UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

SESSION 2K

OUR COMPLEX UNIVERSE: PLANETS, STARS, BLACK HOLES, AND GALAXIES

Session Moderator: Jessica Werk, Astronomy
MGH 284
3:30 PM to 5:15 PM
* Note: Titles in order of presentation.

The Mass Transfer Geometry of V367 Cyg
Aislynn Wallach, Senior, Physics: Comprehensive Physics, Astronomy
NASA Space Grant Scholar, UW Honors Program
Mentor: Jamie Lomax, Physics, United States Naval Academy
Mentor: Emily Levesque, Astronomy

Companion-affected mass loss complicates our understanding of evolved stars; for example, theoretical models predict up to 70% of all main-sequence O stars interact with companions at some point during their lifetimes, but the details of mass loss and transfer in binary systems are poorly understood. V367 Cyg is an eclipsing, low-mass binary system with a complex geometry that offers a unique opportunity to better understand mass transfer processes; the primary star has overflowed its Roche lobe, resulting in an accretion disk that surrounds the secondary star. Using new spectropolarimetric data of V367 Cyg taken with the University of Wisconsin's Half-Wave Polarimeter (HPOL) at the Pine Bluff Observatory, I have resolved the behavior of the accretion disk by determining the position angle and intensity of the polarized light from the system as a function of orbital phase. Here, I will present an analysis of this data and discuss their implications for the mass-loss geometry of the system. By constraining the properties of this interacting binary, we can more precisely study the details of stellar mass transfer.

POSTER SESSION 3

MGH 241, Easel 144
2:30 PM to 4:00 PM

Dual HIV Prevention and Contraceptive Intrauterine Device
Hienschi V. Nguyen, Junior, Bioengineering
Mentor: Kim A. Woodrow, Bioengineering
Mentor: Jamie Hernandez, Bioengineering

For women to have protection from unintended pregnancy and human immunodeficiency (HIV), current lead prevention options use oral antiretroviral drugs (ARV) for pre-exposure prophylaxis (oral PrEP) along with a form of contraception. Failure to adhere to these drug therapies will increase the risk of contracting HIV or pregnancy. We have proposed to integrate drug-eluting materials onto a copper-intrauterine device (IUD) that could provide both HIV prevention and contraception. We will evaluate two methods to formulate a matrix release drug delivery system. Injection molding is a method to inject material into a mold that can be used for constructing drug-eluting medical devices with low drug degradation. For our purpose, we injected a polymer and drug combination into a mold to construct a solid slab. Whereas, electrospinning is a method that uses electric force to formulate stable and high surface-to-volume ratio nanofibers with high drug encapsulation and porosity compared to the molded slab. Both delivery systems will be used to administer ARV drugs to the female genital tract for a year. We optimized the molded slab and electrospun nanofibers technique for maximum polymer-loading, and used 3-D printing and nanofiber wrapping technique as a process for slab integration and fiber integration onto the IUD respectively. The polymer and drug combinations for both electrospun nanofibers and molded slabs were chosen to have the maximum drug-loading and stable mechanical properties. Drug release was measured in vitro to predict daily release rates out to three years. The ideal matrix release drug delivery system method for the dual HIV prevention and conception IUD is determined based on the mechanical properties and drug release rate of the polymer and system combination. We also investigated the drug delivery systems for cytotoxicity to verify dosage safety.