Application to Graduate with Honors

Student ID: 810 88 4265

I plan to defend in: FALL / (SPRING) of 20 11

Personal Information:

Name: Kryszelda Mendoza

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I am an: (IN-STATE) / OUT-OF-STATE student

Academic Information:

☑ I plan to graduate with *Departmental Honors* in: Physics

☐ I plan to graduate with *General Honors*

Cumulative GPA:

Please attach a brief **PROSPECTUS**, **BIBLIOGRAPHY**, and **TIMELINE** of your thesis project to this application. When summarizing your work, consider the following:

- What is the problem you are investigating?
- What is the hypothesis you are testing?
- What is the focus of your study?
- What is your goal in this study?

Primary thesis advisor: Name: Jamie Nagle Dept: Physics

List the other members of your committee:
Name: Cathy Regan Dept: Museum and Field Studies
Name: John Cumalat Dept: Physics
Name: Dept:
Name: Dept:

Departmental and General Honors Committee Checklist:

✓ Applicant has a total of at least three committee members.
✓ At least one Honors Council Representative is included on committee.
✓ At least one committee member from an outside department.

APPLICATION CONTINUED ON BACK OF THIS SHEET

Please initial if you are pursuing Departmental Honors:

KM I have consulted with my department and have completed (or am completing) the requirements they have established.

For Honors Council Representative:

I have met with applicant and approve him/her for departmental honors.

Printed Name: John P. Cumalat Signature: John P. Cumalat

Please initial if you are pursuing General Honors:

_____ I have completed (or am completing) the requirements for graduating with General Honors.
Please list the courses you have or are taking toward General Honors:

_____ _____

_____ _____

For General Honors Council Member:

I have met with applicant and approve him/her for general honors. I agree to be on his/her defense committee.

Printed Name: _____ Signature: _____

For the Thesis Advisor:

I have met with the applicant to discuss the proposed work and agree to provide the necessary help and direction for this thesis project.

Printed Name: James Nagle Signature: _____

For the Student:

I have read the requirements for graduating with honors at the University of Colorado. I also understand that my designation will be sent to the CU email address that I have provided and will not be given out over the phone.

Signature: _____ Date: 12/1/10

For additional graduation information including requirements, guidelines and deadlines, you can download them online at www.colorado.edu/honors

Prospectus and Timeline

Background:

While the Quark-Gluon Plasma (QGP) can be created experimentally, we cannot directly observe the medium. However, we can still learn a great deal about the QGP by studying the particles emitted from the medium as the QGP cools and expands. Using a hydrodynamic code developed by Paul Romatschke (2008), we have created a computer program to model the temperature profile of the QGP as it cools. This provides us with a physical representation of the QGP, which allows us to better analyze its properties.

Our goal with this project is to create an accurate model of the behavior of the temperature of the QGP. Since photons interact on an electromagnetic level, they are not affected by the strong forces in the medium. Once photons are created within the QGP they exit the medium without interacting and thermalizing with other particles. These photons carry a lot of information about the inside of the medium, making them a very interesting particle to study.

I am using the output from this code to model photon emission. The photon emission spectra can be calculated using an equation derived by Joseph Kapusta that calculates the spectra with respect to temperature and energy. These two quantities can be measured, so this is a useful way to model the spectra.

Goals:

The goals that my advisor and I have set out for my project are:

Implement the hydrodynamic code to smooth initial conditions to get a base model for photon emission in the QGP. This model can be further analyzed by adding a velocity shift to the photons emitted throughout the medium. By adding the velocity shift, a more accurate representation of photon contributions within the medium can be analyzed.

There are also other factors that we can consider, like other forms of photon production. Right now we are only considering the first order approximation of thermal photon production. There is a lot of work that can be put into this project, but we are still deciding if it is worth going forth with it.

Progress:

Currently, I am finished with the goals set out for my project. With help from my colleagues, I was able to finish implementing the photon emission spectra with the Doppler blue shift of the photons. The results show that there is a lot more contribution from the cooler photons at the latest time steps because the Doppler shift boosts the outermost photons faster than the photons in the middle of the medium.

Timeline:

May-August: Writing code to calculate photon emission spectra for blackbody and thermal photon yield.

September-October: Working with Chuan to implement the velocity Doppler shift to the emission. Creating poster for the DNP CEU Conference.

November: Present results at the DNP conference. Start writing thesis

November-December: Finish writing thesis since Jamie will be gone in the spring

March-April 2011: Finishing touches on the thesis and defend.

References:

[1] D. Griffiths: *Introduction to Elementary Particles,* Wiley (1987).

[2] K. Adcox et al (2005), "Formation of dense partonic matter in relativistic nucleus-nucleus collisions at RHIC: Experimental Evaluation by the PHENIX Collaboration" Nuclear Phyiscs A 757 (2005) 184-283

[3] H. Caines (2009), "Heavy-Ion Collisions – Examining the Quark Gluon Plasma at RHIC" nucl-ex 321.v1

[4] P. Stankus (2005), "Direct Photon Production in Relativistic-Heavy Ion Collisions" annurev.nucl.53.041002.110533

[5] J. Kapusta et al(1991), "High-energy photons from quark-gluon plasma versus hot hadronic gas" Physical Review D 44

[6] M. Luzum and P. Romatschke, Phys. Rev. C78, 034915 (2008).

[7] C. Wong: *Introduction to High Energy Heavy-Ion Collisions.*