THE OHIO STATE UNIVERSITY

Department of Physics

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Mr. Anthony Tropiano
OSU Department of Physics
Campus

Dear Anthony:

Your Advisory Committee proposes the following topic for your general examination:

"Status of nuclear optical potentials and future prospects."

Please prepare a double-spaced 10–20 page paper on this topic (with references, figures, and tables counted separately, formatted as in a regular publication, e.g., using RevTeX with the "preprint" option). This paper is to be completed and given to your Doctoral Candidacy Examination Committee by **July 30, 2019**.

Optical potentials are a key element in the analysis of low-energy nuclear experiments, but their theoretical underpinning is decades old. In recent years there have been tremendous advances in nuclear structure theory and new efforts to re-examine nuclear reaction theory. What is the current status and important directions for optical potential theory, particularly in light of developments in effective field theory (EFT) and the renormalization group? You should consider the following aspects of the topic:

1. Characterize the current use and phenomenology of optical potentials in modern experimental analyses;
2. examine the status of ab initio and EFT-based optical potentials: their successes and limitations;
3. from your reading, develop a list of critical theoretical issues for optical potentials.

As you prepare your paper you may freely use all of the resources of the University, including discussions with faculty, postdocs, and students. Particularly fruitful discussions should be acknowledged in the paper. You should review a draft of the paper with your advisor, however the paper must be your own work. Members of the Committee reserve the right to not answer every question, but you should feel free to ask any questions, especially questions of clarification. General principles of how to ensure compliance with the rules of academic integrity can be found at `https://oaa.osu.edu/coamtensuggestions.html`. You are not expected to present original research, but to demonstrate the ability to digest the literature and synthesize a coherent picture and understanding of your specific topic and its broader context. You should make sure

you understand the core concepts of your paper very well. This understanding is not expected (but also not forbidden) to be at the detailed level of a front-line researcher working on this problem, but your paper should be useful and understandable to a graduate student interested in this area. Do not attempt to cover too much material, and make sure you understand and can explain everything you include in the paper.

The oral portion of the exam will be given on August 6, 2019 in a room you should reserve. For the oral exam you should prepare a 15-20 minute presentation of your paper. You should review a draft of your slides with your advisor, however the presentation must be your own work. You should practice the presentation with a group of students who have taken the candidacy exam in a similar research area. The Committee will ask you questions during and after your presentation. These questions may diverge from the specific subject matter of your paper at the discretion of the members. The Committee will try to ensure a deep understanding of the core concepts underlying your topic. More detailed information about the Doctoral Candidacy Examination can be found in Graduate School Handbook and in the Physics Graduate Program Handbook at https://physics.osu.edu/candidacy-exam-info.

Good Luck!

Sincerely yours,

Prof. Richard Furnstahl
Advisor, for the advisory committee

cc: Profs. Hirata, Humanic, Perry