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Letter of recommendation for Ondřej Haderka, assoc. prof., RNDr., Ph.D.

I am glad to know that Ondřej Haderka, assoc. prof., RNDr., Ph.D., is now applying for the title of *Professor of Science* for his scientific achievements, as well as pedagogical activity and research organizational achievements. I hope my recommendation letter in support of this Candidate could be useful.

The Candidate defended his Ph.D. thesis on “Nonlinear dynamics of lasers in the regime of mode-locking” under the supervision of Prof. P. Malý at the Faculty of Mathematics and Physics of Charles University in Prague in 1995. He has been employed at the Joint Laboratory of Optics of Palacký University and the Institute of Physics of the Academy of Sciences of the Czech Republic (IP ASCR) since 1994.

It should be stressed that the Candidate was the Scientific Director of the Regional Centre of Advanced Technologies and Materials (RCPTM) in Olomouc in 2010-2019, and he has been the Head of the Joint Laboratory of Optics since 2013. These two facts show clearly his leading role in organizing the research in quantum optics in Olomouc in the last decade.

The Candidate has been performing fundamental and applied research in optics and quantum information. Both these research fields are closely related to quantum technologies. Specifically, the areas of his research in optics cover laser physics, quantum and nonlinear optics with a special emphasis on the detection of light. Moreover, his research in quantum information covers quantum cryptography, quantum communication, quantum random number generation, and quantum information theory including quantum entanglement and other types of quantum correlations.

I would like to mention a few technical points that might help you to be acquainted the areas, in which his contributions could be recognized, by awarding him the scientific title of professor.

Firstly, I would like to note that he is well known for his research works on quantum optics. As a recognition of his contribution to this field he has received a number of awards. These include the Alois Rašín Award (together with J. Valenta), Journal Vesmír in 1997 and the Otto Wichterle Award of the Czech Academy of Sciences in 2006.

His research interest is quite wide, but it is primarily focused on optical systems that lead to the generation and properties of nonclassical states of light (lucidly speaking, quantum optical states without having a classical counterpart) and their applications in quantum information, especially in the context of quantum cryptography.

Further, I would like to acknowledge that he has been systematically investigating both theoretically and experimentally the possibilities of the generation and stabilization of the sub-Poissonian photon-number statistics, photon antibunching, quadrature squeezing, and quantum entanglement of light beams in various optical systems. These studies have revealed many interesting results. The beauty of these investigations in quantum optics lies in the fact that in his works he often tries to answer important or even fundamental questions on both theoretical and applied levels.

His most often cited papers according to the Web of Science are: (1) on “Quantum identification system” (coauthored by M. Dušek, M. Hendrych, and R. Myška), (2) on “Multiple-photon resolving fiber-loop detector” (coauthored by Y. Řeháček, Z. Hradil, J. Peřina and M. Hamar) and (3) on “Direct measurement and reconstruction of nonclassical features of twin beams generated in spontaneous parametric down-conversion” (coauthored by J. Peřina, M. Hamar,

and J. Peřina). These articles were published in Physical Review A and have at least 111, 106, and 72 citations, respectively, excluding self-citations as checked in the Web of Science on June 22, 2020.

I find these and other works of the Candidate very insightful and useful for quantum technologies. In particular, let me mention that multiple-photon-resolving detectors are a holy grail for quantum optical technologies including quantum communications, quantum cryptography, and fundamental tests of quantum theory. Unfortunately, experimentalists have usually access only to the so-called bucket detectors (which cannot distinguish the number of photons but only their presence) or single-photon detectors (which can distinguish 0 and 1 photons from more photons). Thus, I find the experimental proposal described in the above-mentioned article on multiple-photon-resolving detectors to be very promising with wide applications in quantum technologies.

At the end of this part summarising some scientific achievements of the Candidate, let me note that he has been a collaborator of mine for more than 20 years and, as a consequence, I am well aware of his research activities. In particular, we coauthored a 111-page review on “Nonlinear phenomena in quantum optics” (by J. Bajer et al.) published in the monograph on “Modern Nonlinear Optics” edited by M. W. Evans (Wiley, New York, 2001), which appeared in the series on Advances in Chemical Physics. We also wrote an article on “Sub-Poissonian light in third-harmonic generation: Quantum predictions via classical trajectories” (authors: J. Bajer, O. Haderka, J. Peřina, and A. Miranowicz) published in the Czechoslovak Journal of Physics in 2000.

Through our collaboration and in my knowledge of quantum nonlinear optics and quantum information, I find him an excellent researcher with already significant contributions to these fields. The Candidate can easily grasp the nature of a physical problem, put forward creative proposals, and solve the problem efficiently and quickly. He has also a very creative scientific way of thinking. The last but not least, the Candidate is a kind, modest, highly honest, and loyal person.

The Candidate activity concerning the organization of research and obtaining grants is very impressive for me. As I have already mentioned, he was the Scientific Director of RCPTM in Olomouc for almost a decade, and he has been the Head of the Joint Laboratory of Optics since 2013. Moreover, he has actively participated in many (i.e., twenty eight) grant projects concerning fundamental and applied research. In ten projects he was the principal investigator or a primary co-investigator.

Despite of his heavy administration duties, the Candidate was also very active pedagogically. In particular, he supervised two Ph.D. students, i.e., Ievgen Arkhipov (2013-2017) and Martin Hamar (2004-2009). As a remark let me mention that Dr. Arkhipov is now one of my close collaborators. Dr. Arkhipov has a broad knowledge of quantum optics also thanks to the Candidate, who was his great Ph.D. advisor. Moreover, the Candidate supervised eight theses of master’s and bachelor’s students. The Candidate is also a member or chairman of several commissions granting bachelor, master, and doctoral degrees in: computer physics, instrumental physics, applied physics, and nanotechnology.

In addition to his numerous and regular lectures at the Palacký University on the variety of subjects on theoretical and experimental physics, he lectured at the Università degli Studi dell’ Insubria in Como, Italy in 2010 within the Erasmus program.

It is worth mentioning that the Candidate was a member in the years 2010-2018 of the permanent working group for physics at the Accreditation Commission of the Ministry of Education, Youth and Sports of the Czech Republic.

Thus, I am glad to strongly recommend the Candidate, as a creative and brilliant expert in the fields of theoretical and experimental quantum optics and quantum technologies. I deeply believe that he fully deserves the title of *Professor of Science* for his scientific achievements, pedagogical activity, and achievements in organizing the optical research in Olomouc.

If further information is required, please feel free to contact me. I now stand ready to render all my possible support for the Candidate.

Yours sincerely,



Adam Miranowicz