Guedes

Released in 2021, "Happier Than Ever" is the Grammy-nominated second album by American singer-songwriter Billie Eilish, which was 19 years old by the time it came out. Born and raised in Los Angeles, the artist defines this work as a "love letter" to the city and a turning point in her rising career, on which she deals with mature themes and concepts of "timelessness" and "fame". This research investigates how Eilish incorporates "old Hollywood" imagery and elements from the mid-20th century entertainment industry to promote the album. To conduct this case study, the author draws sources that define the idea of a "concept album", and the usage of imagery to support a musician's work. The results help to understand a solid trend in the pop music industry in which artists incorporate various elements to create and promote concepts that match their current music and albums, thus achieving a cohesive meaning to their art.

WOMEN'S RIGHTS IN IRANIAN FEMALE FILMMAKERS' FILMS IN POST-REVOLUTION

Presenter: Irannezhad, Zahra
 Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Iranian cinema can be divided into two sections: before and after the revolution. The social situation has influenced the role of women in cinema in Iran. Although women had more freedom before the revolution, their roles were very limited and unnoticeable, and they merely played the role of mother or wife. These films became known as a genre called Filmfarsi, largely regarded as unintellectual appeals to the masses with love stories and singing women. Moreover, there were few female directors before the revolution, confined by Forough Farrokhzad, who made "the house is black" in 1962. This paper provides an insight into the advent of Iranian female filmmakers in the Iranian post-revolutionary and sees how Iran's social condition influenced the content of films at that time. Also, see why most female filmmakers made films around women's issues. This study examines the works of three Iranian women directors, Rakhshan Bani-Etemad, Tamineh Milani, and Pouran Derakhshandeh, with a focus on three films.

USING COSTUME DESIGN AS A MEANS OF PROMOTING IDENTITY AND REPRESENTATION IN THEATRE

Presenter: Okonma, Jenefas
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Jenefas Okonma

Men on Boats by Jaclyn Backhaus is a critically acclaimed play that has seen many renditions on stages across the world over the years. It is a favorite of colleges across America and is a part of Illinois State University's School of Theatre and Dance '23 season, directed by Professor Maggie Marlin-Hess. As the title implies, Men on Boats is a satirical retelling of Major John Wesley Powell's 1869 expedition with nine other cis-gendered white men on boats, to chart the course of the Colorado river but in a twist, the script calls for a casting of anyone but cis-gendered white men. The script raises questions of whose history is being told in the American history books and who is allowed to tell said history and gives the audience the opportunity to experience historical events without the historical limitations of who could participate in such events. To me, this play is a celebration of the other, of every kind of other that there is, as it does not place a definition of what that other can be, but only what the other is not; cis-gender white men, in American history and society. It is a celebration of individuality, identity, and representation and in this paper, I will explain how I use my design renderings as costume designer for the show to explore this celebration, not just of the characters in the script but also of the actors in the 2023 production of Men on Boats at Illinois State University. I will be exploring how the identities of these actors are captured in the creation of the looks for their characters which will help address the question of how themes of self-identity and representation can be better enhanced even in the design aspects of storytelling in theatre.