Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019

Summary Final Report

Name of the Institute: Institute of Photonics and Electronics of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Optical biosensors (Jiří Homola)
2. Fiber lasers and nonlinear optics (Pavel Honzátko)
3. Synthesis and characterization of nanomaterials (Jan Grym)
4. Bioelectrodynamics (Michal Cifra)
5. Nano Optics (Marek Piliarik)

Part A: Evaluation of the institute

Strengths:
The Institute provides an excellent environment to conduct highly competitive multidisciplinary fundamental and applied research into various aspects of fiber-optic biosensors, high power lasers and optical spectroscopy techniques, including basic research, device development, testing and prototype development. These activities are often conducted within a strong national and international collaboration and supported by an advanced infrastructure that the team has at its disposal and which continually is modernized and upgraded. The institute is extremely well managed, a difficult task considering a high number of external projects and grants.
The institute has employed sufficiently experienced and internationally recognised researchers. The institute can rely on a solid basis which is given by a very good age structure and an international work environment achieved with postdocs from abroad bringing stimulating ideas and extending the professional network.

Weaknesses:
Part of the funding comes from grants, which requires a lot of administrative support and makes its funding a bit fragile. The facility for fiber preparation is located at a distance of about 20 km from the main laboratory, which increases the overhead of the team management and complicates sharing of human and material resources.

Opportunities:
Considering the excellent management and state of the art infrastructure the institute has a real chance to assume an internationally leading position in the near future.
The institute operates inbetween physics and engineering and, thus, is rather interdisciplinary and can rely on a broad basis of skills and capabilities.

Threats:
Given the institute as a whole, we did not see any significant or substantial threats, especially also because the more recently established teams have developed well and will prosper further in the future.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The Institute conducts high quality multidisciplinary research which is documented by 164 papers in respectable journals with an impact factor, with the selected papers mostly being at an excellent international level. In various disciplines the institute manages to perform on a world-leading level, while seen on the whole the quality of selected outputs of Phase I is very good and internationally competitive.	
H1.2	**Contribution of workers on the outputs reached**
The members of the Institute often have a leading role, and always have a significant role in their contributions to the outputs. The major contributions on the outputs stem from workers of the institute themselves, as can be seen from the fractional count. It is estimated that about two thirds of the outputs are contributed from workers of the institute.	
H1.3	**Quality of all outputs and results**
The institute certainly performs on a high international academic level and is capable to produce world-leading and internationally recognized scientific output. The institute meets	

the expectations that can be raised towards a national academy of science, outputs and results are very good, with reach excellence in several parts.

H1.4	The most valuable discoveries and findings in the fields, their importance for the field
The research conducted by the institute is multidisciplinary and has an impact on many areas, like development of new biophotonics tools e.g. by the team of Optical Biosensors that will deepen the understanding of biomolecules and their interactions and will enable rapid quantification of molecular targets with unprecedented sensitivity. Other noticeable achievements are the developments of novel approaches to characterize electromagnetic properties of biological systems by the Bioelectrodynamics team, the development of high-power fiber lasers for industrial, medical, and scientific applications, including material research, design of special optical fibers and fiber components, research of fiber lasers and their stability, and inventing new applications; and investigations of light-matter interactions at the nanometer scale for optical microscopy. Many of these developments are accompanied by very good publication records that reach world-leading level and can be considered as „hot topics“.	

H1.5	Contribution of the participation of the authors in large collaborations
The institute is involved in a number of multilateral and bilateral international collaborations, as suitable for the different teams. There is no significant participation in even larger collaborations.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The institute aims to obtain research results with an application potential (e.g. connected to medical diagnostic methods, applications in food safety, and contributions to advanced technological processes) and to transfer them to the economy and society. In order to facilitate this process, the institute has set up a new support unit (Department of Administrative Affairs) to assist the institute’s management in the field of intellectual property protection and knowledge transfer.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
The Institute has an IP specialist who helps the researchers to identify and to document the IP that was created, and registers it in the Institute’s intellectual property database. This database registers all IP applications, patents, utility models (including deadlines for their renewals), and IP-related contracts, as well as publications and their copyrights. Actual knowledge transfer into practise is still limited, such that the benefits for society still need to be proven. This is a commonly expected situation for an institute that to a significant extent performs fundamental research.	

H2.3	Relation to practice
The institute filed as the sole applicant or jointly with other institutions 6 national patent applications, and has been granted 4 national patents. Moreover, the institute filed 2 international applications in the U.S., Canada, and Europe. The institute has signed 7 research contracts, and a material transfer agreement, as well as a non-disclosure agreement in order to enter into the license negotiation phase. Here, it might be most promising to foster collaborations with life and medical sciences	

H2.4	Participation in AV21 strategy
The institute actively participated in the Strategy AV21 programme. In particular, it contributes to two programmes: Light at the Service of Society and Diagnostic Methods and Techniques. However, this does not involve all teams.	
H2.5	**Cooperation with regions of the Czech Republic**
The Institute is located in Prague and did not have any substantial cooperation with other regions of the Czech Republic.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
The institute compares well with similar national and international institutes, as seen from the publication records.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
In general, the institute engages in a variety of international and national collaborations and often assumes a leading role in them. These are mainly connected to smaller multilateral and bilateral projects rather than large collaborations. The collaborations generate joint publications of high-quality output.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The members of the institute organized and chaired several international conferences and symposia and participated in their technical and scientific committees. Several institute members are on the editorial boards of international journals and are active in professional societies such as IEEE, OSA and SPIE. Also, several of them participated in different bodies of the institute, of the CAS, at universities and at funding agencies. Dr Homola gave many invited and plenary talks at different conferences, and 2 awards have been obtained.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The institute basically plans to further pursue its current strategy with a focus on multidisciplinary and interdisciplinary research. Due to the diversity of the teams it is taken care that all departments follow a meaningful strategy with a focus on relevant strengths. Overall, the future strategy is seen as meaningful and promising.	
D2.2	**Assessment of the previous research objectives and their achievement**
The research activities during the evaluation period 2015-2019 were mainly carried out as planned. It should be noted that the Department of Nano Optics was just recently established during this last period. Overall, the research activities have led to a very good publication record and the continuous modernization of laboratories should be mentioned as very positive as well.	

D2.3	Assessment of implementation of recommendations from past evaluation

The Commission recommended that the Fiber Laser and Nonlinear Optics research team should increase the number of journal publications with an impact factor as compared to the number of conference publications, and rethink the Institute's research orientations to be more connected to the needs of industry. In response to these recommendations, the institute focused on improving the publication output of the teams and increased the number of articles in peer-reviewed journals by 9%. Most of the articles were published in scientific journals belonging to the first or second quartile according to Web of Science. In an effort to strengthen the relationship with industry, cooperation was initiated with several companies in the Czech Republic (e.g. SQS Fiber Optics and MATEX PM s. r. o.) and abroad (7 companies within the TALOS project supported by the European Defense Agency). In addition, the Institute has joined the Czech Optical Cluster, which is a network of the most important Czech photonic companies, research and educational institutions. Moreover, the institute has put great effort in implementing the recommendations from the past evaluation by changing structural boundary conditions and implementing support units. So far, this has led to improvements with respect to the point mentioned. Internationalization has seen improvement but still could be improved further in the future.

D2.4	Success in receiving grants

The institute largely depends on national grants and funds provided by the CAS, amounting to about 50% of its total budget. A drawback is that this also highly increased the administrative burden on the management. It would be beneficial if the institute could enlarge the financial influx from international grants and, possibly, industrial sources, even though the latter might be difficult for an institute which focusses on fundamental and interdisciplinary research.

D2.5	Adequacy of instrumental equipment

The Institute regularly upgrades labs and adds new equipment. Therefore, the research teams are well equipped for the research activities that they conduct. The Institute also has an in-house machine shop, which provides research programmes with prototyping services. The planned relocation of the fiber drawing towers will certainly increase the effectiveness of the research work.

D2.6	Effectiveness of management

The institute is effectively and well-managed, as can be seen from the high-quality scientific outputs and the constant efforts to create supportive boundary conditions and from the monitoring of the strengths and deficiencies of the single departments.

D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth

The institute employs an elaborate HR policy which includes aspects of qualification, employment, support of employees, career development, performance management, internationalisation, employment benefits, and social life. The age structure in the research units is very good, with the vast majority of research staff at a productive age, with a good mixture between younger and more experienced team members. This is the result of the restructuring of research units of the institute in 2012 and the continuous efforts of the management manifested by hiring with a long-term prospective, active involvement of graduate students, and creation of a new research team consisting of young researchers. This provides a perfect environment for professional growth.

D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
The institute endorses the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, and works to ensure that the HR policies and procedures of the institute are developed and applied in accordance with these standards. In addition, a truly international work environment has been achieved with postdocs from abroad bringing stimulating ideas and extending the professional network. The institute employs a rather high percentage of females and part time employment is possible. This all is very satisfying.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
During the evaluation period, the Institute cooperated with a number of domestic and foreign institutions, which included many universities. The main multilateral international collaborations included: development of a plasmonic-based biosensor system for the diagnostics of colorectal cancer within the project entitled Ultrasensitive Plasmonic Devices for Early Cancer Diagnosis (EU programme Horizon 2020); development of tactical laser effector technologies within the project entitled Tactical Advanced Laser Optical System (European Defense Agency). No exact number of university partners collaborating with the Institute within these two large multilateral initiatives was provided, but obviously there were many. In addition, many bilateral collaborations were undertaken with numerous groups in USA, Singapore, Poland, Spain and Canada. These included 8 foreign universities and 3 foreign large government scientific agencies. The largest national project was a centre of excellence, Nanobiophotonics for Future Health Care, coordinated by the Institute. In this project, the Institute collaborated with 2 Czech universities: the Czech Technical University, and with Charles University in Prague.	
D3.2	**Effectiveness of joint research centres**
The institute did not have any joint research centre with universities during the evaluation period.	
D3.3	**Success rate in supervision of PhD students**
The members of scientific staff supervised 24 PhD students during the period of evaluation, 13 of which have completed their degree. This supervision rate is relatively high for a CAS institute of this size, and the success rate in completion is certainly good. In addition, 10 MSc and 3 undergraduate students were supervised.	
D3.4	**Participation of PhD students in the outputs**
From the reports of the single departments it can be drawn the conclusion that PhD students actively participate in the scientific outputs and are well involved within their respective teams. As the institute is mainly conducting fundamental research, this participation is important.	

D3.5	Participation of the institute in master or bachelor studies
10 MSc students were supervised, while 9 have completed their studies. Additionally, 3 BSc students were supervised during the period of evaluation.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The members of the Institute teach at 4 different Czech universities, which amounts to about 1400 hours of instruction during this evaluation period. The amount of teaching varies between the different departments as the two smaller departments with engineering focus do almost not teach at all.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Media strategy and research popularisation is seen as an important part within the strategy of the institute. It maintains a website, has a Facebook page and YouTube channel to communicate with the public. During the evaluation period it had 3 TV shows, gave 5 Radio interviews and also has been featured in the press.	
D4.2	**Publishing activities and its quality**
The institute uses existing and well-established publishing organs for its research output. In terms of outreach activities, 8 newspaper articles were written to present the institute‘s activities.	
D4.3	**Participation in professional organisations in the area of research and development**
The institute has organised 3 International conferences during the evaluation period. In addition, the institute’s researchers have been involved in the organisation of international scientific workshops. They served as conference chairs for more than 20 conferences, and as members of scientific or programme committees of more than 30 conferences.	

Other comments of the commission:

None.

Part B: Evaluation of teams

The commission shall comment on the topics relevant to the evaluation of the team not the institute.

1. Optical Biosensors

Strengths:
The team provides an excellent environment to conduct highly competitive multidisciplinary research into various aspects of fiber-optic biosensors, including basic research, device development, testing and prototype development. These activities are often conducted within strong national and international collaborations, and are supported by the advanced infrastructure that the team has at its disposal.

Weaknesses:
No particular weaknesses were observed.

Opportunities:
The multidisciplinary profile and advanced infrastructure provide an excellent opportunity to continue the high-level scientific research into fiber-optic sensors the team is conducting.

Threats:
No particular threats were observed

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The majority of the selected outputs are internationally excellent and some are world leading. It is worth underlining that some of the outputs are published in Biosensors and Bioelectronics, a journal with an impact factor of about 8.	
H1.2	**Contribution of workers on the outputs reached**
The team members have a leading or a very significant contribution in the selected outputs achieved through national and international collaborations.	
H1.3	**Quality of all outputs and results**
Most of all outputs are on an internationally excellent or a very good international level.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
These include the development of novel plasmonic structures for photonic biosensing, microfluidic devices for analyte management, development of novel coatings for sensors, and investigating interactions of proteins in view of medical applications.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team collaborates extensively with a variety of national and international partners,a fact that is confirmed by 29 out of 43 research papers published jointly as a result of these collaborations.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The team conducts research into the issues that are important to the institute mission and society needs, especially for applications in health monitoring, bio-analytics and detection of pathogens.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
During the evaluation period the team, in addition to high quality scientific results, obtained one US and one EU patent. Also, it delivered 6 SPR sensor systems to 5 institutions in the Czech Republic.	
H2.3	**Relation to practice**
The relation to practice with a specific view on knowledge transfer appears appropriate.	
H2.4	**Participation in AV21 strategy**
The team participates in the Light at Service of Society program.	
H2.5	**Cooperation with regions of the Czech Republic**
The Director of the Institute heads a common Centre of Excellence with two universities, the team members conduct teaching and supervision activities at several universities and are members of several Scientific Committees and Boards.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
This team compares favourably with similar national and international groups in terms of the quality of its journal publications and quality of the scientific infrastructure that is at its disposal.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The team is actively involved in a large multilateral collaboration with 13 partners from 7 countries in the area of Plasmonic Devices for Early Cancer Diagnosis. In addition, it actively participates in several bilateral collaborations with USA, Singapore, Italy and Portugal.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The team members organized and chaired 3 international conferences and symposiums. Several of them are members of the editorial boards of international journals and are active in professional societies such as IEEE and SPIE. Dr Homola and one other team member gave many invited and plenary talks at different conferences, and 2 awards have been obtained.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The group is closely following the research directions defined at the end of the previous evaluation period.	
D2.2	**Assessment of the previous research objectives and their achievement**
The previous research objectives have all been achieved, some additional activities leading to the obtention of patents and preparing 6 industrial prototypes were also conducted.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
This assessment involved a recommendation to continue the team's advanced and competitive research in the area of fiber-optic biosensors, with a view to obtain more cost-effective sensing technology. The team has followed these recommendations.	
D2.4	**Success in receiving grants**
The team apparently receives a lot of grants, although no specific information is provided. It is worth mentioning the largest one, 4MEuro, a Centre of Excellence "Nano-photonics for future health care".	
D2.5	**Adequacy of instrumental equipment**
The instrumentation and fabrication facilities are excellent, and planned relocation of the fiber drawing facility will make the work more efficient.	
D2.6	**Effectiveness of management**
The team and the Institute are excellently managed by Dr. Homola, whose effective hands-on management contributes to the general success of the team.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team displays care in selecting and later developing its young researchers, through supervision in one-on-one meetings, group meetings and carrier development events. The team's composition is 43% of females, and it is very strongly international. Finally, the age structure of the team appears perfect.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
43% of the team members are female. The international composition of the team promotes diversity and stimulates creativity and innovation.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
No information was provided here.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
In addition to research collaborations described in D1, the team members teach lectures at graduate level and supervise graduate MSc (3, 1 completed) and PhD (9, 6 completed) students, and also are members of Scientific Councils and PhD Boards at several universities.	
D3.2	**Effectiveness of joint research centres**
Dr Homola is a Principal Investigator of the Centre of Excellence “Nano-photonics for Future Health Care involving 2 universities and with a 4M Euro budget.	
D3.3	**Success rate in supervision of PhD students**
In the evaluation period considered, 9 PhD students were supervised while 6 have successfully completed their degrees.	
D3.4	**Participation of PhD students in the outputs**
The results obtained by the PhD students were published in good quality scientific journals.	
D3.5	**Participation of the team in master or bachelor studies**
During the evaluation period 3 MSc students were supervised and 1 completed his degree.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The team members conduct teaching activities at 2 universities in CR.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
One radio interview was given by Dr Homola. This media strategy should be better developed and some TV interviews should also be conducted to better develop dissemination to the public. Some promotional video materials are already available on the website.	
D4.2	**Publishing activities and its quality**
4 articles appeared in newspapers and magazines about the development and perspectives of the research in biosensors.	
D4.3	**Participation in professional organisations in the area of research and development**
The team actively participated at the Open-Door Days event at the Institute level, organized lab tours to university students, and participated in the Science week of Czech Technical University in Prague.	

Other comments of the commission:

None.

2. Fiber Lasers and Nonlinear Optics

Strengths:
Well-balanced and well-organized team conducting advanced basic research in materials and in laser physics, and applied research in optical fiber, component and device manufacturing and prototyping. International environment with postdocs from abroad bringing stimulating ideas and extending the professional network.
Horizontally integrated research infrastructure, including an MOCVD system, drawing towers, and a CO_2 preform shaping system

Weaknesses:
Part of the funding comes from grants, which requires a lot of administrative support and makes its funding a bit fragile. Facility for fiber preparation is located at a distance of about 20 km from the main laboratory, which increases the overhead of the team management and complicates the sharing of human and material resources

Opportunities:
The team has at its disposal an advanced research and fabrication infrastructure.

Threats:
No comment.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The quality of the majority of the evaluated outputs is on a good international level	
H1.2	**Contribution of workers on the outputs reached**
Most of the outputs are team work of a large number of team members, demonstrating a fruitful collaboration. And in most of them the team's contribution is very high (70-100%), in only a few outputs it is below 50%.	
H1.3	**Quality of all outputs and results**
The quality of outputs has significantly improved from the last evaluation, with about 10% more publications in scientific journals. All outputs and research results are at a very good international level.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The team carried out valuable research in the areas of advanced optical fibers, fiber lasers and amplifiers, and photonic devices, at both theoretical and experimental levels, and with scientific and industrial applications in mind.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team members have a significant participation in the outputs resulting from collaborations. This includes participation in a program funded by the European Defence Agency to develop a Tactical Advanced Laser Optical system. This program, including 7 industrial partners, involves collaborators in France, Spain, Germany, Poland, Italy, Netherlands, United Kingdom and Czech Republic.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The project Thulium Lasers for Industrial Applications and Medicine (with SQS Fiber Optics a. s. and MATEX PM s. r. o. over the years 2015-2018) was named the best business project by the funding agency (Technology Agency of the Czech Republic). The team is active in the Czech Optical Cluster and participates in the National Competence Center of Electron and Photon Optics. The team has been involved in the development of a low noise fiber laser for an optical clock, and the leader of the team serves as a member of the project's Optical Board.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
The group conducts an intensive collaboration with industry within the project TLAPA, and considers knowledge transfer of their results into industrial applications. Also, a collaboration with SQS Fiber Optics and Matex PM for development of fiber devices and components got an award for the best Business project by the Technological Agency of CR.	
H2.3	**Relation to practice**
The relation to practice with a view to knowledge transfer appears appropriate. The team obtained a new patent for a new optical element for fiber lasers and amplifiers.	
H2.4	**Participation in AV21 strategy**
The team participates in the Light at Service of Society program and conducts workshops and meetings with industry leaders.	
H2.5	**Cooperation with regions of the Czech Republic**
The team collaborates with several CR universities and industrial partners.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
This team performs very well in comparison with similar national and international groups.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The team has a role of the partner in a collaboration with Canada and Spain in the area of subwavelength gratings, and participates in a consortium of 15 European countries within the TALOS program. There was also an active collaboration with Poland, Cyprus and Italy in the area of special lasers and optical fibers, and with NATO in the area of defence related optical components.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Several team members participated intensively in chairing and co-chairing scientific conferences and in their technical and scientific committees. Several members participated	

in different bodies of the Institute, of the CAS, at the universities and at the funding agencies, as well as at several international scientific organizations like SPIE, OSA and IEEE.

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	**Direction in line with the perspective of the planned research directions**
The research directions of the team were closely following the plan established in 2015.	
D2.2	**Assessment of the previous research objectives and their achievement**
All previous objectives were successfully achieved.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The team followed the recommendation from the last evaluation and increased the number of high-quality publications in scientific journals with a high impact factor.	
D2.4	**Success in receiving grants**
The team was very successful in receiving a variety of grants, including those supporting defence related projects, although this introduced some internal administrative burden.	
D2.5	**Adequacy of instrumental equipment**
The team is very well equipped, although the fiber drawing facility is not at the main institute location. It is planned, however, in the next 3 years to co-locate this facility with the institute. This will obviously increase the work effectiveness of the group.	
D2.6	**Effectiveness of management**
The management appears to be of a high quality and effectively deals with managing a significant number of grants, with a matrix approach for delegating a high degree of autonomy to the principal investigators, in addition to solid internal management.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
Over the evaluation period the team hired 2 new PhD students, 5 post-docs and 1 scientist. Care is taken of professional development of the team and training schools and workshops were organized to address this. The age structure of the team appears very adequate to its mission.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
One event, Women in Optics, was organized to help address this issue.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
Does not apply	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
This cooperation appears strong at both teaching and research levels.	
D3.2	**Effectiveness of joint research centres**
The team did not participate in joint research centre activities.	
D3.3	**Success rate in supervision of PhD students**
5 PhD theses successfully defended during the evaluation period and 7 PhD students were supervised. In total 8 PhD students were members of the team during the evaluation period. For 3 PhD students, the team served as consultants. Participation in follow-up projects was offered if necessary.	
D3.4	**Participation of PhD students in the outputs**
The PhD students were first authors in 14 of the journal papers, which is worth underlining. They, further, co-authored other papers.	
D3.5	**Participation of the team in master or bachelor studies**
In addition to the PhD students, there were also several MSc students involved in the research projects of this team.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The team members gave 6 semestrial courses at the graduate level, 40 at MSc level and 5 at the PhD level at several universities.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The media strategy looks excellent, and involves multiple TV and Radio reports**.**	
D4.2	**Publishing activities and its quality**
Several popularization lectures were given by the team members. In addition the Week of Science, Open Doors and Science Fair activities were conducted by the team members.	
D4.3	**Participation in professional organisations in the area of research and development**
Several team members were active in international professional organizations like SPIE, OSA and IEEE.	

Other comments of the commission:
None.

3. Synthesis and characterization of nanomaterials

Strengths:
The team performs very solid and internationally recognized research work. It has a clear focus on well-defined research areas and is well-equipped for nanofabrication and optical characterization of materials.

Weaknesses:
The research topics are located inbetween the fields of material physics and engineering and it is not evident whether the team will stay in fundamental research or manage to connect to industrial technologies. Accordingly, the links to industry are still weak.

Opportunities:
The team might benefit from closer collaborations with more industry-oriented teams of CAS in order to actually have more opportunities to design novel electronics and optoelectronic devices.

Threats:
The team is confronted with a lack of funding, a low level of internationalisation and long turnaround times of research outputs. This might inhibit growth and development of the team.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The selected outputs of Phase I distribute across the second and third quality categories, with a majority being located in the third one. The productivity of the team in terms of excellent outputs is a bit below average.	
H1.2	**Contribution of workers on the outputs reached**
Among the 7 evaluated outputs, 4 have been created within collaborations while 3 have been created by team members only. The number of 7 evaluated number is not very high, leading to limited statistical measures.	
H1.3	**Quality of all outputs and results**
Only a small fraction of scientific output is placed in journals that belong to the first two quartiles, that is, most of the scientific output is located in the last two quartiles or connected to journals with no official ranking.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The team focusses on three different key areas related to the preparation and characterization of nanomaterials and nanostructures, to charge transport in semiconductor heterojunctions, and to the optical characterisation of semiconductors, glasses, and ceramics. Here, the position-controlled growth of ZnO nanorods is considered to be the most important achievement within the evaluation period. This has potential applications in technologies related to lasers and optoelectronical devices.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team did not participate in any large collaborations during the evaluation period.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
There is no immediate societal relevance to the outputs and results. This, however is typical for the type of research performed and not related to quality. Societal relevance might become more obvious if the results of the team will be turned to technological applications that serve societal benefits.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
As stated above, the research of the team is oriented towards fundamentals with no immediate impact on society. However, an understanding of nanomaterials with corresponding synthesis and characterisation method should be considered as a fundamental building block of modern technological applications which can lead to developments that serve human societies.	
H2.3	**Relation to practice**
Within the considered research field the relation to practice is connected to relations to industry which operates on a high technological level, such as semiconductor industry, for example. Due to its small size the team has difficulties to connect to this type of industry.	
H2.4	**Participation in AV21 strategy**
According to the report and presentation of the team there is no explicit participation in the AV21 strategy.	
H2.5	**Cooperation with regions of the Czech Republic**
There are no notable cooperations with regions of the Czech Republic.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
Compared to the pursued technological level, the team is rather small and the scientific output reflects solid research which appears as good and on an average level. Overall, the team has strengths and selling points in certain fields, such as given by the position-controlled growth of ZnO nanostructures, but does not excel as a whole if compared to similar institutes.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
National cooperations are mainly centred around a large number neighbouring departments of the CAS, supported by national research grants and leading to joint publications. On an international level, a variety of collaborations exist, notably to the Department of Physics of the Brookhaven National Laboratory, USA. These collaborations appear as bilateral and do not lead to external international funding, such as given by common Horizon 2020, for example.	

D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
It is mainly the team leader who is active in relevant scientific communities on a medium level. The team did not organize conferences and workshops. Awards were earned by three students on a national and international level and there has been one invited lecture for the team during the evaluation period.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
For the current period 2020-2024, the team plans to further focus on its strengths and will no longer continue research in the field of electrophoretic deposition of nanomaterials. The team will also benefit from the laboratory environments that have been created during the last evaluation period 2014-2019. This all constitutes a meaningful strategy.	
D2.2	**Assessment of the previous research objectives and their achievement**
Apart from the pure research activities that led to solid and good research output the team also concentrated on the development of two key laboratories which should prove to be beneficial for future research.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
Recommendations of the past could only be implemented to a moderate degree. Interaction with industries and technology transfer still is low, even though the team has established contacts with several companies. It was achieved to become more focussed and to strengthen interactions with postdoctoral fellows, PhD students and high-school students. Internationalisation of the research staff still is difficult.	
D2.4	**Success in receiving grants**
The team mainly relies on national grants and receives these on an average level. Due to a lack of industrial cooperations and large international collaborations, there is no corresponding financial influx.	
D2.5	**Adequacy of instrumental equipment**
The instrumental equipment is seen as sufficient and adequate. The developing of two new key laboratories during the last evaluation period certainly is a plus for future research activities.	
D2.6	**Effectiveness of management**
The small team appears as well-managed as it is able to perform fundamental research in a highly advanced research fields and on an international level.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
Since the establishment of the team in 2013 the team had some difficult times since at the beginning of the evaluation period 2015-2019 three out of eight team members retired. In 2016, the team was even reduced to its minimum size. This was counteracted by attracting post-doctoral fellows and PhD students, starting in 2017, thus leading to a substantial growth of the team.	

D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
The department employs an elaborate HR strategy which aims to attract qualified candidates from academia – this turned out to be successful in the recent past. Well-being and safety of the team members are an important part of the HR strategy as well.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N.A.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Cooperations with national universities exist on the basis of research collaborations and the supervision of PhD students. There are no significant cooperations with universities on an international level.	
D3.2	**Effectiveness of joint research centres**
The team did not participate in any research centre with universities during the evaluation period.	
D3.3	**Success rate in supervision of PhD students**
During the evaluation period, one PhD student successfully defended her/his thesis. It is recommended to improve this number and it appears that corresponding measures already are under way.	
D3.4	**Participation of PhD students in the outputs**
The participation of PhD students in scientific outputs just recently increased, due to a lack of PhD students during the first half of the evaluation period. The present PhD students are sufficiently involved in the research activities of the department.	
D3.5	**Participation of the team in master or bachelor studies**
During the evaluation period, 5 master theses could successfully be completed. Bachelor studies have not been conducted. In view of developing future PhD students, these numbers should possibly be improved.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Teaching activities on a university level are low. Each year, two lectures with a total of 3 hours, are delivered at the Charles University, being the only teaching activities. The team might consider to increase these activities in order to be more attractive to prospective young scientists.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team takes part in corresponding activities which are on a usual level, such as taking part in Open Door Days, in a Science Festival, in a Companies Day for Physics, or in the Open Science project of CAS. Apart from this there are no particular outreach activities.	
D4.2	**Publishing activities and its quality**
There are no specific publishing activities which aim towards popularisation of research.	
D4.3	**Participation in professional organisations in the area of research and development**
As mentioned above, it is mainly the team leader who participated in professional research organisations on a moderate level.	

Other comments of the commission:

4. Bioelectrodynamics

Strengths:
The team pursues highly innovative and rather unique research topics. It is effectively managed by an active team leader and there is a meaningful balance between fundamental research and proof-of-concept experiments. The research topics reach into several disciplines, the combination of which creates unique selling points.

Weaknesses:
The team needs more growth to maintain its variety of research directions, to push to real-life applications, and possibly to connect to industry.

Opportunities:
The innovative research of the team can be seen as a hot topic that is attractive enough to open up new doors, leading to more international projects and funding.

Threats:
The team still is small and it is not clear how long it will take until the fundamental and experimental research will lead to technologies that actually can be used in medicine.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Even though the selected outputs do not enter the highest quality group, most of the outputs reach the second quality group. The productivity of the team is very high and the outputs themselves are largely considered to be internationally excellent. The team can be considered as amongst those within CAS with the highest rankings.	
H1.2	**Contribution of workers on the outputs reached**
Most of the selected outputs of Phase I were conceived and written by team members themselves. The selected outputs consist of 7 articles, that is, a rather small number, such that the statistical value of this statement is limited.	
H1.3	**Quality of all outputs and results**
Among the total of 36 outputs, a fraction of one sixth reaches the first quartile in terms of journal ranking. Overall, what is remarkable is the fact that the outputs have been produced by a comparatively small team, leading to the above-mentioned high productivity.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
A main breakthrough was reached in 2019 when it was shown, guided by previous computational work, that intense nanosecond electric pulses can modulate the self-assembly of protein tubulin into nanoscopic cytoskeleton structures. This means that the excitation of biological matter by electromagnetic pulses might trigger complex biological structure building.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team did not participate in any large collaboration during the evaluation period.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The team has the vision to create gentler medical treatment methods and bio-nanotechnology by means of novel electromagnetic methods. This vision certainly is of societal relevance and in line with the mission of CAS and the institute.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
The research results obtained so far are promising and point into the direction of usefulness for societies. Aiming at more gentle medical treatment methods, such as applicable to cancer therapy, they connect to the area of social sciences and humanities.	
H2.3	**Relation to practice**
It is not yet clear how long it will take to turn the recent findings into actual practice. This is part of the vision which is intensely pursued by the team.	
H2.4	**Participation in AV21 strategy**
The team does not explicitly participate in the AV21 strategy.	
H2.5	**Cooperation with regions of the Czech Republic**
There is no substantial cooperation with regions of the Czech Republic	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
It is a remarkable and very positive characteristic that, despite of its small size, the team manages to do internationally recognized research in a rather special field, both on a fundamental and experimental level.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
National cooperations are mainly limited to neighbouring teams of CAS and two national university groups, leading to commonly published papers. On an international level, the team has been and still is involved in two COST networks, several bilateral collaborations and research visits. Other broad international cooperations, possibly leading to more international funding, have not been established, yet.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
It is mainly the team leader who is very active in several scientific communities and serving in different scientific positions, as is typical for a successful researcher. He has been invited to several conference talks and earned two awards and recognitions. The whole team took part in the organization of several workshops and seminars, mostly on a local level.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The planned research directions will continue the pursued vision of the team and will be heavily supported by a CZK 50 million grant that was obtained from the Czech Science Foundation framework EXPRO for excellent basic research for the years 2020-2024. This should be seen as a great success and certainly points into the right direction.	
D2.2	**Assessment of the previous research objectives and their achievement**
The previous research objectives have led to promising results, in particular in the fields of „Interaction of electromagnetic fields with biomatter“ and „Emission of electromagnetic fields (photons) from biomatter“. These findings made it possible to acquire the afore mentioned EXPRO grant.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The recommendations of the past evaluation could only partly be followed. Some progress has been made in view of internationalization of the research staff, as two former PhD students now work abroad and two international postdocs were part of the team for some time. An increase of research funding from international projects or industrial contracts could not be achieved. The latter type of contracts is not really pursued by the team as it intends to focus for the next years on fundamental research with its corresponding freedom.	
D2.4	**Success in receiving grants**
The team has been very successful in receiving the above mentioned national EXPRO grant which provides solid funding for the time period 2020-2024. Noticeable international funding has not been acquired, yet.	
D2.5	**Adequacy of instrumental equipment**
The team is very well-equipped with one RF-microwave laboratory, one Photonics laboratory, one Biolab, and one Chemistry lab.	
D2.6	**Effectiveness of management**
The small team is very well managed by its team leader, as can be seen from the high productivity of the team.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
As of December 2019, the team consisted of 5 team members, all below 40 years. There have been quite some fluctuations which made the team size vary between 5 to 8 during the evaluation period. That is, there has not been significant growth during the last years and it seems to be difficult for the team to develop and keep scientists.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team employs a rather involved HR policy which includes various aspects of personal training and development. Feedback loops to the team itself are employed as well.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N.A.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Cooperations with national and international universities are restricted to a reasonable number and reflect the small size of the team.	
D3.2	**Effectiveness of joint research centres**
During the evaluation period, the team did not participate in research centres with universities.	
D3.3	**Success rate in supervision of PhD students**
During the evaluation period, one supervised PhD thesis was successfully defended. This rate should be improved and already is improving, in particular since the research topics of the team appear as very suitable to be pursued by PhD students.	
D3.4	**Participation of PhD students in the outputs**
PhD students involved with the team frequently receive recognitions, fellowships and other prizes. They contribute to many papers, either as first author or co-author, thus supporting the research of the team.	
D3.5	**Participation of the team in master or bachelor studies**
There have been two master studies and no bachelor study during the evaluation period 2015-2019. This might be due to the small team size but it is recommended to improve these numbers.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Teaching activities at universities are very limited and restricted to single lectures or practical sessions in order to support Master's courses. If possible, this should be improved as well.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team is very good in marketing, taking advantage of social media channels such as Facebook and Twitter. More traditional media and events are used as well in order to popularise the research of the group.	
D4.2	**Publishing activities and its quality**
Popular publications are not mentioned and might not be in the focus of the team, as the more modern social media channels are used for communication.	
D4.3	**Participation in professional organisations in the area of research and development**
The team leader is actively involved in various professional research organizations, as can be expected from a successful scientist.	

Other comments of the commission:

The team has the vision to create gentler medical treatment methods and bio-nanotechnology by means of novel electromagnetic methods. It is a remarkable and very positive characteristic that, despite of its small size, the team manages to do internationally recognized research in a rather special field, both on a fundamental and experimental level.

5. Nano Optics

Strengths:
Excellent research in an emerging innovative and novel field.

Weaknesses:
Potentially not enough people for the ambitious aims to have a critical mass.

Opportunities:
Potential to be internationally leading for a prolonged time.

Threats:
Needs good management for the available infrastructure and personnel resources

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
This team was only established in 2016 and is currently still small and growing, mainly consisting of students. It is thus not surprising that the number of outputs is too small for any meaningful statistics, as the infrastructure of the team needed to be set up, and team members needed to be recruited during only the latter half of the evaluation period. The team nevertheless managed to publish a few papers, which appeared in leading top journals. The selected outputs can be categorised in the quality class between internationally recognised and internationally leading, considering the quality of the journals.	
H1.2	**Contribution of workers on the outputs reached**
The main outputs were solely contributed by the team.	
H1.3	**Quality of all outputs and results**
High quality outputs in excellent world leading journals.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The most valuable contributions to the field were the establishment of single protein tracking, as well as quantitative phase imaging at the nanoscale, which allows 3D image reconstruction with a resolution of about 5nm. The developments in microscopy at the nanoscale will be of outmost importance for understanding the physics and biophysics of processes in biology, and specifically in protein research at the single molecule level.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team is well established in international and national collaborations through the former research contacts of the team leader. Since the team is still somewhat in the phase of being established, it can be expected that these contacts will be fostered in the near future, together with cooperations between other teams at CAS. International collaborations are in place with respect to computer modelling and quantum optics.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The outputs of the team are highly relevant for society, as they drive fundamental research to new frontiers and at the same time contribute to an understanding of biophysical and biochemical processes which will have impact in the areas of medicine and quantitative biology.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
A system for effective knowledge transfer is in place and is being used to patent IP where appropriate.	
H2.3	**Relation to practice**
The development of super resolution microscopy is of great importance to future research in many areas of physics and biology, especially for protein structures and their dynamics. Equipment development which may be used for fundamental studies by the team will surely also find its way into practical application in biophysics and other branches of optics where ultra-high resolution is required.	
H2.4	**Participation in AV21 strategy**
This was not specifically discussed.	
H2.5	**Cooperation with regions of the Czech Republic**
As the team has just been set up, collaborations with other groups throughout the Czech Republic are currently in place and are further being developed.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
Again, the team has just been established half way through the evaluation period and is still in the process of infrastructure building. A comparison with internationally established centres is thus not yet appropriate. Nevertheless, indications are that this team really has potential to become one of the internationally leading teams in the field of Nano-optics.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
Quantity and quality of the international and national collaborations is already very good and encompass several groups in different countries, complementing the research done by the team, for example in the areas of numerical modelling and quantum optics. The commission encourages the team leadership to foster these and build on them in the future.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Given the very short time of existence of the team, the involvement and participation in the scientific community is very good through membership in committees and on Boards,	

invited lectures etc. Seeing how active this team already is with respect to public outreach and similar activities, one can rest confident that further involvement, for example through the organisation of conferences and workshops, will follow soon in the near future.

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The planned activities are in direct continuation and enhancement of the current activities of the team, which are very timely and highly promising. A very ambitious research plan was discussed for the next 5 years. We advise that the team leadership takes into consideration that this ambitious plan should not become overly ambitious given the relatively small size of the team, which in addition is largely inexperienced, because many of the researchers are PhD students and postdocs on time-limited contracts.	
D2.2	**Assessment of the previous research objectives and their achievement**
This does not apply here, as the team was only formed during the evaluation period.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
Ibid.	
D2.4	**Success in receiving grants**
The team is so far very successful in generating grant income and we hope that this will continue over the next evaluation period.	
D2.5	**Adequacy of instrumental equipment**
As the team was only very recently formed, the instrument infrastructure is modern and state-of-the-art.	
D2.6	**Effectiveness of management**
So far, the team has been very effectively managed. Nevertheless, we recommend that the management will give some thought towards the question of the „critical mass“ of the team, which currently consists to a large percentage of postdocs and PhD students (50%), who traditionally stay only for a limited amount of time.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
Having just been established during the evaluation period, the age structure of the team members is obviously not equally distributed among all ages, but the team is relatively young. This will change over the years, especially if a few more fully employed researchers can join the team. The development strategy of the team is certainly an issue which needs to be thought about over the next years, especially given the very ambitious research plans.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The gender balance of the team appears to be fine, but given the team size, this is of course statistics of small numbers, which often shows large fluctuations. Certainly one should keep an eye on this issue in the future, which we are sure is being done.	

D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
This seems to be fine and good plans are in place to enhance collaborations both internationally as well as nationally.	
D3.2	**Effectiveness of joint research centres**
The team has just been established, so this cannot really be answered at the present time.	
D3.3	**Success rate in supervision of PhD students**
Given the size of the overall team, the number of supervised PhD students (and postdocs) is absolutely fine. A success rate cannot be determined yet as the team was only recently established, and due to small number statistics.	
D3.4	**Participation of PhD students in the outputs**
PhD students are involved in the outputs as it should be.	
D3.5	**Participation of the team in master or bachelor studies**
The team hosts a larger than average number of bachelor and master students, which will eventually also be beneficial for the recruitment of PhD students.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
This does not seem to have been established yet, which is most likely due to the fact that the team is still to a certain extent in construction. For the future we would recommend that the team leadership seeks the possibility to lecture a course at one of the universities, also because this is generally an excellent tool for the recruitment of PhD students.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team is very much involved in outreach activities through open door days, public lectures, science fairs and the like. As this is becoming increasingly important, we would encourage to maintain these activities in the future. There have also been a number of interviews with the team leader, including radio and TV appearances.	
D4.2	**Publishing activities and its quality**
We are not aware of any publications relating to outreach activities, which also would not be expected from members of a Natural Science / Engineering team.	

D4.3	Participation in professional organisations in the area of research and development
Members of the team are very well involved in professional organisations.	

Other comments of the commission:

The team consists to a relatively large extent of postdocs and PhD students, which naturally implies a large fluctuation of expertise and knowledge. The team leadership is encouraged to take this into account when formulating the ambitious objectives, plans and aims for the next few years. We would like to mention that the commission was duly impressed with the research activities of this team, as well as the activities in general, given that the team was only established in 2016 and still has a quite small size.

Final report was elaborated by:

Commission 2 - Physical sciences
Evaluated teams No.: 1, 2, 5

Commission Chair: Prof. Martin Stutzmann
Commission Deputy Chair: Karol Flachbart
Commission Members:
- Wojtek Bock
- Ingo Dierking
- Niall English
- Stefano Forte
- Peter Grabmayr
- Sebastian Hoenig
- Thomas Kuehl
- Massimo Persic
- Juergen Reif
- Jochen Schieck
- Claus Schneider

Commission 7.1 - Engineering and technology
Evaluated teams No.: 3, 4

Commission Chair: Dr. János Lábár
Commission Deputy Chair: Jan Dusza
Commission Members:
- Tobias Bauer
- Frank Gronwald
- Stefan Haase
- Oliver Kastner
- Vladislav Musil
- Ryszard Pohorecki