Leibniz-Gemeinschaft

Der Senat

23. März 2015

Stellungnahme zum Leibniz-Institut für Plasmaforschung und Technologie e. V. (INP Greifswald)

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Vorbemerkung

Die Einrichtungen der Forschung und der wissenschaftlichen Infrastruktur, die sich in der Leibniz-Gemeinschaft zusammengeschlossen haben, werden von Bund und Ländern wegen ihrer überregionalen Bedeutung und eines gesamtstaatlichen wissenschaftspolitischen Interesses gemeinsam gefördert. Turnusmäßig, spätestens alle sieben Jahre, überprüfen Bund und Länder, ob die Voraussetzungen für die gemeinsame Förderung einer Leibniz-Einrichtung noch erfüllt sind.[1]

Die wesentliche Grundlage für die Überprüfung in der Gemeinsamen Wissenschaftskonferenz ist regelmäßig eine unabhängige Evaluierung durch den Senat der Leibniz-Gemeinschaft. Die Stellungnahmen des Senats bereitet der Senatsausschuss Evaluierung vor. Für die Bewertung einer Einrichtung setzt der Ausschuss Bewertungsgruppen mit unabhängigen, fachlich einschlägigen Sachverständigen ein.

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 3. und 4. Juni 2014 das Leibniz-Institut für Plasmaforschung und Technologie e. V. (INP Greifswald) in Greifswald. Ihr stand eine vom INP erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das INP nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 23. März 2015 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich den Beurteilungen und Empfehlungen der Bewertungsgruppe an.

Das Leibniz-Institut für Plasmaforschung und Technologie e.V. (INP Greifswald) betreibt anwendungsorientierte Grundlagenforschung auf dem Gebiet der Niedertemperaturplasmen und entwickelt plasmagestützte Verfahren und Produkte. Dabei schlägt das Institut den Bogen von der Modellierung und Simulation von Plasmen über die Diagnostik und Prozessanalyse in Plasmen bis hin zur Entwicklung von Prototypen für unterschiedliche Anwendungen im Bereich Materialien und Energie (Forschungsbereich A) sowie Umwelt und Gesundheit (Forschungsbereich B).

Seit der letzten Evaluierung hat sich das INP in seinen beiden Forschungsbereichen strategisch bemerkenswert gut weiterentwickelt. Im **Forschungsbereich „Plasmen für Materialien und Energie“**, in dem am INP überwiegend die klassischen Themen der Plasmaphysik und -technologie bearbeitet werden, hat das Institut klug auf sich verändernde Rahmenbedingungen reagiert und vorhandene Ressourcen von weniger erfolgsversprechenden Arbeiten zu Gunsten von Forschungen umgeschichtet, die sich mittlerweile als sehr erfolgreich erwiesen haben. Die Leistungen der vier Forschungsprogramen werden als „exzellent“, „sehr gut“, „gut bis sehr gut“ und „gut“ bewertet.

[1] Ausführungsvereinbarung zum GWK-Abkommen über die gemeinsame Förderung der Mitgliedseinrichtungen der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.

Darüber hinaus konnte das INP in dem **Forschungsbereich „Plasmen für Umwelt und Gesundheit“** seine plasmabiologischen und -medizinischen Forschungen ausgezeichnet weiterentwickeln. Diese thematische Ausweitung der Arbeiten wurde vom amtierenden Direktor bereits seit seinem Dienstantritt 2003 verfolgt und schon bei der letzten Evaluierung waren erste Ergebnisse zu erkennen. Inzwischen gehört das INP zu den weltweit führenden Instituten auf dem Gebiet der Plasmamedizin und -biologie. Es ist gelungen, in diesem neuen und im besten Sinne risikoreichen Arbeitsgebiet eine klare Vision zu formulieren. Überzeugend ist dabei nicht zuletzt, wie unterschiedliche fachliche Kenntnisse aus der Chemie, der Biochemie, der Biologie, der Medizin und der Pharmazie mit der Physik zusammengeführt werden. Das INP sollte künftig seine Kontakte zur Medizin weiter intensivieren und frühzeitig klinische Studien einbeziehen. Zudem sollten Kontakte zu Unternehmen in diesem Bereich aufgebaut werden, um für das hohe Anwendungspotential zu werben und frühzeitig industrielles Interesse zu wecken. Das Sitzland sowie die Universitäten Greifswald und Rostock sollten durch komplementäre Planungen z. B. im Bereich gemeinsamer Berufungen die Realisierung der Chancen unterstützen, die auf diesem zukunftsträchtigen Feld liegen. Die Leistungen der drei Forschungsprogramme werden als „exzellent“, „sehr gut bis exzellent“ und „sehr gut“ bewertet. Ein viertes Forschungsprogramm befindet sich derzeit noch im Aufbau.

Der Bund und das Land Mecklenburg-Vorpommern haben die Entwicklung der Plasmamedizin und -biologie durch umfangreiche Projektmaßnahmen maßgeblich unterstützt. Es war gut, zunächst im Rahmen zeitlich befristeter Förderungen die Tragfähigkeit der neuen Ansätze zu prüfen. Diese weitsichtigen Entscheidungen waren die Grundlage für die erfolgreichen Entwicklungen am INP. Nun müssen zügig Wege für eine dauerhafte Finanzierung durch zusätzliche Mittel der institutionellen Förderung gefunden werden.

Die Bundes- und Landesförderungen im Bereich der Plasmamedizin und -biologie trugen erheblich dazu bei, dass die **Drittmitteleinnahmen** des INP auf zuletzt 53 % des Gesamtbudgets gestiegen sind. Auch ohne diese Förderungen sind die Drittmitteleinnahmen wie bereits vor sieben Jahren hoch. Es ist erfreulich, dass das INP seit 2013 auch deutlich mehr Mittel von der DFG und der EU einnimmt. So wird z. B. drei Jahre lang das umfangreiche EU-Vorhaben „PlasmaShape“ am Institut gefördert.

Die **Publikationsleistung** konnte ebenfalls deutlich verbessert werden und ist insgesamt sehr gut. Wie im Bewertungsbericht näher ausgeführt, sollte das INP nun anstreben, bei der Veröffentlichung von Forschungsergebnissen die Auswahl der Zeitschriften noch strategischer und mit Blick auf die relevanten Zielgruppen anzugehen.

Durch seine intensive Zusammenarbeit mit Unternehmen leistet das INP in seinen klassischen Arbeitsfeldern einen bedeutenden **Wissens- und Technologietransfer**. Kooperiert wird dabei in der Regel im Rahmen von Forschungsvorhaben mit Industriebeteiligung bzw. mit einer Finanzierung durch ein Unternehmen. Häufig bilden dabei Patente des INP die Grundlage für die gemeinsamen Arbeiten, mit denen das INP auch zusätzliche Mittel generiert. Zudem sind seit 2005 insgesamt drei Ausgründungen aus dem INP hervorgegangen. Mit den dabei neu geschaffenen hochqualifizierten Arbeitsplätzen leistet das INP auch einen wichtigen Beitrag für die wirtschaftliche Entwicklung der strukturschwachen Region.

Das INP hat in den vergangenen Jahren die **Kooperation mit Hochschulen** weiter verstärkt. Neben der Universität Greifswald wird inzwischen insbesondere mit der Universität Rostock zusammengearbeitet. Während vor sieben Jahren lediglich der Direktor gemeinsam mit einer Hochschule berufen war, sind inzwischen eine weitere W3- sowie zwei W2-Positionen gemeinsam mit den Universitäten in Rostock und Greifswald besetzt worden. Auch mit der Fachhochschule Stralsund wird eng zusammengearbeitet. Es wird begrüßt, dass das INP weitere gemeinsame W2-Professuren vorsieht.

In Bezug auf den **Anteil der Wissenschaftlerinnen** ist die Situation am INP nach wie vor unbefriedigend. Unter dem leitenden Personal befindet sich keine Frau. Unter den 43 wissenschaftlichen Beschäftigten ohne Leitungsaufgaben sind lediglich acht Frauen, die alle befristet beschäftigt sind. Auf der Ebene der Promovierenden hat sich die Geschlechterrelation seit der letzten Evaluierung verbessert. Das Institut muss alles daran setzen, die Zahl von Wissenschaftlerinnen oberhalb der Doktorandenebene zu erhöhen.

Es wird begrüßt, dass die Zahl der **Promotionen** seit der letzten Evaluierung gestiegen ist. Allerdings sind die Möglichkeiten in der Nachwuchsförderung noch nicht ausgeschöpft. Zudem sollte das Institut die Rekrutierung von Promovierenden, aber auch vom übrigen wissenschaftlichen Personal, stärker internationalisieren.

Der Senat erwartet, dass die zwischen Bund und Ländern vereinbarten **Flexibilisierungen der Bewirtschaftungsgrundsätze** umgesetzt werden. Insbesondere ist die Verbindlichkeit des Stellenplans aufzuheben.

Auf der Basis seiner permanent weiterentwickelten technologischen Ausstattung bearbeitet das INP themenbezogene Forschungsfragen, die von der anwendungsorientierten Grundlagenforschung bis zur Prototypentwicklung reichen, wie es in dieser Form nicht an einer Hochschule geleistet werden kann. Eine Eingliederung in eine Hochschule wird daher nicht empfohlen. Das Institut hat sich in den vergangenen Jahren auf schlüssige Weise strategisch weiterentwickelt und erbringt überzeugende Leistungen. Das INP erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischem Interesse zu stellen sind.

2. Zur Stellungnahme des INP

Der Senat begrüßt, dass das INP beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das INP als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

5 May 2014

Annex A: Status Report

Leibniz Institute for Plasma Science and Technology (INP Greifswald)

Contents

1. Structure, Tasks and Institutional Environment

Development and Funding

The Leibniz Institute for Plasma Science and Technology e.V. (INP) in Greifswald is jointly funded by federal and *Länder* governments. The institute dates back to the Research Centre for Gas Discharge Physics established in 1946 and hosted by the Academy of Sciences of the GDR. Its history is closely connected with that of the Physical Institute of Greifswald University, where fundamentals of gas discharges, spectroscopy and theoretical plasma physics have been researched very early.

On 31 December 1991, the Institute was formally dissolved. Upon recommendation by the Science Council of the Federal Republic, it was re-founded on 1 January 1992 as the Institute for Low Temperature Plasma Physics as a member of the Blue List (later Leibniz Association). On 14 September 2007, INP was renamed to Leibniz Institute for Plasma Science and Technology e. V. in order to document the affiliation with the Leibniz Association and to better express the new strategy of INP.

Responsible department at federal level:

Federal Ministry of Education and Research (BMBF).

Responsible department at level of the *Land* Mecklenburg-Western Pomerania:

Ministry of Education, Science and Culture of Mecklenburg-Western Pomerania.

Legal form and organisation

The Leibniz Institute for Plasma Science and Technology e.V. (INP) is a non-profit organization which forms part of the Leibniz Association. The institutes of the Leibniz Association are independent scientific research facilities of supraregional importance and relevance for nationwide scientific policy interests.

The boards of the association (INP e.V.) are the General Assembly, the Board of Trustees, the Scientific Advisory Council and the Board of Directors (see appendix 1).

The General Assembly is the highest decision-making Body of INP. It elects the Board of Trustees, passes resolutions on amendments to the Articles of association, approves the report of the Board of Directors on the general position of INP.

The Board of Trustees is the supervisory body of INP and decides on all essential scientific, economic and organizational issues (see chapter 6). It consists of at least four and up to six members with voting rights. The Federal Government and the *Land* each delegate one member. Other members with voting rights are elected by the General Assembly, of which at least one represents a cooperating university and at least one represents industry. The Board of Directors of INP, the Chairperson of the Scientific Advisory Council and the Head of Administration at INP attend the meetings of the Board of Trustees in an advisory capacity.

The Scientific Advisory Council is comprised of at least six members who are not employees of INP. They are appointed by the Board of Trustees after consultation with the Chair-

person of the Board of Directors. The Scientific Advisory Council advises the Board of Trustees and the Board of Directors in all relevant scientific and organizational issues (see chapter 6).

The Board of Directors of INP consists of the Chairperson (Director) and at least one Deputy (at present there are two). The Chairperson of the Board of Directors runs INP and represents it in court and out of court in all matters related to INP.

Mission and tasks

According to its Articles of Association INP has the task of conducting application-oriented basic research, particularly in the field of low-temperature plasmas, and promoting their application. It also promotes the training and education of scientific and technical junior professionals in the field of low temperature plasma physics in cooperation with universities and industry.

Research structure

The institute is divided into two Research Divisions. The head of Division A (Plasmas for Materials and Energy) holds a joint professorship at the university of Rostock, the head of Division B (Plasmas for Environment and Health) is the director of INP and holds a joint professorship at the university of Greifswald (both remunerated on level W-3).

Each Research Division has four Research Programmes. Out of the 8 Research Programme heads two hold a joint professorship at a university: The head of Research Programme 6 (Plasma Medicine / Decontamination) holds a joint professorship at the University of Greifswald and the head of Research Programme 8 (Bioelectrics) holds a joint professorship at the University of Rostock (both remunerated on level W-2). Furthermore, the head of Research Programme 3 (Process Monitoring) holds an honorary professorship at the Stralsund University of Applied Sciences. In the long term, INP aims at setting up joint W2-professorships for all 8 Reasearch Programme heads. The Research Programmes are presented in detail in Chapter 3.

In the frame of the matrix organization of INP, the Scientific Departments form the basic organizational and personnel structure and ensure the long-term development of expertise at INP. The main working areas of the Scientific Departments in the Research Programmes are indicated in the scheme of the matrix structure in Appendix 1 at the bottom.

National and international scientific environment

Low-temperature plasmas are being studied at various universities, technical universities and universities of applied sciences in Germany. In the non-university sector, low-temperature plasma research is done to an appreciable extent at a number of Fraunhofer Institutes and the Leibniz Institute for Surface Technology (IOM) in Leipzig.

Of all these institutions INP views in the field of applied research the Fraunhofer Institute for Surface Engineering and Thin Films in Brunswick (IST) and the Fraunhofer Institute for Electron Beam and Plasma Technology in Dresden (FEP) as well as, in the field of fundamental research, the Ruhr University of Bochum (RUB), together with INP, to be the leading institutions in Germany.

With regard to INP's field of activity, internationally leading institutions are the Eindhoven University of Technology (Netherlands), the Laboratory on Plasma and Conversion of Energy (France), the Plasma Science Center at the University of Michigan (USA), the Loughborough University in Leicestershire (UK), the Nagoya University (Japan) and the St. Petersburg State University (Russia).

In recent years, interdisciplinary research extending the scope of plasmas has been globally intensified. For INP, cooperation between plasma physicists and physicians / biologists in new areas such as plasma medicine is of particular importance. Here the immediate environment includes nationally the University Medical Center Göttingen, the Charité-Universitätsmedizin Berlin, the University Hospital Munich-Schwabing, the Faculty of Medicine at the University of Jena, the University of Rostock, and the University Medicine Greifswald. In this context internationally to be mentioned are Drexel University in Philadelphia and Old Dominion University in Norfolk (both USA), GREMI Université d'Orléans (France), Université de Montreal (Canada), ETH Zurich (Switzerland) and Università degli Studi di Bari (Italy). The collaborations of INP are described in chapter 4.

National interest and justification for funding as a non-university institution

The Agenda Photonics 2020 of the German Federal Ministry of Education and Research from 2010 mentions the importance of plasma technology for the future of Germany in the photonics industry. Also, in 2011 an Expert Group of the European Commission identified plasma technology as essential for all key enabling technologies. Among the technology-oriented public and industrial research institutions working on low-temperature plasmas, INP sees itself in a unique position. With its wide range of research, the Institute reflects the important aspect of plasma technology as a cross-sectional technology. INP sees itself as an important cooperation partner and service provider particularly for research institutions and companies.

INP performs its tasks as an institution outside the university because application-oriented fundamental research in the field of low-temperature plasmas requires that scientists interact smoothly and highly efficiently with the wide range of plasma technology users, including many small and medium-sized enterprises. Especially in cooperation projects with industry, problems often need to be addressed at short notice without training time or the extensive reconstruction of measuring devices. The non-university research allows INP to bundle knowledge and skills by maintaining a significant permanent staff and form teams for successful project handling within a short time. As an institution with an independent management including judicature, INP is capable of quick and customized contract design, also allowing short term initiation and flexible participation in structures and collaborative projects. By having this procedure, and with its specialized range of topics, INP operates in complementary fashion to universities.

2. General concept and profile

Development of the institution since the last evaluation

Since the last evaluation in 2007 INP achieved a substantial increase in third-party funding, especially from the Federal Ministry of Education and Research (BMBF), connected with a substantial growth of the Institute. At the time of the last evaluation in 2007, the Institute comprised five Research Programmes, supplemented by five Scientific Departments. Since then two new Scientific Departments have been established ("Plasma Bioengineering" and "Plasma Sources") and the structure of the Research Divisions and Programmes and thus the strategic orientation of the Institute were adjusted.

A new and now major direction of the Institute's work has been opened up from the old Research Programme "New Fields". It was intended to clarify the potential of new ideas and has resulted in the emergence of the new Research Division "Plasmas for Environment and Health". Today, this Research Division takes in almost 50 % of the Institute's public funds and third-party funds. This development was essentially driven by successful fund-raising for the joint projects "Campus Plasma Med I" and "Campus Plasma Med II" as well as the Centre for innovation competence (ZIK) plasmatis, coordinated by INP and funded by the BMBF. In the frame of these projects INP received a funding of roughly 20 M€ (see below for details). For the head of the Research Programme 6 (Plasma Medicine / Decontamination) a professorship for plasma medicine was set up at Greifswald University in 2011.

Furthermore, the former Research Programme "New Fields" provided the bases for two new subjects in the fields of electric power engineering and bioelectrics. In 2011, these two new topics were associated with joint professorships at Rostock University, one professorship of High-voltage and high current technologies (head of Research Division A) and a professorship of Bioelectrics (head of Research Programme 8).

In 2012 two qualified junior scientists became the heads of the Research Programmes 4 and 5 as part of INP's internal leadership career programme.

Results

All projects at INP are focused on results that culminate either in a publication or in a patent or prototype. Exceptions to this are projects with industry partners under special confidentiality conditions. Based on its research activities, INP offers scientific services and consultancy. INP also hosts conferences and informs the general public about its activities.

Publications

INP's publication concept provides that research results with reasonable value in terms of their novelty are to be published systematically and rapidly. In the selection of the journals for publications INP is geared primarily to the goal of optimally reaching the respective group of users of the research results and thus to increase the citation frequency. Journal indicators such as the impact factor are used only as a secondary guide. Since 2011 INP has annually published more than 80 articles in peer-reviewed journals (excluding conference proceedings and collective editions, see appendix 2 for an overview).

Knowledge and technology transfer

INP carries out a significant portion of its knowledge and technology transfer through direct cooperation with companies. The third-party funds from direct research contracts with businesses amount to an average of 767 K€ per year for the past three years (see appendix 3).

A majority of the Institute's externally funded projects are joint projects with industrial participation funded by the German Federal Ministry of Education and Research (BMBF) or the German Federal Ministry of Economic Affairs and Energy (BMWi). A significant amount of knowledge transfer takes place via the direct participation of project-related committees in which primarily small and medium-sized German companies are represented. In these projects, the Institute participates in the development of established fields of application.

INP's patent strategy focuses on the long-term benefits and the safeguarding of chances for commercial exploitation rather than on the number of patents held. The institute strives for submission of two patents per Research Division and year. INP holds patents in particular on atmospheric pressure plasma sources for surface modification and plasma medicine, for plasma processes of exhaust air cleaning and decontamination, and for diagnostics and control systems for plasma processes. On this basis, a number of license agreements have been concluded with INP spin-offs (see below) and other companies. In the years 2011 to 2013, license revenues amounting to 23 K€ were obtained from such agreements. In the same period 9 patents and 6 exploitation rights have been granted (see appendix 2 and 3).

INP exploits its research results through its spin-off concept. In 2005 the technology company neoplas GmbH was founded as the transfer centre of INP. The Institute is the 100 % shareholder of the GmbH. Neoplas GmbH deals with the qualification of research-based knowledge and scientific results for industrial applications. Two other spin-offs of INP, neoplas control GmbH and neoplas tools GmbH, were founded with the participation of neoplas GmbH in 2006 in 2009, respectively. The neoplas control GmbH specializes on the production and global marketing of the various products of quantum cascade laser measurement and control systems. The neoplas tools GmbH deals with the development, production and distribution of plasma sources for use in the medical field.

Altogether, 17 jobs (12.66 full time equivalents) have been created by the three companies. The Institute considers the foundation of the spin-offs to be one of the most important measures to develop the environment of the Institute in the long-term. The developments in the field of plasma medicine led to considerations to push another spin-off in this area.

For the future, a new plasma technology centre in the vicinity of the institute is planned by INP, the Western Pomerania Technology Centre and the Greifswald Biotechnical Department. The centre shall support innovations and transfer of new ideas together with an intensification of the regional cooperation.

Scientific services and infrastructure tasks

INP uses its specific competencies and its equipment and facilities to provide scientific services for its target groups. Customers and users are primarily companies and research institutions working with plasmas. Examples of services include the production of plasma source prototypes and coating samples for research purposes, simulation of plasma proc-

esses and the offer to use application laboratories with plasma technology equipment. In addition, INP offers plasma and surface diagnostics which can partly also be used on mobile platforms. Services are provided under contracts or subcontracts in projects, which are handled mainly via the neoplas GmbH (see above). From service contracts excluding research projects with industry, INP generated an average of 25 K€ per year (see appendix 3).

Scientific consultancy

INP directs its consulting services primarily at companies and business associations as well as at representatives of federal and *Länder* institutions and funding agencies. E. g. the director is a member of the "Optical Technologies" Programme Committee, which advises the German Federal Ministry of Education and Research.

INP also provides consulting services as part of its participation in international bodies. E. g. the director is chairman of the competence network BalticNet-PlasmaTec, as well as past president of the International Society for Plasma Medicine. INP's staff provides expert reviews for a variety of scientific journals as well as recommendations for funding agencies like the German Research Foundation (DFG) or the National Science Foundation (USA).

Conferences held at the institution

INP has hosted numerous national and international scientific events. In particular, INP successfully applied for the organization of the 18th International Conference on Gas Discharges and their Applications in 2010 (178 participants from 29 countries) and the 22nd Europhysics Conference on Atomic and Molecular Physics of Ionised Gases in 2014. INP employees are regularly involved in the conception and organization of international symposia and conferences. From 2011 to 2013 INP staff was invited to a total of 65 lectures at international conferences.

Public relations

The coordination and supervision of the media and publicity work is handled by INP's marketing group. The general public is informed about INP's activities via own press releases, annual reports and INP's homepage. In the context of public events, in the last 4 years approximately 4,500 people have visited INP.

Strategic work planning for the next few years

INP's future work is built on the Institute's particular characteristics, which include:

- the unique combination of plasma science with biology and medicine, both as a subject of fundamental research and with regard to application;
- the consistent combination of plasma modelling and spatially and temporally resolved diagnostics with application-oriented electric power engineering (e. g. arcs), supplemented by modern experimental laboratories;
- the extension of the range of issues in plasma science to the field of bioelectrics (pulsed electric fields) with atmospheric pressure plasmas.

In 2011, each of these potential unique features was, in cooperation with the Universities of Greifswald and Rostock, strategically linked with a professorship and successfully filled.

For the future, the appointment of a W2 professorship for surface engineering is planned together with the University of Rostock (Department of Mathematics and Natural Sciences, Field of Physics). Furthermore, INP and the Medical Department at the University of Rostock have set up a non-permanent W2 Leibniz professorship for the field of plasma bioengineering. 50 % of the position will be funded by INP and 50 % by the University, with both institutions sharing about 50 % of the work.

INP's strategic goal is to become the leading centre of excellence in Germany with respect to fundamental and applied research in selected core areas of plasma research. In the next years, INP focuses on three scientific approaches:

- In terms of gaining knowledge into the fundamentals of plasma physics, INP plans to intensify research on surface reactions on different time scales, which have a significant influence on the expression and volume chemistry of atmospheric plasmas.
- Methodically, INP will further intensify the coupling of powerful diagnostics with physical-chemical modelling and the simulation of plasma processes, especially involving the processes on surfaces and in the adjacent media.
- In the technical-technological field, INP focuses on the development of non-thermal atmospheric pressure plasma sources and systems.

Both divisions of INP will pursue a further concentration on scientific core topics, together with the development of new fields. In Research Division A, the three aforementioned approaches are applied to the issues of energy and production technology, in particular for the generation of catalytic materials using plasma processes, surface modification and coating utilizing low and atmospheric pressure plasmas and the interaction of arcs with materials in welding and switching processes. In Research Division B, a major goal is the growth of the topic of plasma medicine and decontamination and to expand upon the international leadership in this area. Research on atmospheric pressure plasma sources acts as the connecting item to the further topics of pollutant degradation, generation of bioactive surfaces and the use of short electrical pulses in medicine and environmental applications.

Appropriateness of facilities, equipment and staffing

Core funding and third party funding

In 2013, the core funding of INP was 7.5 M€ excluding specific startup funds (*Sondertatbestände*). In the frame of such *Sondertatbestände* 2.0 M€ in 2012 and 2.3 M€ in 2013 have been invested by the Institute for building up laboratories with high-voltage and high-current equipment along with the filling of new professorships (see below). This led to a total institutional funding of 9.8 M€ in 2013 (see appendix 3).

Since the last evaluation, the third-party funding has been increased from 3.0 M€ (in 2007) up to 10 M€ (in 2013). In 2013 INP was able to increase the funding from the German Research Foundation (DFG) to 832 K€ and from the EU to 1.9 M€. Averaged over the last three years the DFG-funding is 520 K€ and the EU-funding 710 K€ per year.

A special role is played by the substantial third-party funding from the Federal Ministry of Education and Research (BMBF). Here, especially the joint initiatives of the research clus-

ter "Campus PlasmaMed" and the centre for innovation competence (ZIK) plasmatis are to be mentioned. For PlasmaMed INP received a funding of 5.5 M€ in the period from 2009 to 2012, while the funding of all cooperation partners totalled 13.5 M€. ZIK plasmatis is funded for the period from 2009 to 2015 with 15 M€ in total. It consists of two scientifically independent junior research groups, which study the impact of physical plasmas on the extracellular physiological milieu of cells and the corresponding processes in the cells, respectively. (see Research Programme 6).

Funds for staff

The staff costs of about 8.2 M€ in 2013 have been compensated by 3.8 M€ from core funding and by 4.4 M€ from third-party funding. In relation to the Institute's objectives, INP views its stuffing funded by the core budget as tight. The availability of core-funded positions for scientists and technicians is rather low, the institute argues. Since the founding of the Institute, there has been only a single increase in the number of scientific positions, from 21 to 22. The number of employees has nearly tripled in this time. INP points out that the continued successful implementation of its strategy requires an increase in the number of senior positions, a strengthening of the technical engineering expertise as well as permanent management support in the form of assistances including legal and marketing expertise to fulfill increasing demands on the professional appearance and presentation of the Institute.

Technical equipment

In the last years various microbiological laboratories of biosafety level S2 were built, whose equipment allows for the full scopes of microbiological analyses. With the appointment of the second W3 professorship (head of Division A), laboratories with high-voltage and high-current equipment have been established. Along with the filling of the W2 professorship for bioelectrics (head of Research Programme 8), a laboratory for the generation of ultra-short high-voltage pulses, high field strengths and pulsed plasmas were built. Regarding the available scientific instruments, systems and measurement technology, INP has generally a good base for handling its upcoming tasks adequately.

However, in view of INP this level cannot be maintained with the current funding. By means of investments, particularly via *Sondertatbestände*, the Institute was able to upgrade its equipment to the required state of the art in recent years. Over the next few years, however, additional funds will be required for the replacement of equipment depreciated long ago. According to INP *Sondertatbestände* will no longer be approved in future years due to a decision of the *Land*. In view of INP it will then not be possible to maintain the current equipment status with the investment funds available from the core funding.

Information technology

INP's IT concept is based on the principle of operating as few as possible central but efficient software structures for communication, management and administration. All relevant data from the scientific units and administrative departments have been centrally stored and backed up. About 300 personal computers are in use at the Institute and linked via various servers. In addition, the plasma modelling group uses a high-performance computing cluster with 10 nodes and about 100 cores.

Facilities

INP's building was extended to include an annex mainly for interdisciplinary work and for the ZIK plasmatis. With a current average of 170 employees, INP sees itself very near to its capacity limits. This applies both to the necessary laboratory space as well as office rooms.

3. Subdivisions of INP

Research Division A: Plasmas for Materials and Energy

Research Division A deals with established industrial applications and combination of surface technology and electrical engineering. It addresses subjects involving the production of functional surfaces, thin films and catalytic materials using plasma processes accompanied by diagnostic techniques for process monitoring, as well as topics in electric power engineering and process technology, particularly in the field of arc discharges.

Research Programme 1: Surfaces/Thin Films

(7 full-time equivalents [FTE] in research and scientific services, 0.7 FTE doctoral candidates, 4.3 FTE service staff)

The Research Programme is devoted to plasma-chemical modification of surfaces and plasma-assisted deposition of thin films. Since 2007 the focus of the Research Programme has been on studying plasmas for the production of functional thin films for optical, mechanical and chemical applications, with the goal of controlling the inner nanostructure of the thin films. As a long-term key subject plasma-based production of dense, compact thin films with a variable chemical structure under atmospheric pressure conditions, as corrosion protection or barrier coatings has been identified. In 2010 the scope of research was extended to film deposition by ion-assisted deposition processes for high-precision optical coatings. Here, research has been focused on active process control based on the plasma-physical characterization of the deposition process.

Between 2011 and 2013, the Research Programme published 43 articles, 19 of which in collaboration with other Research Programmes of INP. 27 articles were published in peer-reviewed journals. Furthermore, 4 persons finished their PhD successfully.

In the same period, revenue from project funding grants totalled 1.2 M€, 530 K€ of which were spent from grants from the Federal or *Länder* governments, 370 K€ from the German Science Foundation (DFG) and 270 K€ from Industry.

Research Programme 2: Catalytic Materials

(4.7 FTE in research and scientific services, 1 FTE doctoral candidates, 1.9 FTE service staff)

The Research Programme is focused on the plasma-based change in the properties of materials. At the beginning of the evaluation period the research was addressed intensively to the surface treatment of powdery micro- and nanoscale substances for the development of polymer and metallic composite materials and fuel cell catalysts. As part of the strategic shift to catalytically active materials, the collaboration with other research institutes of chemistry and energy was extensively expanded. In the last four years, further potential

use in the area of renewable energies has also been tapped. A central scientific issue is to realize the non-destructive binding of molecule complexes on surfaces for the generation of electrochemical-functional coatings. For the deposition of nano structured functional thin films a new process technology approach for solar applications has been developed.

Between 2011 and 2013, the Research Programme published 40 articles, 9 of which in collaboration with other Research Programmes of INP. 29 articles were published in peer-reviewed journals. Furthermore, 2 persons finished their PhD successfully.

In the same period, revenue from project funding grants totalled 1.2 M€, 1 M€ of which were spent from grants from the Federal or *Länder* governments and 160 K€ from the German Science Foundation (DFG).

Research Programme 3: Process Monitoring

(5 FTE in research and scientific services, 1 FTE doctoral candidates, 4 FTE service staff)

For many years, the Research Programme has been focused on a plasma-diagnostic approach for the time-dependent monitoring of the densities of a great number of plasma-chemically and technologically relevant species. In recent years, the established multi-component detection ability has been complemented by providing a time resolution considering the time scales of transient or pulsed plasmas. On the basis of this general objective, methods of absorption spectroscopy, primarily in the infrared spectral range, have been developed systematically. Taking advantage of new classes of infrared lasers, high-performing compact spectrometers of the Q-MACS family have been designed. The potential of environmentally friendly plasma technologies for new applications was also a focus of this Research Programme and has been strengthened since 2009. The research was mainly dedicated to reaction mechanisms of molecular plasma components in chemically active molecular non-equilibrium plasmas that are used for pollutant degradation such as those from volatile organic compounds (VOCs) and aerosols.

Between 2011 and 2013, the Research Programme published 44 articles, 4 of which in collaboration with other Research Programmes of INP. 27 articles were published in peer-reviewed journals. Furthermore, 2 persons finished their PhD successfully.

In the same period, revenue from project funding grants totalled 2.1 M€, 1.3 M€ of which were spent from grants from the Federal or *Länder* governments, 380 K€ from the German Science Foundation (DFG) and 380 K€ from Industry.

Research Programme 4: Welding/Switching

(8.9 FTE in research and scientific services, 1.3 FTE doctoral candidates, 3 FTE service staff)

INP has pursued fundamental and applied research in the field of arcs and thermal plasmas for applications since 2005. INP developed expertise in computational fluid dynamic (CFD) and magneto-hydrodynamic (MHD) simulations of thermal plasmas. In recent years, the increasing importance of LEDs as lighting sources has led to a significant decline in research contracts in the field of plasma lamp research. Therefore, resources and expertise from the studies on high-pressure lamps were used to intensify research in the fields of welding and switching arcs over the last four years. Diagnostic investigations have been

performed for welding arcs, in particular with spatially resolved emission spectroscopy, which focused on the gas metal arc welding of steel. In addition, studies on laser-assisted plasma welding and model experiments with tungsten inert gas processes were carried out. Research on arcs in switchgear technology was primarily focused on emission spectroscopic studies of model experiments and on the development of models based on the experiment results and selected arc simulations in cooperation with research institutions and companies. A recent measure with the highest priority is the development of an independent experimental basis for studies of switching arcs, particularly in the area of high currents (arc research laboratory), which was begun in 2013.

Between 2011 and 2013, the Research Programme published 88 articles, 4 of which in collaboration with other Research Programmes of INP. 43 articles were published in peer-reviewed journals. Furthermore, 1 person finished his PhD successfully.

In the same period, revenue from project funding grants totalled 1.9 M€, 1 M€ of which were spent from grants from Industry, 480 K€ from the Federal or *Länder* governments and 390 K€ from the German Science Foundation (DFG).

Research Division B: Plasmas for Environment and Health

Research Division B deals with non-thermal atmospheric pressure plasma sources as well as new scientific issues and applications in the fields of environmental technologies, biology and medicine. The Division is characterized by a high degree of interdisciplinarity. The atmospheric pressure plasma sources (dielectric barrier discharge, jet, microwave, micro-plasmas, etc.) present an essential link in the Research Division.

Research Programme 5: Bioactive Surfaces

(2 FTE in research and scientific services, 1.2 FTE service staff)

The Research Programme is dedicated to use plasmas for product surfaces that are intended for medical or biological applications. A part of the work is highly application-oriented and is specified by the requirements of different manufacturers. At the beginning of the work in the Research Programme, issues such as antimicrobial and cell adhesive surfaces of implants took priority. Currently, the work primarily addresses the finishing of infusion systems, cell chips or cell culture dishes, and of quick point-of-care allergy tests. The goal is to obtain research results on application-oriented health- and environment-related topics and to transfer the findings to applications that are relevant in practice. The high interdisciplinarity in the Research Programme means that very close collaborations with other Research Programmes are indispensable. This exemplary collaboration can be seen in the framework of the joint research cluster “Campus PlasmaMed”, which was administratively assigned to the Research Programme 6. Here the Research Programme “Bioactive Surfaces” attended to its own sub-projects. Two Scientists and one Technician working on these projects have therefore been assigned to the Research Programme 6.

Between 2011 and 2013, the Research Programme published 43 articles, 21 of which in collaboration with other Research Programmes of INP. 28 articles were published in peer-reviewed journals. Furthermore, 1 person finished his PhD successfully.

In the same period, revenue from project funding grants totalled 1.1 M€, 800 K€ of which were spent from grants from the Federal or *Länder* governments and 270 K€ from Industry.

Research Programme 6: Plasma Medicine/Decontamination

(9.5 FTE in research and scientific services, 2.8 FTE doctoral candidates, 8.8 FTE service staff)

The work in the Research Programme was supported to a considerable extent by the research cluster "Campus PlasmaMed" and the centre for innovation competence (ZIK) plasmatis, funded by the German Federal Ministry of Education and Research (BMBF). Especially, there are two independent junior research groups of ZIK plasmatis, which work on the field of plasma medicine (see below).

The Research Programme was established in 2008 as a result from a strategic development. It emerged from the former Research Programme "New Fields". The Research Programme addresses direct therapeutic applications of physical plasmas on or in the human (or animal) body. The strategic and close involvement of clinical partners allows and ensures a very pronounced correlation of research with application. The work includes fundamental research to clarify the mechanisms of biological plasma effects as well as application-oriented research to identify possible areas of use in medical practice. A further focus of the Research Programme is set on the field of plasma decontamination. Up to now, the integration of plasma processes in applications such as sterilization, decontamination and treatment processes has been implemented partially and will continue to be pursued intensely. Since 2009, the Research Programme has increasingly concentrated on food related topics and critical issues from a hygienic point of view.

Between 2011 and 2013, the Research Programme published 103 articles, 33 of which in collaboration with other Research Programmes of INP. 77 articles were published in peer-reviewed journals. Furthermore, 1 person finished his PhD successfully.

In the same period, revenue from project funding grants totalled 3.4 M€, 3.3 of which were spent from grants from the Federal or *Länder* governments.

ZIK plasmatis junior research group "Cellular Effects"

(4 FTE in research and scientific services, 1.9 FTE doctoral candidates, 1 FTE service staff)

Funded for the period from 2009 to 2014, the group examines the influence of physical plasmas on cellular activities. Between 2011 and 2013, the Junior Research Group published 18 articles, 11 of which in collaboration with other Research Programmes of INP. 16 articles were published in peer-reviewed journals.

ZIK plasmatis junior research group "Extracellular Effects"

(3 FTE in research and scientific services, 2.7 FTE doctoral candidates)

Funded for the period from 2010 to 2015, the group examined plasmas as well as liquids (physiological liquids and extracellular matrix as well as buffer solutions) with state of the art optical diagnostic techniques. Between 2011 and 2013, the Junior Research Group

published 25 articles, 16 of which in collaboration with other Research Programmes of INP. 21 articles were published in peer-reviewed journals.

Research Programme 7: Pollutant Degradation

(7.5 FTE in research and scientific services, 0.7 FTE doctoral candidates, 1 FTE service staff)

The Research Programme deals with chemical decontamination of process gases and exhaust air by means of plasma-based methods. The primary focus lies on the conversion or degradation of contaminants. Additionally, the existing mechanisms of interaction of plasma species with contaminants open up the possibility for its detection in lower concentrations (speciation analysis). The work in the Research Programme includes a wide range of environmental and health-related tasks, such as gas treatment (e. g. marine diesel exhaust), the degradation of volatile organic compounds, odours and aerosols, as well as novel plasma sources for sensitive species analysis. Connected with this is the development of atmospheric pressure plasma sources that can effectively treat large gas streams. The fundamental research is focused on the investigation of filamentary plasmas and their plasma-chemical effects. Therefore, the Research Programme established diagnostic methods with high time and spatial resolution as well as specific models of the particle kinetics and plasma chemistry.

Between 2011 and 2013, the Research Programme published 69 articles, 16 of which in collaboration with other Research Programmes of INP. 34 articles were published in peer-reviewed journals. Furthermore, 1 person finished his PhD successfully.

In the same period, revenue from project funding grants totalled 1.7 M€, 840 K€ of which were spent from grants from the Federal or *Länder* governments and 370 K€ from the EU, 260 K€ from Industry and 250 K€ from the German Science Foundation (DFG).

Research Programme 8: Bioelectrics

(2 FTE in research and scientific services, 1.5 FTE doctoral candidates)

The development of this Research Programme began with the appointment of the position of a Professor for Bioelectrics (together with the University of Rostock) in September 2011. Programme topics are the manipulation of living cells and their environments by pulsed electric fields and by pulsed discharges. The latter approach offers new opportunities for INP to generate non-thermal plasmas in air and water. The application driven objective of this technology is the degradation of chemical compounds and decontamination of water. Biophysical phenomena are the focus of fundamental studies on the interaction of pulsed electric fields with cells. Findings advance the understanding of respective tumor therapies and the development of effective methods for microbial inactivation in liquids and on tissues. Accordingly, there is considerable potential overlap with other Research Programmes and Scientific Departments at INP, which allows synergies to be developed and to be exploited.

Between 2011 and 2013, the Research Programme published 14 articles, none of which in collaboration with other Research Programmes of INP. 8 articles were published in peer-reviewed journals. Furthermore, 1 person finished his PhD successfully.

Until 2013 there has been no revenue from project funding grants.

4. Collaboration and networking

Collaboration with domestic universities

The director of INP works under a joint appointment at the Ernst Moritz Arndt University of Greifswald. Furthermore, a professorship for plasma medicine was set up for the head of Research Programme 6 at Greifswald University in 2011. The supervision of dissertations, master and bachelor theses by students at Greifswald University is complemented by two lecturers employed at INP.

Noteworthy is the long-standing partnership between INP and the Institute for Physics at Greifswald University in the framework of the Collaborative Research Centre (*Sonderforschungsbereich*) Transregio 24 "Fundamentals of Complex Plasmas", together with the Christian Albrechts University of Kiel since July 2005. INP is involved with four subprojects in its third funding period from 2013 to 2017.

In addition INP has strengthened the relationships to other fields at Greifswald University, including medicine, pharmacy and mathematics. Here, reference is made in particular to the joint initiatives of the research cluster "Campus PlasmaMed" and the centre for innovation competence (ZIK) plasmatis (see also Research Programme 6). In the frame of the joint projects INP was able to develop cooperations with the University of Greifswald, the University of Rostock, Charité – Universitätsmedizin Berlin, the University of Applied Science of Stralsund and of Neubrandenburg and further partners from industry.

INP expanded its cooperation with the University of Rostock. In 2011 there were two joint appointments at the University of Rostock: a professorship for high-voltage and high-current engineering at the Department of Computer Science and Electrical Engineering (head of Research Division A) as well as a professorship for bioelectrics in the field of applied physics in the Department of Mathematics and Natural Sciences (head of Research Programme 8). The establishment of a lecture series on plasma technology at Rostock University is planned.

Also, there are long-term interdisciplinary research partnerships with scientific departments in biomedicine and the Center for Life Science Automation (CELISCA) at Rostock University. Furthermore, the Innovative Regional Growth Core "Centifluidic Technologies" (2012 - 2014) funded by the BMBF has to be mentioned, in which INP cooperates with scientific departments at the Universities of Greifswald and Rostock.

At the Stralsund University of Applied Sciences, a plasma technology module was established in the master's degree programme for electrical engineering in 2005, with an honorary professorship created for a researcher of INP (head of Research Programme 3). The cooperation with the Stralsund University contributes to the maintenance of the engineering expertise necessary for INP's activities. In addition, Stralsund University is also involved in the research cluster "Campus PlasmaMed".

In addition to the already mentioned cooperation with the Christian Albrechts University of Kiel INP emphasizes the relationships to the Ruhr University Bochum, the Rhine-

Westphalia Technical University of Aachen, the Dresden University of Technology, the Technical University of Berlin, and the Institute for Interfacial Process Engineering and Plasma Technology at the University of Stuttgart.

Collaboration with other domestic institutions

The collaboration with non-university research institutes in Germany includes institutions in the Leibniz Association such as the Leibniz Institute for Catalysis at the University of Rostock, the Leibniz Institute for Crystal Growth, the Leibniz Institute of Freshwater Ecology and Inland Fisheries, the Ferdinand Braun Institute, Leibniz Institute for High Frequency Technology (all in Berlin), as well as the Leibniz Institute for Agricultural Engineering (Potsdam-Bornim).

There exist also collaborations with several institutes of the Fraunhofer Society as well as with the Helmholtz Centres in Geesthacht and in Berlin and with the Max Planck Institute for Plasma Physics (Greifswald branch).

Other national networks

INP is continuously involved in a variety of national research projects that are funded by the federal government. In addition to Campus PlasmaMed and ZIK plasmatis (see above) INP coordinated the cooperation project “PT Grid – Plasma Technology Grid” (funded by the BMBF) and the cluster “Arc Welding”, funded by the German Research Foundation – Alliance for Industrial Research (DFG AiF).

Since 2005, INP has been a member in the INPLAS network, an alliance of industry and research for the purpose of promoting the use and development of industrial plasma surface technology.

In June 2013, the National Centre for Plasma Medicine was founded at the initiative of INP. This Germany-wide network of all research groups in the field of plasma medicine unites companies, research institutes and universities in the fields of medicine, biology, pharmacy, physics and engineering. The association is to promote the purpose, research and development of plasma medicine throughout Germany.

Collaborations with international institutions

There are guest professorships for INP-scientists at Old Dominion University, Norfolk, New York University (both USA) and St. Petersburg State Polytechnical University (Russia) as well as an honorary professorship at the St. Petersburg State University (Russia). There are also agreements that relate to the joint training of doctoral students and other qualification work. A co-operation with the Masaryk University of Brno and the Technical University of Prague in the Czech Republic includes a joint training agreement, guest lectures and internships for junior scientists. Other international co-operations exist with the University Paul Sabatier and the Palaiseau Polytechnical University in France, Cambridge University in the UK and Eindhoven Technical University in the Netherlands. 58 % of INP’s peer-reviewed publications in the years 2010 to 2012 were published together with international partners.

In the years 2011 to 2013, a total of 102 scientists visited INP. About half of the visitors

came from Europe, and one-third from non-European countries. The number of guest stays by members of the Institute at other institutions amounts to 36. They took place at international institutions, with an equal number at European and non-European institutions.

Other international networks

In 2013 the project “PlasmaShape” started at INP. It is funded over a period of 3 years with a total of 2.64 M€ by the European Union. The project's aim is to expand the networking of INP in Europe by staff exchanges, investments in equipment, the hiring of highly qualified scientists and targeted marketing activities. Furthermore, the Institute was involved in two EU-COST campaigns.

INP is a co-founder of the international network BalticNet-PlasmaTec with 57 partners from 12 countries, including more than half from industry. In 2012, the director of INP was elected for two more years as chairman of the association. In close cooperation with the network INP raised EU-funding for the project "PlasTEP", in which 15 partners from eight countries worked to produce practical applications from plasma-based technologies for air and waste water treatment.

In the framework of the cooperation project "Plasma-based Catalytic Treatment of Exhaust Emissions of Marine Diesel Engines" of the ERA-NET for Maritime Technologies (MARTEC), INP has been working with German and Polish partners on the reduction of nitrogen and sulphur oxides in the exhaust of marine diesel engines. The work of INP in this joint project was funded by the German Federal Ministry of Education and Research.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

The total number of employees increased since the last evaluation from 107 to 168 on 30 June 2013 (including support staff, see appendix 4). In the area of research and scientific services INP had 77 employment contracts. Of these, 67.4 % were funded by third parties and 75.3 % were involved in non-permanent contracts.

Senior scientists, who should be hired as members of the Board of Directors or as heads of a Research Division, are remunerated on the W-3 level; heads of Research Programmes are ideally remunerated on the W-2 level. They are recruited as part of the joint appointments with the University of Greifswald or Rostock according to the respectively planned procedures. Heads of Scientific Departments and Research Programmes are remunerated as a rule on the E14 level.

At present, 2 scientific positions have not been filled so far and are reserved for two desired W2 professorships. The appointment of a W2 professorship for surface engineering is planned together with the University of Rostock (Department of Mathematics and Natural Sciences, Field of Physics). Furthermore, INP and the Medical Department at the University of Rostock have set up a non-permanent W2 Leibniz professorship for the field of plasma bioengineering. 50 % of the position will be funded by INP and 50 % by the University, with both institutions sharing about 50 % of the work.

There is a low staff turnover due to retirement or resignation for other reasons in the next years (three positions above remuneration level E13 till 2017). A part of the positions which will become open in the next years will be used to offer permanent full-time or part-time positions to executive scientists, which currently have temporary positions. The remaining positions will be used to support the postdoctoral programme of INP, e. g. by offering 5 year contracts for leaders of junior research groups.

Promotion of gender equality

Of 77 employees working in research and scientific services, 19 are women (24.6 %). Between the heads of the Research Programmes and of the Scientific Departments there are no women. According to the cascade model to be implemented, the Institute considers it essential to fill scientific management positions to a reasonable extent with women in the future. For the posted position of Department Head “Plasma Surface Technology” in 2012, a woman was offered the position, but unfortunately turned it down.

The percentage of female doctoral students is 50 %. This is partly due to INP's increased interdisciplinary orientation with new topics in the field of life sciences (in this field 5 of 5 doctoral students are female). On the other hand, it has been possible to increasingly gain female physicists for doctoral studies (6 women among a total of 17 doctoral students in the field of physics).

Promotion of junior researchers

From 2011 to 2013, 13 PhDs were successfully completed under supervision of INP employees (10 by employees of INP and 3 by external students). Currently, 22 doctoral students at INP are working on their dissertation, 5 of them are financed by INP and 17 by funding from third parties. Furthermore, 9 external doctoral students are supervised.

From 2001 to 2012, INP, the Greifswald University and the Max Planck Institute for Plasma Physics, Greifswald branch, conducted a graduate school. Since 2012, this graduate school, as part of the "International Helmholtz Graduate School for Plasma Physics" (HEPP), has been run jointly by the Max Planck Institute for Plasma Physics, the Technical University of Munich and the Greifswald University in cooperation with the Leibniz Computer Centre in Garching and INP as associated partners.

Two employees are preparing their postdoctoral dissertation (Habilitation). To expand the promotion of young scientists after their dissertation, INP plans to establish a postdoctoral programme, which should be funded by available third party resources at the Institute. Under this programme, postdoctoral students should be given the opportunity to be exempted from other project work for a period of at least two years in order to address a given basic subject independently.

A special role is played by the centre for innovation competence (ZIK) plasmatis, where two young scientists were given the chance to realize their own research concepts with a very high degree of autonomy in their own research group (see Research Programme 6). Furthermore, two junior scientists became the heads of the Research Programmes 4 and 5 as part of INP's internal leadership career programme.

From 2011 to 2013, 16 diploma and master theses were successfully completed at INP.

Vocational training for non-academic staff

In 2011, a female trainee finished training as a management assistant for office communication. To strengthen this professional training at INP, another employee was trained to be an instructor.

In 2013 an apprentice in the mechanical workshop successfully completed his training. A new apprenticeship is offered in this profession. INP aims to offer vocational training in the area of laboratory and technician occupations starting in 2014.

In addition to the apprenticeship, INP also offers its employees the opportunity to participate in professional further education with a certified degree. This programme is offered to employees whom INP would like to retain. As one example of this type of training, an employee in INP's mechanical workshop got a qualified degree as certified industrial foreman in the field metal working (Industriemeister Metall) by absorption of half of the programme costs by the Institute. Another example is the training of IT staff in the acquisition of various certificates at full cost absorption by INP.

6. Quality assurance

Internal quality management

The Chairperson of the Board of Directors (see chapter 1) runs INP and represents it in court and out of court in all matters related to INP and is authorized to represent on his own. In the event of absence, the deputy is responsible for representation. The Board conducts the day-to-day business of INP within the framework of the Articles of Association and in accordance with the resolutions of the Board of Trustees, the General Assembly as well as in compliance with the programme budget.

Quality management by the Scientific Advisory Board and Supervisory Board

The Board of Trustees is the supervisory body of INP (see chapter 1) and decides on all essential scientific, economic and organizational issues of INP. It determines the guidelines of INP's work and pays attention to use of the budget funds in accordance with the Articles of Association. Resolutions with research policy significance, with substantial financial impact, or in relation to the managerial personnel, can only be passed with the votes of the Federal Government and the *Land*.

The Scientific Advisory Council (see chapter 1) advises the Board of Trustees and the Board of Directors in all relevant scientific and organizational issues, particularly in long-term research and development planning. It develops proposals and recommendations on the fields of research handled by INP and the associated work planning and convenes at least once a year. It periodically, but at least every three years, evaluates the research achievements and work planning of INP in a written report.

Implementation of recommendations from the last external evaluation

INP responded to the 11 recommendations made by the Senate of the Leibniz Association in the last evaluation (highlighted here in italics, see also Statement of the Senate of the Leibniz Association from 5 March 2008 page 3 and 4) as follows:

1. The Institute should ensure that a fair share of fundamental research remains guaranteed within the framework of the total external funding.

In the last years the funding of the German Research Foundation (DFG) could be increased to about 830 K€ in 2013. A significant portion of the funds raised through the German Federal Ministry of Education and Research (BMBF) relate to the two junior research groups of the centre for innovation competence (ZIK) plasmatis, which are dedicated to fundamental research in the field of plasma medicine. Furthermore, research on fundamental topics is also demanded in most of the projects with industrial participation supported by the BMBF (see chapter 2).

2. To improve its international visibility and adoption of a leadership role in European and international plasma physics, the Institute must intensify its efforts substantially.

According to INP, the institute has achieved an internationally recognized leadership and visibility in the field of plasma medicine in recent years in addition to the worldwide recognized developments in infrared laser-plasma diagnostics (see chapter 2).

3. The INP must improve its publication output; particularly the number of publications in peer-reviewed journals is too low in some Research Programmes.

The number of publications increased and roughly doubled from the level at the time of the last evaluation (see chapter 2).

4. The INP must also increase its efforts to strengthen competitive funding from the German Research Foundation (DFG) and the EU, which is clearly too low with respect to the INP's Research Programme in the industry contract area.

The increased acquisition of German Research Foundation (DFG) funding was explained under point 1. On the one hand, successful acquisition of EU funds took place within the framework of the international network BalticNet-PlasmaTec (for example the project PlasTEP). The project PlasmaShape is funded by the EU with a total of 2.64 M€ over a period of 3 years (see chapter 4).

5. The Institute should combine the already very well-developed application research and its compelling and effective industrial orientation with equally powerful fundamental research.

Based on the targeted fundraising (see point 1) and the use of core resources, the area of fundamental research could be significantly strengthened. In view of INP, the achievement of a recognized leadership in the field of plasma medicine as well as internationally excellent results, in the, for example, infrared laser absorption spectroscopy would not have been achievable without efficient fundamental research (see chapter 2).

6. To further increase the scientific performance of the INP, a clear strengthening of the second level of management is required in various places. For the development of solution

strategies and their implementation in this issue, the INP's management, the Scientific Advisory Council, the Board of Trustees and the donors are equally responsible.

The strengthening of the second level of management was achieved in particular by three new appointments. These were the Head of the Research Division A, the Head of the Research Programme 8 and the Head of the Research Programme 6. In addition, other appointments in cooperation with the University of Rostock are planned (see chapter 5). Furthermore, two qualified junior scientists became the heads of the Research Programmes 4 and 5. In order to relieve the Board of Directors, two deputies for the Board of Directors were appointed and confirmed by the boards of the Institute.

7. The establishment of an independent junior research group in the new interdisciplinary areas of plasma medicine / biology or plasma-based environmental technology would be a very sensible measure for the development of the INP; an increase in the institutional core funding of the Institute that is required for this is strongly recommended by the Senate.

As mentioned in point 1, the centre for innovation competence (ZIK) plasmatis was established with two junior groups and the mission to pursue fundamental research with a funding period of 5 years. The raising of funds for a second funding period is sought. The increase in the Institute's core-funding for the long-term establishment of junior groups and the continuity of the research has been achieved to a small part. Three positions for doctoral students have been established together with the new professorships. In completion, INP plans to establish a postdoctoral group (see chapter 5).

8. The INP should continue its research collaborations with other, especially West-German, universities.

According to INP the university partnerships were expanded. In particular, the contacts with the Ruhr University of Bochum and the Universities of Kiel and Stuttgart existing for many years, and the start of active joint work with RWTH Aachen, TU Berlin, TU Dresden and the Universität der Bundeswehr Munich should be mentioned. Furthermore, active cooperation in Europe and abroad was expanded in recent years (see chapter 4).

9. Unfortunately, the creation of a joint plasma centre in Greifswald did not succeed. The realization of such a centre requires intensive efforts by all three local institutions (University of Greifswald, INP, Max Planck Institute for Plasma Physics – IPP).

There has been intense and institutionalized collaboration with the Institute of Physics at the University of Greifswald and the Max Planck Institute of Plasma Physics in Greifswald in areas such as the doctoral programme as part of the International Helmholtz Graduate School for Plasma Physics (HEPP) for example, the succession of the Graduate School IMPRS (International Max Planck Research School for bounded plasma). In addition, the ties with both institutions on various levels of work in the bodies of INP, university teaching, cooperation in joint projects such as the “campus PlasmaMed” and the Collaborative Research Centre (*Sonderforschungsbereich*) TR24 and acquisition efforts have been intensified. However, a joint plasma centre could not be implemented mainly because of the different long-term topics and orientation of the three local institutions.

To strengthen the Greifswald location as a centre of plasma research and application the construction of a plasma technology centre in the immediate vicinity of INP is planned. This

centre will support the regional cooperation concerning plasma technological issues e.g. with the Western Pomerania Technology Centre and the Greifswald Biotechnical Department. Moreover, it will offer additional opportunities for the joint promotion of plasma-technological applications together e. g. with the University of Greifswald and the Max Planck Institute of Plasma Physics (see chapter 4).

10. To substantially improve the ties of graduate and undergraduate students to the Institute, the INP must significantly intensify its promotion of junior talent; the number of doctoral students is still too low.

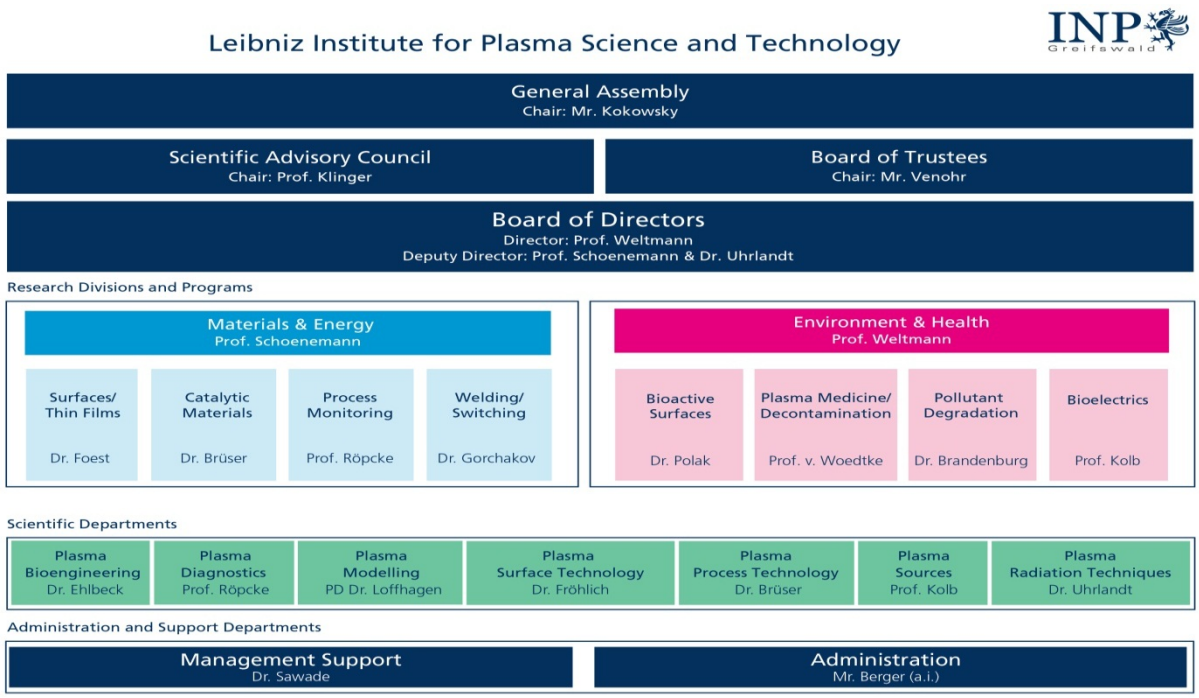
The number of doctoral students at INP could be increased from 7 in 2005 to 22 in 2013. INP considers the proportion of graduate and undergraduate students at the Institute still to be too low, and the measures for their increase should be further intensified (see chapter 5).

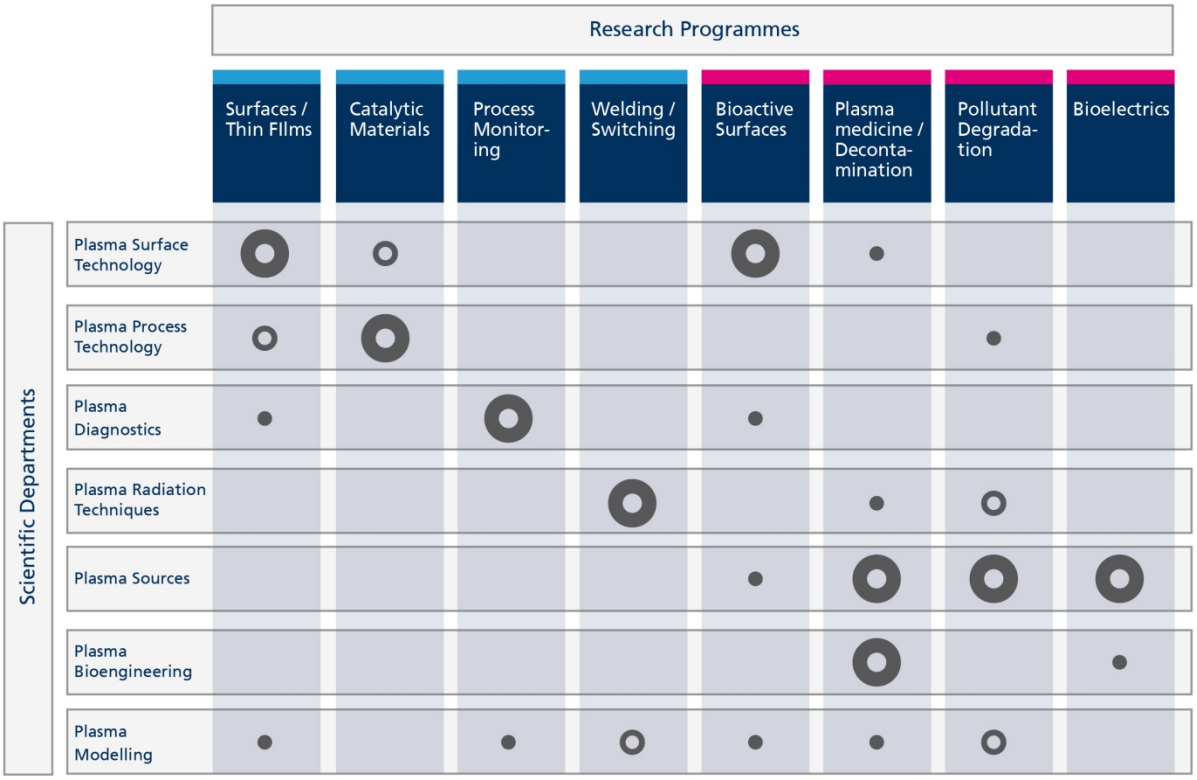
11. The parallel preparation of a programme budget and an economic plan required by the home State of Mecklenburg-Western Pomerania ties up unnecessary resources at the INP. The abolition of the rigid job plan would give the Institute much more flexibility.

According to INP, no fundamental change could be brought about, and the Institute is still bound to the preparation of a programme budget and an annual economic plan with less financial flexibility. The abolition of the job plan did not contribute to an increase in the number of core-financed and thus non-permanent hired employees due to the continuation of the budget based on it. The number of non-permanent scientists increased significantly thanks to the rise in third-party funding.

Appendix 1

Organisational Chart





Appendix 2

Publications and patents

Type of publication	2011	2012	2013
Monographs	-	-	-
Individual contributions to edited volumes	10	12	16
Articles in peer-reviewed journals (contributions that have been accepted for publication but not yet appeared may be added in parentheses for the respective year)	88	80	88
Articels in peer-reviewed proceedings	31	37	29
Articles in other journals	3	11	7
Working and discussion papers	-	-	-
Editorship of edited volumes	-	-	1
Number of publications per full-time equivalent (FTE) in 'research and scientific services' (excluding doctoral candidates)	1,61* 2,16	1,77* 2,69	1,96* 2,64

*only peer-reviewed articles in journals and individual contributions to edited volumes

Industrial property rights (2011)	Granted	Registered
Patents	2	11
Other industrial property rights		
Exploitation rights / licences (number)	5	

Industrial property rights (2012)	Granted	Registered
Patents	2	5
Other industrial property rights		1
Exploitation rights / licences (number)	1	

Industrial property rights (2013)	Granted	Registered
Patents	5	5
Other industrial property rights		
Exploitation rights / licences (number)		

Appendix 3

Revenue and Expenditure

Revenue		2011			2012			2013 [1]		
		T€	% [2]	% [3]	T€	% [2]	% [3]	T€	% [2]	% [3]
Total revenue (sum of I., II. and III.; excluding DFG fees)		14.971,6			15.781,4			20.972,0		
I.	**Revenue (sum of I.1., I.2. and I.3)**	14.530,9	100%		15.659,9	100%		20.933,8	100%	
1.	Institutional funding (excluding construction projects and acquisition of property)	7.137,9	49,1%		9.254,1	59,1%		9.809,4	46,9%	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	7.137,9			9.254,1			9.809,4		
1.1.1	*Proportion of these funds received through the Leibniz competitive procedure (SAW procedure)* [4]	-			-			-		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	-			-			-		
2.	Revenue from project grants	7.343,7	50,5%	100%	6.388,4	40,8%	100%	11.087,5	53,0%	100%
2.1	DFG	369,1		5,0%	348,4		5,5%	831,5		7,5%
2.2	Leibniz Association (competitive procedure) [4]	-		0,0 %	-		0,0%	-		0,0%
2.3	Federal, *Länder* governments	6.108,2		83,2%	5.076,3		79,5%	7.557,4		68,2%
2.4	EU	90,3		1,2%	172,1		2,7%	1.859,0		16,8%
2.5	Industry *(if applicable, break down by source)*	745,3		10,1%	733,5		11,5%	741,9		6,7%
2.6	Foundations *(if applicable, break down by source)*	0		0,0%	-		0,0%	-		0,0%
2.7	*If applicable: other sponsors (break down by source)*	31,0		0,4%	58,1		0,9%	97,7		0,9%
3.	Revenue from services	49,2	0,3%		17,4	0,1%		36,9	0,2%	
3.1	Revenue from commissioned work	43,7			11,7			25,1		
3.2	Revenue from publications	-			-			-		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models etc.)	5,5			5,7			11,8		
3.4	Revenue from exploitation of intellectual property without industrial property rights	-			-			-		
3.5	*Revenue from other services, if applicable; please specify*	-			-			-		
II.	**Miscellaneous revenue** (e.g. membership fees, donations, rental income, funds drawn from reserves)	**134,4**			**121,5**			**38,2**		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* governments, EU structural funds, etc.)	306,4			-			-		

Expenditures		T€	T€	T€
Expenditures (excluding DFG fees)		14.971,6	15.781,4	19.892,9
1.	Personnel	8.152,0	7.508,1	8.251,5
2.	Material resources	3.252,2	3.735,2	4.116,1
2.1	*Proportion of these expenditures used for registering industrial property rights (patents, utility models etc.)*	45,6	127,4	96,0
3.	Equipment investments and acquisitions	3.050,6	3.979,8	7.525,2
4.	Construction projects, acquisition of property	306,4	821,8	-
5.	"Reserves" (e.g. cash assets, unused funds)	210,4	-263,4	-
6.	Miscellaneous items	-	-	-

DFG fees (if paid for the institution – 2.5% of revenue from institutional funding)	168,1	210,3	196,6

[1] Preliminary data: yes

[2] Figures I.1, I.2 and I.3 add up to 100 %. The information requested here is thus the percentage of "Institutional funding (excluding construction projects and acquisition of property)" in relation to "Revenue from project grants" and "Revenue from services".

[3] Figures I.2.1 to I.2.7 add up to 100 %. The information requested here is thus the percentage of the various sources of "Revenue from project grants".

[4] Competitive procedure of the Leibniz Association: until 31 December 2010, funds allocated through this procedure were designated as institutional funding. Since 1 January 2011, the Leibniz Association has granted these funds as project grants.

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 30.06.2013)

	Full time equivalents		Employees		Female employees	
	Total	on third-party funding	Total	on temporary contracts	Total	on temporary contracts
	Number	Percent	Number	Percent	Number	Percent
Research and scientific services	**66,8**	**67,4**	**77**	**75,3**	**19**	**100**
Professors / Direct. (C4, W3 or equivalent)	2		2			
Professors / Direct. (C3, W2, A16 or equi.)	2	50,0	2			
Academic staff in executive positions (A15, A16, E15 or equivalent)	6		6			
Junior research group leaders / junior professors/ post-doctoral fellows (C1, W1, A14, E14 or equivalent)	2	100,0	2	100		
Scientists in non-executive positions (A13, A14, E13, E14 or equivalent)	41,5	78,3	43	79,1	8	100
Doctoral candidates (A13, E13, E13/2 or equi.)	13,3	71,4	22	100	11	100
Service positions	***36,1***	**43,5**	***39***			
Laboratory (E9 to E12,upper-mid-level service)	16,7	58,1	18			
Laboratory (E5 to E8, mid-level service)	8,5	58,8	9			
Workshops (E5 to E8, mid-level service)	3,9		5			
Library (from E13, senior service)						
Library (E9 to E12, upper-mid-level service)						
Library (E5 to E8, mid-level service)	1		1			
Information technology - IT (E9 to E12, upper-mid-level service)	3		3			
Technical (large equipment, service) (E5 to E8, mid-level service)	3	33,3	3			
Administration	***23,2***	**27,6**	***27***			
Head of the administration	0,4		1			
Staff positions (from E13, senior service)	4,9	79,6	5			
Staff positions (E9 to E12, upper-mid-level service)	5,7	26,3	7			
Internal administration (financial administration, personell etc.) (from E13, senior service)						
Internal administration (financial administration, personell etc.) (E9 to E12, upper-mid-level service)	10,6	9,4	12			
Building service (E1 to E4)	1,6		2			
Student assistants	**6,8**	**72,1**	**24**			
Trainees	**1**		**1**			
Scholarship recipients at the institution	**-**	**-**	**-**		**-**	
Doctoral candidates						
Post-doctoral researchers						

15 September 2014

Annex B: Evaluation Report

Leibniz Institute for Plasma Science and Technology (INP Greifswald)

Contents

1. Summary and main recommendations

INP conducts application-oriented basic research in the field of low-temperature plasmas and promotes their application, ranging from the modelling and simulation of plasmas via diagnostics and analysis of processes in plasmas to the development of prototypes for various applications. With regard to technology, INP focusses on the development of non-thermal atmospheric pressure plasma sources and systems.

Since the last evaluation seven years ago, INP has been remarkably successful in continuing its strategic development. This is true, on the one hand, for the advancement of INP's classic themes in the field of plasma physics and plasma technology, which are important, for example, for developing new surfaces, i.e. surface treatment and coatings. This work is relevant and is one of the indispensable pillars of research at INP. The institute has demonstrated that it is able to respond intelligently to changes in scientific boundary conditions and to deploy existing human and material resources for new research tasks.

On the other hand, INP has built up a new field of activity with plasma medicine and plasma biology, which was launched some ten years ago but was still in the orientation phase at the last evaluation. Since then, research has been very systematically and rigorously expanded both in scientific and organisational terms. It is very pleasing that the BMBF and the *Land* Mecklenburg-Vorpommern are intensively driving the development of this internationally new and thus, in the best sense of the word, high-risk research direction by their funding policy.

INP has seven Scientific Departments, designed with a long-term perspective in mind, two of which have been established in the last two years in response to the institute's strategic goals and expansion policy. Research is currently conducted in eight Research Programmes, which are assigned to two Research Divisions: Plasmas for Materials and Energy and Plasmas for Environment and Health. A lot of life has been breathed into this matrix organisational structure, which is continually being developed.

Two Research Programmes are rated as "excellent", one as "very good to excellent", two as "very good", one as "good to very good" and one as "good". One Research Programme that is still under construction cannot be evaluated at this stage. It is pleasing to note that, in both Research Divisions, the programmes that are particularly important in terms of content both presented excellent outcomes.

The publication level and the volume of third-party funding have both been raised significantly since the last evaluation. Every year, approximately twice as much is published as it was seven years ago and the level achieved is now very good. Third-party funding figures have increased from 30 % at the last evaluation to 48 % (average for 2011 to 2013). Within the Leibniz Association this is a very high percentage. Such a remarkable increase is explained, above all, by the considerable funding provided by the BMBF for the development of plasma medicine and plasma biology. The number of doctoral candidates at INP has also risen. This is good, but the institute is not yet exploiting its potential to promote junior researchers to the full.

In the last few years, INP has continued extending its links to universities. In particular, it has developed a collaboration with the University of Rostock. Whilst seven years ago, only the Director held a joint appointment with a university, one further W3 position as well as two W2 positions now constitute joint appointments with the universities in Rostock and Greifswald. The designations have been very well chosen to promote strategic aims.

Special consideration should be given to the following main recommendations in the evaluation report (highlighted in **bold face** in the text):

General concept and profile (Chapter 2)

1. The expertise available in the Plasma Diagnostics Department, to which process monitoring is assigned, should be exploited more fully by both Research Divisions. It is suggested that the important topic of process monitoring should be included in the title of the Research Division (e.g. Plasma Processes for Materials and Energy) and thus highlight the division's particular strength in this field.
2. Worldwide, INP is one of the most appropriate places, if not the most appropriate, for driving research in the new field of plasma medicine and plasma biology in the coming years. The institute is aware that, in scientific terms, this internationally still young research area is, in the best sense of the word, high-risk. Against this backdrop, INP is firstly recommended to intensify existing contacts with the medical sector and include clinical trials at an early stage. Secondly, contacts should be sought to companies to alert them to the potential for medical and biological applications and awaken industrial interest early on.
3. The Federal Government and the *Land* Mecklenburg-Vorpommern are recommended to continue providing their important third-party funding for research in plasma medicine and plasma biology. Starting second respective funding phases would be greatly welcomed; access to bridging funding, if required, should also be facilitated to ensure the continuation of these activities at the institute. Furthermore, based on the success of this support, the Federal Government and the *Land* should work together with INP leadership to put the new research direction at the institute on a permanent footing.
4. Following on from the pleasing increase in the publication record, it is now time to pursue a yet more targeted publication policy. Outcomes that are of relevance to applications or are of interest to companies should be published differently from fundamental scientific findings. To a much greater extent than has been the case so far, fundamental results should reach the entire physics community, i.e. beyond plasma physics, via high-impact journals. Above all, however, it is important to reach other disciplines that have now become of major potential interest to INP's work, particularly medicine and biology.

Collaboration and networking (Chapter 4)

5. In addition to the appointments made since 2011, INP envisages that every head of a Research Programme should hold a W2 professorship. This plan is welcomed. Due

to the age-structure amongst senior scientists it will only be possible to implement this plan in the long term.

6. The path embarked upon to invite a larger number of scientists from abroad and increase the number of visits abroad by INP researchers should be consolidated. The institute is recommended, in particular, to utilize the EU's Marie Curie Programme.

Staff development and promotion of junior researchers (Chapter 5)

7. A comparatively large number of INP's leading scientists have spent a significant part of their academic careers in Greifswald. It can be seen that INP's new topics are leading to a greater number of appointments of both male and female researchers from other parts of Germany and abroad. When recruiting doctoral candidates and other scientists the institute must, however, pursue a policy of more comprehensive internationalisation.
8. There is an urgent need to improve the situation in gender equality, especially with respect to leading positions. INP must take this into account in case of new appointments. Given that there is unlikely to be significant fluctuation amongst the 12 leading scientists in higher income groups in the immediate future, INP furthermore has to find other ways to attract female scientists, e.g. by mid-term or long-term exchange programmes with other institutes. The number of women amongst the scientists in non-executive positions must also be increased.
9. The number of doctoral candidates should be increased even further.

Quality Assurance (Chapter 6)

10. The staff appointment plan is still, unfortunately, binding. This and other restrictions to flexible resource management occurring in practice should be aligned with the relevant agreements between the Federal Government and the *Länder* without further delay.

2. General concept and profile

Development of the institution since the last evaluation and strategic work planning for the next few years

Since the last evaluation, INP has been remarkably successful in continuing its strategic development. There is great potential for further significant advances in the coming years. Research and development at the institute are assigned to two large Research Divisions. The evaluations below refer to the organizational form of research within the matrix structure (I.), followed by general comments on and assessments of the two divisions (II. and III.).

I.

INP is organized according to a matrix structure. On the one hand, it is composed of seven Scientific Departments which provide, above all, essential long-term technologies, processes and methods, and develop them very effectively. Since the last evaluation, the Plasma Sources and Plasma Bioengineering Departments have been meaningfully and

strategically extended. On the other hand, for a number of years, research has been assigned to two Research Divisions, each with four Research Programmes (RP). This working structure is designed to facilitate the fusion of the departments' basic competencies for fixed-term, problem-related research tasks.

INP applies this matrix organisational structure consistently and has filled it with life. In most cases, the Departments and Research Programmes are headed by different scientists. However, all leadership personnel are responsible for specific, convincingly-allocated parts of the budget. This form of organisation enhances the leading scientists' interest in working together for the benefit of all.

INP's leadership envisages continually monitoring the organisation of the Research Programmes and flexibly adapting it to new research questions. This is an important principle. It allows the institute to stop research that has become scientifically outdated, a course of action it has already been prepared to put into practice (see information on arc welding and switching below). Against the backdrop of the flexible structure of the Research Programmes, in the foreseeable future, INP quite rightly intends to restructure the existing programmes within the Research Divisions. This could prove particularly rewarding with regard to Research Division Environment and Health.

II.

Since the last evaluation, the work previously carried out on surfaces, switching and welding as well as process monitoring, which is now bundled in Research Division Materials and Energy, has been continually developed, including the adoption of new approaches. The significance of the work on process monitoring deserves special mention. The research is fundamental to INP as a whole. **The expertise available in the Plasma Diagnostics Department, to which process monitoring is assigned, should be exploited more fully by both Research Divisions. It is suggested that the important topic of process monitoring should be included in the title of the Research Division (e.g. Plasma Processes for Materials and Energy) and thus highlight the division's particular strength in this field.**

In the last few years, INP had to face the fact that the development of LEDs relativized the importance of research on plasma lamps. The institute responded to this development very positively: it ceased activities on plasma lamps and channelled its years of accumulated expertise into novel work on arc welding and switching. This re-established a connection between technologies based on plasma physics and electrical engineering, which had become obsolete in the international research community. As of 2011, when the second W3 professor, who works on high-voltage and high-current technologies, was appointed by INP together with the University of Rostock, this new approach was given further impetus.

The institute has thus demonstrated that it is able to respond intelligently to changes in scientific boundary conditions and to deploy existing human and material resources for new research tasks. Work in the Research Division is relevant and is one of the indispensable pillars of research at INP.

III.

After assuming the position in 2003, the Director began establishing the new fields of plasma biology and plasma medicine research at INP. By 2007, the first convincing results could already be seen but the Review Board at the time noted that, with respect to the new topic, the institute was still in an orientation phase.

Since then, INP has advanced the field excellently and has developed an independent Research Division Environment and Health. It has managed to formulate a clear vision in an area of work, which is fairly new to the entire international research world. One particularly convincing aspect is the degree to which different kinds of specialist knowledge deriving from chemistry, biochemistry, biology, pharmacy and medicine have been combined with physics.

Across the world, there are institutes that bundle activities in the field of plasma medicine or plasma biology, especially in Japan and South Korea. In Europe as well as in the USA research is conducted at various institutes, amongst other things, into plasmas targeting medical and biological applications. In comparison with these activities, the institute is among a small group of global leaders.

Worldwide, INP is one of the most appropriate places, if not the most appropriate, for driving research in the new field of plasma medicine and plasma biology in the coming years. The institute is aware that, in scientific terms, this internationally still young research area is, in the best sense of the word, high-risk. Against this backdrop, INP is firstly recommended to intensify existing contacts with the medical sector and include clinical trials at an early stage. Secondly, contacts should be sought to companies to alert them to the potential for medical and biological applications and awaken industrial interest early on.

The establishment of this new topic has been strategically promoted with the far-sighted support of the Federal Government and the *Land* Mecklenburg-Vorpommern. The Centre for Innovation Competence Plasmatis (ZIK Plasmatis), funded by the BMBF with an annual budget of approx. two million EUR, and the Campus PlasmaMed in Greifswald, funded to the tune of one million EUR, have been essential for the development of the research.

The Federal Government and the *Land* Mecklenburg-Vorpommern are recommended to continue providing their important third-party funding for research in plasma medicine and plasma biology. Starting second respective funding phases would be greatly welcomed; access to bridging funding, if required, should also be facilitated to ensure the continuation of these activities at the institute. Furthermore, based on the success of this support, the Federal Government and the *Land* should work together with INP leadership to put the new research direction at the institute on a permanent footing.

Results

Publications

Criticism was voiced at the last evaluation that INP was not publishing enough, particularly in peer-reviewed journals. During the reporting period 2011 to 2013, the institute responded to this recommendation by doubling the number of articles in peer-reviewed journals and refereed conference proceedings in comparison with 2003 to 2005.

Based on the significant improvement in publication performance, in 2011 and 2013, the Board of Trustees urged INP to devote more attention to elaborating a publication strategy. The Review Board endorses this recommendation. **Following on from the pleasing increase in the publication record, it is now time to pursue a yet more targeted publication policy. Outcomes that are of relevance to applications or are of interest to companies should be published differently from fundamental scientific findings. To a much greater extent than has been the case so far, fundamental results should reach the entire physics community, i.e. beyond plasma physics, via high-impact journals. Above all, however, it is important to reach other disciplines that have now become of major potential interest to INP's work, particularly medicine and biology.**

Knowledge and technology transfer

INP cooperates intensively with companies, usually in the context of research projects involving industry or funding provided by a company. In the period 2011 to 2013, income from projects financed directly by industry accounted for an average of approx. 740k EUR per annum. INP has developed a number of prototypes, such as various plasma source prototypes, including an endoscope with an integrated plasma device.

It is against this backdrop that the institute's patents policy is evaluated by the review panel. INP's expenditure on patents still outstrips income. The institute's claim, that patents primarily open doors to industrial partnerships and do less to generate income, is endorsed by the Review Board. To this extent, expenditure on patents and other property rights is justified and should be seen in relation to income from industrial projects.

In 2005, INP founded a spin-off company, a step that was greatly welcomed by the expert reviewers in March 2007. At the time, it was not possible to foresee whether the spin-off would be successful. It is now clear that the company has managed to establish itself in the marketplace and has led to the foundation of two additional small firms. INP's spin-off companies have now generated 17 new, highly qualified jobs (12.6 full time equivalents) in the structurally underdeveloped region of Vorpommern. The companies, in which INP is the shareholder, offer a portfolio of services which market INP's outcomes effectively, for example in the field of diagnostics.

Appropriateness of facilities, equipment and staffing

Core funding and third-party funding

Since the last evaluation, institutional funding by the Federal Government and the *Länder* has increased significantly. It is appropriate for the purpose of upholding the institute's long-established core activities in plasma physics and has also made it possible to introduce the new fields of plasma medicine and plasma biology. On the basis of the existing additional funding, it is, however, recommended to seek further ways of ensuring the sustainability of this field of activity (see above).

In the period 2003 to 2005, for which figures were presented at the last evaluation, approx. 30 % of INP's income derived from third-party funding. In the period 2011 to 2013, the proportion of third-party funding in the overall budget ranged from 40.8 % to 53 % p.a. This remarkably high percentage, not least in comparison to other Leibniz institutions, is explained, above all, by the considerable funding provided by the Federation and the *Land* for the development of plasma research focussing on medicine and biology.

However, in absolute figures, the amount of income from other third-party funding is also very good. The income from DFG outstrips DFG fees, and it should also be noted that income from the EU, which was still low in 2011, had increased considerably by 2013. INP's strategy for acquiring European funding is convincing, as was demonstrated during the evaluation visit. Whilst there is no programme directly targeting plasma physics in the new Horizon 2020 research framework programme, the institute is analysing in precisely which programmes it could participate. To prepare its proposals it makes purposeful use of its connections with other institutions and, not least, the Leibniz Association's office in Brussels. It is good that the acquisition of EU funding is supported and driven by a staff position at INP.

Technical equipment, IT, facilities

INP's facilities are excellent; laboratory and technical equipment is also very good and has been systematically extended in the last few years, not least due to appointments. The institute points out that it will be necessary to modernise and purchase new equipment in future. Given the restraints on public funding, the Review Board believes that it is imperative and, in principle, scientifically viable to set priorities. Ongoing discussions between INP leadership and the funders on this point should be continued as planned.

Furthermore, it should be noted that it would be scientifically rewarding for INP to be able to use a new, state-of-the-art X-ray Photoelectron Spectrometer (XPS) for its research.

3. Subdivisions of INP

Research Division A: Plasmas for Materials and Energy

Research Programme 1: Surfaces/Thin Films

(7 full-time equivalents [FTE] in research and scientific services, 0.7 FTE doctoral candidates, 4.3 FTE service staff)

This Research Programme is devoted to plasma-chemical modification of surfaces and plasma-assisted deposition of thin films. The model-based understanding of plasma processes aims to develop plasmas for the production of functional thin films for optical, mechanical and chemical applications. The RP uses very innovative technologies. Particular mention should be made of a new approach to plasma spraying which offers important new diagnostic options. Diagnostics is very convincingly combined with modelling.

New results are being generated on this basis and published very well. The work is also being very successfully promoted both by third-party funding from the Federal Government and the *Länder* as well as from DFG (in the framework of CRC/Transregio "Fundamentals of Complex Plasmas"). The scientists involved are encouraged to highlight the outstanding potential for applications ensuing from their insights more than they have so far and to seek contact with companies.

It is pleasing that, in the last three years, some doctoral candidates have been able to successfully complete their work in the Research Programme. Currently, the number of doctoral candidates has dropped and should be increased once again.

The outcomes are highly relevant to a number of other INP Research Programmes. Collaboration with the Fraunhofer Institute for Applied Optics and Precision Engineering (IOF) in Jena is also highly welcomed. Further work in the RP would benefit considerably from the employment of an X-ray photoelectron spectrometer (XPS).

In summary, the Research Programme is rated as "very good".

Research Programme 2: Catalytic Materials

(4.7 FTE in research and scientific services, 1 FTE doctoral candidates, 1.9 FTE service staff)

This Research Programme investigates catalytically active materials, a topic that promises to spark many developments. The most important work addresses the structuring of surfaces that play a role in catalysis research. Research work has been published well and supported by third-party funding.

In future, the focus should be placed on investigations of surfaces, which will highlight the RP's unique scientific feature to greater effect. By contrast, investigations of chemical processes should rather be conducted by institutes with which this Research Programme cooperates very successfully. At present, these are the Leibniz Institute for Catalysis (LIKAT) in Rostock and some groups in Japan. It should be considered whether the circle of partners in chemical research could be extended (in Germany, for example,

to include the Helmholtz-Zentrum Berlin or the MPI für Kohlenforschung in Mülheim an der Ruhr).

Within INP, too, greater use should be made of synergies; with regard to content, close links already exist, particularly involving the RP Surfaces/Thin Film. It is good that INP's leading scientists are aware of these points and have already made plans to take them into account in the future development of the Research Division.

In summary, the Research Programme is rated as "good".

Research Programme 3: Process Monitoring

(5 FTE in research and scientific services, 1 FTE doctoral candidates, 4 FTE service staff)

This Research Programme is seminal to both of INP's Research Divisions. Plasma diagnostics and the analysis of chemical processes in plasmas are conducted at an outstanding international level. In addition, excellent procedures and technologies are developed, especially in infrared spectroscopy.

These diagnostic procedures, which have been developed on the basis of quantum cascade lasers (QCL) in the last few years, are not exclusively of relevance to the study of plasmas but are of further-reaching scientific interest. It is important and is welcomed, however, that the scientists involved intend to continue concentrating primarily on plasma-related issues in order to uphold the focus of the Research Programme.

The RP is encouraged to examine to what extent cooperation could be strengthened with groups inside and outside INP, researching in plasma generation. Despite restricted human and material resources, it could prove productive to diversify the research in methods development more beyond QCL based methods.

The research conducted in the last few years has been excellently published and supported by third-party funding from various funders. The head of the programme is, for example, involved in a project within the Collaborative Research Center/Transregio 24 "Fundamentals of Complex Plasmas". It should be mentioned that the RP generated the spin-off "neoplas control GmbH".

In summary, the Research Programme is rated as "excellent".

Research Programme 4: Welding/Switching

(8.9 FTE in research and scientific services, 1.3 FTE doctoral candidates, 3 FTE service staff)

With this Research Programme INP has trodden new ground in the last few years. On the basis of knowhow that had previously been used for research on plasma lamps, four years ago, INP changed direction to focus on arc welding and switching.

Particularly in the field of switching, the RP has already produced remarkable new insights, which are also of major relevance to applications, for example in switchgear technology. Based on experiments, especially with emission spectroscopy, models and simulations were developed for this purpose. This work is rated as "excellent". Insights in the field of welding, for example in relation to the gas metal arc welding of steel, are of

practical relevance. They do not yet quite reach the standards of the other work conducted in the RP and are currently rated as “good to very good.”

Overall, the performance of the various fields of the Research Programme is rated as “very good”.

Research Division B: Plasmas for Environment and Health

Research Programme 5: Bioactive Surfaces

(2 FTE in research and scientific services, 1.2 FTE service staff)

The Research Programme is dedicated to using plasmas for product surfaces that are intended for medical or biological applications. The contents of the investigations are closely aligned to the RP Plasma Medicine/Decontamination. The goal is to obtain research results on application-oriented health- and environment-related topics and to transfer the findings to applications that are relevant to practice. The theme and the goal are coherent and located in a field that is already well-established in international research.

This work is the subject of intensive scientific competition from, for example, the excellent scientific activities taking place in Bari (Italy). On the basis of extremely convincing technological developments, however, very good results are being achieved and appropriately published in Greifswald, too. In terms of method, the research could benefit from closer cooperation with RP Process Monitoring. It is pleasing that there are contacts to companies to facilitate application-related research. However, it still remains to be seen whether the tools the programme has developed for industry prove practically useful.

In summary, the Research Programme is rated as “good to very good”.

Research Programme 6: Plasma Medicine/Decontamination

(9.5 FTE in research and scientific services, 2.8 FTE doctoral candidates, 8.8 FTE service staff)

ZIK plasmatis junior research group "Cellular Effects" (BMBF-third party funding (4 FTE in research and scientific services, 1.9 FTE doctoral candidates, 1 FTE service staff)

ZIK plasmatis junior research group "Extracellular Effects" (BMBF-third party funding) (3 FTE in research and scientific services, 2.7 FTE doctoral candidates)

This Research Programme forms the core of Research Division B. When the last evaluation was held in 2007, INP’s research in plasma medicine and plasma biology was in its infancy. The Review Board at the time considered the new field to be highly significant but judged the work still to be in an orientation phase.

The subsequent development is impressive. Questions and hypotheses are elaborated very systematically and addressed with great clarity of method. The diagnostics at INP for plasma processed air for sterilisation and decontamination as well as for plasma activated liquids as disinfectants are excellent. Work in this RP benefits from close cooperation in physics with the University of Rostock and in medicine with the

University of Greifswald. Since 2011, there has also been a formal link with the Faculty of Medicine via the head of the Research Programme who holds a W2 professorship there in Plasma Medicine.

Research outcomes set international standards in this young research field. Consequently, the excellent publications by Greifswald elicit a strong response across the world. It should be mentioned that this work is not only of major interest to natural science but to medical research as well. This is particularly true with regard to methods of treatment for wound healing and wound care. However, there are other fields of application with major health policy potential, e.g. in cancer treatment. Applications are possible also in other important fields, for example in food hygiene.

Looking to the coming years, the Research Programme has an excellent basis for driving forward its leading international position in the new and, in the best sense of the term, high-risk field of plasma medicine and plasma biology. The RP is encouraged to consolidate its cooperation with medicine and seek to conduct more clinical trials. It would also be advantageous to start developing contacts to large, international companies. The excellent basic research conducted in the RP is so far advanced that steps of this kind would be meaningful.

The BMBF and the *Land* Mecklenburg-Vorpommern are seriously engaged in promoting the development of the new research field by providing third-party funding. Two junior research groups have been established on the strength of BMBF funding, both of which are excellently integrated in the work of the Research Programme. It was an important and far-sighted decision to invest in this new research direction. Funding should now be appropriately channelled into sustainable structures (see Chapter 2), especially as consolidation of this kind is a very good basis for acquiring further third-party funding from other sources.

In summary, the Research Programme is rated as “excellent”.

Research Programme 7: Pollutant Degradation

(7.5 FTE in research and scientific services, 0.7 FTE doctoral candidates, 1 FTE service staff)

The portfolio of this Research Programme includes a wide range of environmental and health-related tasks. Connected with this is the development of atmospheric pressure plasma sources that can effectively treat large gas streams. This work is very convincing. Special mention should however be made of the fundamental insights into filamentary plasmas and their plasma-chemical effects which have been the focus of the Research Programme for some time. Both the newly-developed diagnostic methods and the modelling in this area are excellent and internationally unique.

It is pleasing that the RP has acquired third-party funding from very different sources such as DFG, BMBF, EU and, to a lesser extent, also from industry. Links to industry should be strengthened in the coming years, building on important fundamental results achieved during recent years, which form a basis of INP’s international scientific standing.

In summary, the Research Programme is rated as “very good to excellent”.

Research Programme 8: Bioelectrics

(2 FTE in research and scientific services, 1.5 FTE doctoral candidates)

This Research Programme was established when the head was appointed to a joint W2 professorship in bioelectrics with the University of Rostock and became head of the Plasma Sources Department in September 2011. As of May 2012, a post-doctoral researcher was involved, gradually followed by three doctoral candidates in 2012 and 2013.

The application goals are quite rightly broadly-based and range from the degradation of chemical compounds via the decontamination of water to medical applications in tumor therapy. The RP is recommended to concentrate on processing living cells, bacteria etc. In order to develop the RP further additional third-party funding must be acquired in future. The outcomes so far are very promising but not yet far enough advanced to be able to make a definitive evaluation.

4. Collaboration and networking

Collaboration with domestic universities

INP is connected with the Universities of Greifswald and Rostock as well as Stralsund University of Applied Sciences by joint appointments and honorary professorships. At the time of the last evaluation only the Director held a joint appointment (physics at the University of Greifswald). In 2011, an additional W3 and two W2 professors were appointed in collaboration with the Universities of Rostock and Greifswald. The designations comply with INP’s strategic planning and have played a considerable role in driving the new topics at INP (see Chapter 2 for information on strategic new topics).

Thus the W3 position in “High-voltage and high-current technology” at the University of Rostock was filled very successfully by a scientist who, like the Director before him, had worked for a major Swiss technology company. The incumbent is responsible for the development of new approaches in Research Division A (see Chapter 2), which he heads, and is one of the two Deputy Directors of INP. The scientist recruited to the W2 professorship in “Bioelectrics” in Rostock was previously employed in the United States. At the University of Greifswald a new formal link to the Medical Faculty was created through the W2 position in “Plasma Medicine”. The position was filled by a scientist who was already employed at INP. The development of plasma medicine and plasma biology, which is being promoted by the Director, was given an impetus by these two professorships.

In the immediate future, INP plans to appoint two further W2 professors in “Surface Engineering” and “Plasma Bioengineering” in conjunction with the faculties of natural sciences and medicine at the University of Rostock. These positions also accord very well with INP’s strategic development. The financial involvement of the University of Rostock in the second position also means that the formal link is being consolidated yet further. **In addition to the appointments made since 2011, INP envisages that every**

head of a Research Programme should hold a W2 professorship. This plan is welcomed. Due to the age-structure amongst senior scientists it will only be possible to implement this plan in the long term.

INP is also linked to the Universities of Greifswald and Rostock as well as Stralsund University of Applied Sciences on the basis of an honorary professorship and various forms of lectureship (*Privatdozentur* and *Lehraufträge*).

In research, collaboration with Greifswald is becoming more established due, in particular, to the Campus PlasmaMed (see Chapter 2). Furthermore, cooperation also exists in the Collaborative Research Centre/Transregio "Fundamentals of Complex Plasmas". Apart from the three part-projects already mentioned in the context of the Research Programmes, INP is also involved in a modelling project. It is pleasing that this important cross-cutting expertise thus radiates out beyond the confines of the institute.

In comparison to the two non-university institutions at Greifswald, the INP and the Max Planck Institute for Plasma Physics, Physics at the University of Greifswald is a small department (according to verbal information during the evaluation visit, approx. 20 to 30 new students per semester). Given this proportion, the potential for recruiting doctoral candidates from the University is limited. It is pleasing that the University of Greifswald is planning to re-fill the professorship in "Low-temperature Plasma Physics", which will become vacant in the coming years due to retirement, under the same designation. This is essential to continuing cooperation between the university and INP.

Collaboration with other domestic institutions

INP cooperates very effectively with other non-university institutions. Particular mention should be made of the contact to several Fraunhofer Institutes, e.g. the Fraunhofer Institutes for Electron Beam and Plasma Technology in Dresden (FEP), for Surface Engineering and Thin Films in Braunschweig (IST) and for Applied Optics and Precision Engineering in Jena (IOF). Within the Leibniz Association important collaborations are maintained, especially with the Leibniz Institute of Surface Modification in Leipzig (IOM) and the Leibniz Institute for Catalysis in Rostock (LIKAT). In Greifswald there are contacts to the MPI for Plasma Physics, although the MPI conducts research in the quite different field of fusion research. The MPI is, therefore, not involved in the CRC/Transregio in low-temperature plasma physics at the University of Greifswald. Thus it is unlikely that extensive cooperation will take place beyond the existing contexts.

Industrial collaboration is also successful. With regard to medical applications contacts should be sought to the relevant, large companies at an early stage (see Chapter 2). Furthermore, INP is encouraged to offer more workshops for small and medium-sized enterprises (SMEs), especially in plasma diagnostics.

Other national and international collaborations

The institute is intensively involved in networks and associations. Amongst others, in February 2013, one head of department at INP became the chairman of the German Society for Plasma Technology, DGPT. In June 2013, on the initiative of the Director, the National Centre for Plasma Medicine was founded to bundle activities in this field.

Internationally, INP is also active in networks, especially in the Baltic region. One of the two Deputy Directors of the institute has held a visiting professorship in St. Petersburg (Russia) since 2010.

The number of short-term visits (between one week and three months) to the institute by scientists from abroad increased from 22 in 2011 to 42 in 2013, whilst the number of visits abroad by INP scientists grew from four (2011) to 14 (2013). Longer visits in both directions are uncommon. **The path embarked upon to invite a larger number of scientists from abroad and increase the number of visits abroad by INP researchers should be consolidated. The institute is recommended, in particular, to utilise the EU's Marie Curie Programme**.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

INP sees the need for a larger number of permanent positions because the proportion of fixed-term contracts amongst the group of post-doctoral employees in non-executive positions is 79 %. This comparatively high percentage is explained by the volume of the institute's third-party income. In the Review Board's opinion, INP could consider the feasibility of the option offered by the funders to use a designated amount of the third-party funding for permanent positions. This is, however, fraught with risk because any reduction in third-party income would result in a burden on the institutional budget. The Review Board does not, however, consider it necessary to suggest any other measures, not least because the sustainable consolidation recommended for developing plasma medicine would change the relationship between basic and third-party funding.

A comparatively large number of INP's leading scientists have spent a significant part of their academic careers in Greifswald. It can be seen that INP's new topics are leading to a greater number of appointments of both male and female researchers from other parts of Germany and abroad. When recruiting doctoral candidates and other scientists the institute must, however, pursue a policy of more comprehensive internationalisation.

Promotion of gender equality

Half of the 22 doctoral candidates currently working at INP are women (in 2007 there was one woman amongst the total of 7 doctoral candidates). Of the 43 scientific staff in non-executive positions, eight are female and all of them are on fixed-term contracts. There is still no woman at executive level. One woman who was offered an executive position in 2012 unfortunately did not accept the offer at INP.

In comparison with the situation at the last evaluation, the gender balance has only improved at the level of doctoral candidates. At the level of scientists in executive and non-executive positions the situation has remained less than satisfactory. **There is an urgent need to improve the situation in gender equality, especially with respect to leading positions. INP must take this into account in case of new appointments. Given that there is unlikely to be significant fluctuation amongst the 12 leading**

scientists in higher income groups in the immediate future, INP furthermore has to find other ways to attract female scientists, e.g. by mid-term or long-term exchange programmes with other institutes. The number of women amongst the scientists in non-executive positions must also be increased.

Promotion of junior researchers

Between 2011 and 2013, 13 doctorates supervised by INP employees were completed. Since the last evaluation, the number of doctoral candidates employed at INP has increased from 7 (2005) to 22 (2013). **The number of doctoral candidates should be increased even further**.

Due to the restricted number of students in Greifswald and in order to promote INP's networking, more doctoral candidates should be recruited from other universities at home and abroad. With regard to the continuing academic careers of this group it would be positive if they were regularly able to gain experience in teaching undergraduates by taking charge of tutorials and laboratory exercises.

Doctoral candidates benefit from the closely application-related nature of many of INP's doctoral topics and thus have very good employment prospects after completing a doctorate at the institute. It is a positive aspect of internal quality assurance that INP records doctoral candidates' subsequent employment in science, industry and other areas. This is an important indication of whether an institute's own training performance is effective.

Vocational training for non-academic staff

With just one apprentice, INP's training record in comparison with other Leibniz institutes is limited. It should be examined whether there is room for growth. INP does, however, support the professional development of non-scientific staff in a very positive and innovative fashion, for example by partially financing the acquisition of higher qualifications ("Meister").

6. Quality Assurance

Internal quality management

INP has appropriate procedures and internal bodies for regularly checking and adjusting its research programme. Strategy meetings are held at the level of the various organisational units and are brought together once a year at a two-day meeting relating to the entire institute.

The ongoing monitoring of the current research programme is very convincing and intensive. All projects report back once a month on the status of work. This is done irrespective of whether the financing comes from basic or third-party funding. The measure is supported by cost and performance accounting. Depending on a project's success, performance-related funding is also allocated from institutional funds.

Quality management by the Scientific Advisory Board and Supervisory Board

The Scientific Advisory Board conducts its tasks excellently. The minutes and audits show that it intensively addresses both the scientific performance of individuals and the basic strategic issues of the institute. The Board takes a critical stance, argues in a differentiated way and is prepared to revisit critical points that do not seem to have been addressed satisfactorily. INP regularly reports back on how it is dealing with the Scientific Advisory Board's hints and recommendations.

The Supervisory Board also conducts its tasks very well. Unfortunately, not all aspects of budgetary legislation and practice in Mecklenburg-Vorpommern are structured in such a way as to be compatible with the minimum requirements for the programme budget agreed upon by the Federal Government and the *Länder.* **The staff appointment plan is still, unfortunately, binding. This and other restrictions to flexible resource management occurring in practice should be aligned with the relevant agreements between the Federal Government and the *Länder* without further delay.**

Implementation of recommendations from the last external evaluation

The recommendations made at the last evaluation essentially expressed the need for INP to achieve a better relationship between fundamental and application-related research. The Review Board considers the current research programme to be highly appropriate for this purpose. INP now manages to close the circle between theory and application.

Third-party funding from DFG and EU, which was criticised as being too low, is now considerably higher. INP is pursuing a clear strategy to position itself in the new EU Horizon 2020 research framework programme.

The publication record, which was criticised for being too low, has been enhanced significantly.

The institute was recommended to strengthen the second level of management. This has been done. Budget responsibility for their own Departments and Research Programmes now resides with the heads, who are systematically involved in strategic planning.

The low level of cooperation with partners in Greifswald has been enhanced, particularly by CampusPlasmaMed and additional joint appointments to W2 professorships. The continuation of collaboration in a CRC/Transregio is also positive. Due to the fact that physics is a relatively small subject at the University of Greifswald, the potential for further collaboration is restricted.

It is still the case that due to the budgetary parameters stipulated by Mecklenburg-Vorpommern budgeting is not as flexible as would be expected according to the relevant agreements between the Federal Government and the *Länder.*

Appendix

Participants:

1. Review panel members

Chair (Member of the Senate Evaluation Committee)

Manfred **Bayer**	Experimental Physics II, TU Dortmund

Vice Chairman (Member of the Senate Evaluation Committee)

Ursula **Gaedke**	Institute for Biochemics und Biology, University of Potsdam

External Experts

Nicholas **Braithwaite**	Department of Physical Sciences, The Open University, Milton Keynes (UK)
Gary **Friedman**	Plasma Medicine Lab, Drexel Plasma Institute, Philadelphia (USA)
Thomas **Hirth**	Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB and Institute of Interfacial Process Engineering and Plasma Technology IGVP, University of Stuttgart
Christophe **Hollenstein**	Plasma Physics Research Centre, Swiss Federal Institute of Technology, Lausanne (CH)
Herbert **Störi**	Institute of Applied Physics, Vienna University of Technology (A)
Johannes **Strümpfel**	VON ARDENNE, Dresden
Bernd **Szyszka**	Department of High-Frequency and Semiconductor System Technologies, TU Berlin
Richard **van de Sanden**	Dutch Institute for Fundamental Energy Research (DIFFER), Nieuwegein (NL)

Federal Representative

absent with apologies

Representative of the States (Member of the Senate Evaluation Committee)

absent with apologies

2. Guests

Representative of the responsible Federal Department

Frank **Schlie-Roosen**	Federal Ministry of Education and Research, Bonn

Representative of the responsible Land *Department*

Woldemar **Venohr**	Ministry of Education, Science and Culture of the Land of Mecklenburg–West Pomerania, Schwerin

Chairman of the Scientific Advisory Board

Thomas **Klinger**	Max Planck Institute for Plasma Physics, Greifswald

Representative of the Leibniz Association

Günther **Tränkle**	Ferdinand-Braun-Institut, Leibniz-Institut fuer Hoechstfrequenztechnik, Berlin

Representative of the Office of the Joint Science Conference, Bonn

Rebekka **Kötting**

3. Representatives of collaborative partners (one-hour interview)

Dagmar **Braun**	Braun Beteiligungs GmbH, Mesekenhagen
Norbert **Kaiser**	Deputy Director of the Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena
Wolfgang **Schareck**	Rector of the University of Rostock, Chair of Vascular Surgery and Transplantation Surgery
Johanna Eleonore **Weber**	Rector of the University of Greifswald, Chair of Differential and Character Psychology / Psychological Diagnostics

23 October 2014

Annex C: Statement of the Institution on the Evaluation Report

Leibniz Institute for Plasma Science and Technology (INP Greifswald)

The Leibniz Institute for Plasma Science and Technology e.V. (INP Greifswald) would like to thank the chair and the members of the Review Board for their great efforts during the evaluation process.

The INP is pleased and grateful for a fair and accurate evaluation report which includes rounded and even-handed measurements as well as constructive and clear recommendations for the future development. The INP appreciates the good to excellent assessments of the scientific work in its Research Programmes, the excellent assessments of the Research Programmes Plasma Medicine / Decontamination and Process Monitoring on a worldwide leading level in particular.

The INP welcomes the main recommendations of the review panel which support the INP's internal strategy and agrees with it to a large extent.

It should be mentioned with respect to recommendation 1 that the expertise of the Plasma Diagnostic Department, in particular methods of infrared absorption spectroscopy, are meanwhile extended and used for new concepts for investigating plasma surface coating processes and plasma sources for biomedical applications. These methods allow to study cold plasma regions in arc applications as well. It is aimed by the INP to involve innovative plasma diagnostic methods in all main research topics. Therefore, a more strictly establishment of plasma diagnostics as a cross sectional expertise at the institute (besides plasma modelling) is planned. However, the label "Plasma Processes for Materials and Energy" for the Research Division would be misleading because of the limitation to processes.

Recommendation 2 fits well to the INP's strategy to strengthen contacts to the medical sector and to international companies including device manufacturers for a sustainable development of the research fields of plasma medicine and biology and to support the transfer of research results into the medical practice. Complementary, the INP aims to expand and to strengthen the topic plasma decontamination and to intensify contacts to the hygiene sector and the food industry in particular. Here, synergies to the Research Programmes Pollutant Degradation and Bioelectrics will be used to a larger extent.

The INP welcomes recommendation 3: The support of a second funding phase for research in plasma medicine and biology, the support of access to bridging funds as well as to recommend putting the research area on a permanent footing. As pointed out in the report, the INP has developed the field of plasma medicine and biology in an excellent way and is among the global leaders based on the close cooperation of specialists from life science, chemistry and physics under one roof. Therefore, it is of particular importance to secure expertise and cooperation in the long term.

With respect to recommendation 4 the INP will adapt its publication policy: More targeted on fundamental scientific findings on the one hand, and results with high relevance to applications on the other. The INP will further support the publication of fundamental findings in journals which reach the entire physics community as well as the publication of interdisciplinary work in high-impact journals e.g. in the medical field.

The recommendations for collaboration and networking as well as for staff development (5 to 9) encourage the INP to follow its strategy. A main focus will be to improve the gender equality situation especially with respect to leading positions together with the long term perspective that every head of a Research Programme holds a W2 professorship or a comparable position. The last point is a common responsibility of the INP and the cooperating universities. The recommendations for an increase of the number of doctoral candidates as well as for the attraction of female scientists are recognized by the INP as urgent tasks. These points will be addressed among others by an intensification of international contacts including exchange programmes. In addition, the hiring of excellent scientists by Europe-wide job advertisements will be intensified.

The INP welcomes recommendation 10 and the request on agreements between Federal Government and *Land* to delete restrictions of a flexible resource management without further delay. In addition, the urgent need of additional core-funded staff positions for holding engineering, legal and marketing expertise as well as for providing assistance for management support in view of the considerable growth of the institute staff has been pointed out in the evaluation report (see p. 61). The INP would very much appreciate a more detailed recommendation with respect to these urgent demands.

The INP is thankful for the detailed assessment of their Research Programmes and corresponding recommendations. Some remarks should be added at this point.

The INP aims at an improved development of the scientific topics in the Research Programme Catalytic Materials. This is due to the fact that plasma-based synthesis and modification of catalytic active materials have great potential for renewable energy applications. The INP fully agrees with the recommendation on strengthening and expanding the present circle of collaborators and to shift investigation of chemical processes to this circle. It should be noted that active collaborations have been extended considerably in the last years and include 7 institutions in Germany and 6 institutions abroad. This includes the successful acquisition of a number of joint projects and postgraduate programmes.

Concerning the Research Programme Welding / Switching the insights obtained recently by simulations and emission spectroscopy have been highlighted in the report as remarkable. It should be noted that these results have been obtained mainly in the field of welding arcs, and not in the field of switching. The expertise of simulation and diagnostics of thermal plasmas is developed in one team at the INP and applied to different technological areas. The targeted transfer to switching arcs together with the extension of fundamental and applied research for this topic is in the focus of future work in connection with the use of the new arc research laboratory.

The further development of the relatively new Research Programme Bioelectrics which has not been evaluated definitely in the report is in the focus of INP's strategy. Because of the thematic links to topics of pollution control and decontamination a closer collaboration and combination of expertise with other Research Programmes in the Research Division is aimed. This issue has been identified by the INP already before the evaluation

visit. However, changes in the structure of the corresponding research division have been postponed to receive the opinion of the review panel.

With respect to the estimation of appropriateness of technical equipment and facilities (page B-8), the INP welcomes the statement of the review panel that a new state-of-the-art X-ray Photoelectron Spectrometer (XPS) is urgently needed for the further development of plasma surface technologies. The requirement of powerful surface diagnostics is seen in the context of the general approach to start with laboratory experiments on a small scale, the analysis of surface structures and plasma-physical mechanisms to optimize new processes and finally the transfer to industrial scale. Meanwhile, it was possible to procure a new XPS system by EFRE third party funds by Land MV. Therefore, future funds are urgently needed to demonstrate and establish processes for plasma surface technologies on industrial scale equipment. This concerns in particular the recently developed system of the combined High-Power Impulse Magnetron Sputtering (HiPMS) and Plasma Immersion Ion Implantation and Deposition (PII&D) (see p. 133 of the INP Documents) which would support also new research directions of the Department Plasma Surface Technology and its new head Dr. Maik Fröhlich.

The review panel has pointed out on page B-14: “It is pleasing that the University of Greifswald is planning to re-fill the professorship in “Low-temperature Plasma Physics”, … , under the same designation.” which would be important beside others for recruiting doctoral candidates. However, meanwhile different assignment plans have been announced in July 2014 via the actual development planning (Hochschulentwicklungsplan) of the University of Greifswald 2016-2020. The professorship which will become vacant, should now be filled in the area of high-temperature plasma physics and astro-physics. In addition, a new professorship in “Medical Physics” should be established at the institute of physics which should “flank the research program plasma medicine at INP”. The INP does not see this proposed link to be beneficial for the INP, neither in general nor in the specific case of plasma medicine. Both areas have only marginal or even no relations to scientific topics of the INP. Therefore the INP has proposed a joint Leibniz professorship for “Low-temperature Plasma Physics” with the University of Greifswald in the future as an additional approach to come again close to the present status in low-temperature plasma physics and the corresponding education. Meanwhile, this idea is generally supported by the institute of physics. It will be the common responsibility of the INP and the University of Greifswald to create this new professorship position with respective financial funds.