

REVIEW

On the competition for the occupation of the academic position Associate Professor in the specialty 4.1. Physical Sciences (Particle Physics) published in the State Gazette №93, November 26, 2019, for the needs of the Faculty of Physics of Sofia University "St. Kl. Ohridski" with the sole candidate Chief Assistant Dr. Peycho Stoev Petkov of SU. Member of the Scientific Jury: Assoc. Prof. Dr. Plamen Iaydjiev, INRNE - BAS

1. Description of the materials presented:

He defended his dissertation for the degree of Doctor of Physical Sciences in 2009. The topic of the dissertation is fully relevant to the specialty of the competition:

"Investigation and optimization of the characteristics of resistive-plate cameras for the CMS detector".

For participation in the competition he submitted papers as follows:

20 publications in international journals with impact factor:

Physical Review Letters - 3 articles

Journal of Instrumentation - 8 articles.

Physics Letters B - 3 articles.

Nature - 1 article.

Journal of High Energy Physics - 3 articles.

Nuclear Instruments and Methods A - 2 articles.

149 citations were noted.

The applicant fulfills the recommended requirements of the Faculty of Physics of the Sofia University for the position of Assistant Professor.

Compliance with the minimum national requirements under Art. 2b of the ZRASRB:

The publications submitted by the applicant according to the groups of indicators A,B,Г,Д and the reported points comply with the requirements of the rule of **ZRASRB** and the requirements of the Faculty of Physics of the Sofia University.

2.Characteristics of research and development and pedagogical activities of the candidate

2.1 Research and development activities of the candidate

He has been working for about 18 years in the following fields - Particle and high energy physics, experiments in elementary and high energy physics, detectors in elementary and high energy physics, high-performance calculations, supercomputer complexes, biological molecule interaction modeling, molecular dynamics applications of machine learning methods.

The most extensive activity with a large contribution from the applicant to this competition may be mentioned

- Design and design of RPC for the CMS muon system;
- Development of a trigger system of the test bench in Sofia;
- Investigation of the stability of RPC characteristics;
- Maintenance and testing of RPC during LS1;

- Cosmic ray and muon collision data collection at LHC in periods 2010-2012 and 2015-2018;
- Study the evolution over time of the characteristics of the RPC system.

2.2 Pedagogical preparation and activity

He read a course of lectures and leads seminars and laboratory exercises on:

"General Physics 8" for Compulsory KKTF and Seminars

"Ionizing accelerators and detectors in medicine" - lectures and seminars

UNIX Programming - Lectures

UNIX Programming - Practicum Programming

Information Technology - Practicum

"Modeling the interaction of biological molecules" - lectures and workshops

Courses in the Master's Program of Sofia University:

UNIX Programming Elective for Bio and Medical Informatics - Lectures and Practicum

The applicant fulfills the recommended requirements of the Faculty of Physics of the Sofia University for the position of Assistant Professor.

3. Basic scientific and methodological contributions:

Scientific contributions:

Using data mainly from the muon system, upper limits are set to observe rare events such as $B_s^0 \rightarrow \mu^+ \mu^-$, $B^0 \rightarrow \mu^+ \mu^-$.

Assessment of background deviations in the search for light resonances splitting into pairs of muons.

Measurement of the production cross section for hadrons containing b-quarks $\sigma(pp \rightarrow b + X \rightarrow \mu + X^*) = 1.32 \pm 0.01$ (stat) ± 0.30 (syst) ± 0.15 (lumi) μb .

Evaluation of background deviations in the search for a light Higgs pseudoscalar boson decaying into pairs of muons.

The cross section $\sigma(pp \rightarrow bbX \rightarrow \mu\mu X^*)$ was measured to obtain b and anti-b quarks which decay into pairs of muons in the final state.

Estimation of background deviations and Higgs boson search beyond the Standard Model, decaying pairs of light bosons with a final expected four muons

In 2015, in collaboration with the collaboration of the LHCb experiment, the observation of the rare decay of $B_s^0 \rightarrow \mu^+ \mu^-$ with statistical significance of five standard deviations and of $B^0 \rightarrow \mu^+ \mu^-$ with statistical significance of three standard deviations was published.

One of the important physical results with the leading role of the CMS muon system, obtained after analyzing the data collected in 2015 was an upper bound of 6.4×10^{-4} on the partial probability of observing the Higgs boson decay of two muons.

Methodological contributions:

- In 2010 - 2011 develops procedures for performance of chambers by scanning of the high-voltage and the result was improved stability and homogeneity of the RPC system. In the first three years of its operation, operating channels were 97.5% and the contribution to the CMS dead time (the time during which there were collisions at the interaction point but no data was collected due to a CMS malfunction) was 1.5 %

- During the planned technical shutdown of the LHC in 2013-2014. (Long Shutdown 1 - LS1) hardware issues in the high-voltage power system and front electronics of resistive-plane chambers have been resolved.

- Leak tightness of gas chambers in the cylindrical part of the CMS was investigated.

4. The importance of contributions to science

Contributions are, to a large extent, the applicant's personal involvement.

There is significant contribution to:

1. Investigation of the characteristics of RPC prototypes in Bari, Italy, control tests and measurement of their characteristics on specially designed muon telescopes and the construction of a muon telescope at INRNE-Sofia for measuring the efficiency of chambers.
2. Certification of the RPC system of the CMS experiment by collecting data from the passage of cosmic muons. Study of the stability of RPC's current and measurement of their efficiency and spatial resolution. Participating in the Cosmic Muons Passage Data Set. The first physical result obtained using all the CMS subsystems before the Large Hadron Collider (LHC) was put into operation, was the ratio of positively/negatively charged cosmic muons at the ground level. The measured value of 1.2766 ± 0.0032 (stat.) ± 0.0032 (syst.) was the most accurate at this time and does not depend on the muon momentum below 100 GeV / c.
3. Measurement of the relative position of each RPC station with respect to the DT cameras in the $r\phi$ direction, and determination of the spatial resolution of the RPC system. Optimization of the power supply values and thresholds of the front electronics, as well as improving the timing of RPC signals in the cylindrical part of the detector.
4. Using data mainly from the muon system, upper limits are set for observing rare events such as $B_s^0 \rightarrow \mu^+ \mu^-$ and $B^0 \rightarrow \mu^+ \mu^-$, estimation of background deviations in the search for light resonances that break down into pairs of muons, the cross section for obtaining hadrons containing b-quarks $\sigma(pp \rightarrow b + X \rightarrow \mu + X^*) = 1.32 \pm 0.01$ (stat) ± 0.30 (syst) ± 0.15 (lumi) μb , estimation of background deviations when searching for a light Higgs pseudoscalar boson decaying into muon pairs, the cross section $\sigma(pp \rightarrow b\bar{b}X \rightarrow \mu\mu X^*)$ was measured for b and anti-b quarks which decay into muon pairs at the end state, evaluation of deviations from the background in the search for the Higgs boson beyond the Standard Model, which decays to the couples of light bosons and in the final state are expected four muons.
5. One of the important physical results with the leading role of the CMS muon system, obtained after analyzing the data collected in 2015, is to place an upper bound of 6.4×10^{-4} on the partial probability of observing the Higgs boson decay of two muons.

I have no critical remarks and recommendations.

CONCLUSION:

The presented scientific papers characterize the candidate for this competition Chief Assistant Dr. Peicho Stoev Petkov as a distinguished Bulgarian scientist-physicist who worthily presents the Bulgarian physics of elementary particles in the world particle physics community (Letter from G. Pouliese). Given the topicality, importance and international recognition of his scientific contributions, I strongly believe that Peycho Stoev Petkov, Chief Assistant, should take up the academic position of Assistant Professor in the professional field 4.1. Physical Sciences(Particle Physics).

01.03.2020 Assoc. prof. PhD Plamen Iaydjiev, INRNE-BAS