

**Tuesday**  
**Mar. 20<sup>th</sup>**  
**At 3:45pm**



## **Relativistic Electron-Positron Plasma Screening in Astrophysical Environments**

### **Abstract:**

If an astrophysical environment is hot enough (greater than approximately 0.5 MeV or so), screening in the associated nuclear reactions can be modified by the presence of a relativistic electron-positron plasma. For non-zero electron chemical potentials, the effect is compounded as the relativistic Debye length in a plasma can be much lower than the classical Debye length. The screening is then enhanced beyond the commonly used classical approximation. This can result in a further enhancement of nuclear reaction rates, and the reaction rate enhancement factor is studied in several relevant scenarios. For sub- or near-threshold resonances, this could potentially change the reaction rates by a significant amount as the reaction energy effectively shifts the resonance above or below threshold. Possible sites where relativistic plasma screening could have a significant effect on observed results include Big Bang Nucleosynthesis,  $\alpha$ -rich freezeout in the r-process, x-ray bursts, type Ia supernovae, and late-stage burning in massive stellar cores. Current results will be presented in which relativistic plasma effects in high-temperature and high-density environments have been studied. In addition, plasma screening is extended into the intermediate screening regime by exploring higher-order terms in the relativistic Poisson-Boltzmann equation.

## **CYCLOTRON COLLOQUIUM**

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**Dr. Michael  
Famiano**

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**Associate  
Professor**

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**Department of  
Physics**

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**Western Michigan  
University**

**CYCLOTRON  
INSTITUTE**

Room 228

Refreshments will be  
served at 3:30pm



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