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Dear Habilitation Committee,

It is my pleasure to support the request of Dr. Georgui Kornakov Van to confer the post-doctoral degree of doctor habilitated.

I am a member of the CMS collaboration at LHC, specializing in the physics of heavy ion collisions. I am familiar with the overall physics program of the heavy-ion field, but I am not directly involved with the experiments where Dr. Kornakov is active.

Dr. Kornakov is an experimental nuclear physicist interested in the studies of the properties of nuclear matter. The hot and dense matter created in the collisions of heavy nuclei is a likely recreation of the conditions in the early Universe and the conditions that might be present in other parts of the Universe, e.g., in the interior of neutron stars. It is also a laboratory for studying QCD, the fundamental theory of strong interactions. Dr. Kornakov is doing his experiments using accelerator facilities at GSI in Germany and CERN in Switzerland. At GSI, he has been a member of the HADES collaboration, and at CERN, he is with the ALICE collaboration. The two accelerators span a large range of energies, giving access to nuclear matter across a large range of temperatures and densities.

Dr. Kornakov exploits the nuclear phase diagram by correlating identified particles produced in individual ion-ion collisions. Understanding the details of that diagram is a "Holy Grail" of the whole field of nuclear physics. The specific goal of Dr. Kornakov is to study the time dependence and size of the source of particle production. To disentangle the details of production processes, the experiments need to distinguish the type and mass of the correlated particles. The HADES and ALICE experiments can identify electrons, pions, kaons, protons, and their antiparticles. There are also techniques to identify heavier particles like lambda or other so-called hadronic resonances. The correlations of identical particles are sensitive to quantum interference, and the correlations between particles with different masses carry information about time dependence.

The challenge of conducting the femtoscopic measurements is to develop precise particle identification techniques in hardware and devise efficient analysis techniques to improve particle ID further and characterize and remove background. Dr. Kornakov has made significant contributions to addressing both of these challenges.

In HADES, he improved the Time of Flight system's resolution by recalculating the collision time (a start for TOF measurement) by combining information from multiple tracks. He also improved the resolution and efficiency of electron identification with a new algorithm to enhance data from Ring Imaging Cerenkov detectors. With the improved identification of particles, he could then analyze particle correlations and deduce fundamental parameters of the collision fireball, like the temperature and lifetime of decoupling of various particles.

In ALICE, his main contributions were to data analysis and, in particular, the background subtraction using the so-called "iterative method," a significant improvement over the mixed event method, frequently used in the heavy ion field. This new technique led to exciting baryon-anti-baryon correlations and the measurements of pion-proton emission. We expect mesons and baryons will have different production mechanisms, and these new experimental data will help improve that understanding. ALICE is presently the only detector at the LHC that can identify reliably distinguish between pions, protons, and strange hadrons.

Dr. Kornakov is also involved in an exciting proposal to study antiprotonic atoms within the AEgIS collaboration. The experiment exploits new avenues to understanding fundamental physics using nuclear and particle physics techniques combined with the dramatic advances in atomic and molecular methods. CERN is at the forefront of these advances. Dr. Kornakov showed an excellent taste for physics and good leadership by joining that collaboration and forming a strong team in Poland.

In summary, I find that Dr. Kornakov made significant contributions to the field of heavy ion physics. His systematic and detailed measurements of particle correlations advance our knowledge about particle production, the essential ingredient of understanding the nuclear phase diagram. His research involves leading experiments and groups at major international laboratories. I expect him to continue fruitful research in the future.

I support his promotion to the post-doctoral degree of doctor habilitated in the field of heavy ion physics.

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