Leibniz Gemeinschaft

Der Senat

SEN 0046/06
23.11.2006

Stellungnahme zum
Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (MBI)

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Vorbemerkung

Der Senat der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz – Leibniz-Gemeinschaft – evaluiert in Abständen von höchstens sieben Jahren die Forschungseinrichtungen und die Einrichtungen mit Servicefunktion für die Forschung, die auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen[1] von Bund und Ländern gemeinsam gefördert werden. Diese Einrichtungen haben sich in der Leibniz-Gemeinschaft zusammengeschlossen. Die wissenschaftspolitischen Stellungnahmen des Senats werden vom Senatsausschuss Evaluierung vorbereitet, der für die Begutachtung der Einrichtungen Bewertungsgruppen mit unabhängigen Sachverständigen einsetzt. Die Stellungnahme des Senats sowie eine Stellungnahme der zuständigen Fachressorts des Sitzlandes und des Bundes bilden in der Regel die Grundlage, auf der der Ausschuss Forschungsförderung der Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK) überprüft, ob die Einrichtung die Fördervoraussetzungen weiterhin erfüllt.

Auf der Grundlage der vom Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (MBI) eingereichten Unterlagen wurde eine Darstellung der Einrichtung erstellt, die mit dem MBI sowie den zuständigen Ressorts des Sitzlandes und des Bundes abgestimmt wurde (Anlage A). Die vom Senatsausschuss Evaluierung (SAE) eingesetzte Bewertungsgruppe hat das MBI am 14./15. November 2005 besucht und daraufhin einen Bewertungsbericht erstellt (Anlage B). Auf der Grundlage dieses Bewertungsberichts und der vom MBI eingereichten Stellungnahme zum Bewertungsbericht (Anlage C) erarbeitete der Senatsausschuss einen Vorschlag für die Senatsstellungnahme. Der Senat der Leibniz-Gemeinschaft hat die Stellungnahme am 23. November 2006 erörtert und verabschiedet. Er dankt den Mitgliedern der Bewertungsgruppe für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich der Beurteilung und den Empfehlungen der Bewertungsgruppe an. Das MBI ist weltweit eines der führenden Institute auf dem Gebiet der nichtlinearen Optik und Kurzzeitdynamik bei der Wechselwirkung von Materie mit Laserlicht und erbringt sehr gute, in Teilen exzellente wissenschaftliche Leistungen. Außergewöhnlich ist die fachliche Breite der Forschungsaktivitäten, die von der Physik bis hin zur Biologie reicht. Die Zahl der Publikationen hat sich seit der letzten Evaluierung deutlich gesteigert. Die herausragende wissenschaftliche Qualität der Arbeiten wird durch Publikationen in den führenden internationalen Zeitschriften belegt.

Das MBI entwickelt und nutzt ultrakurze und ultraintensive Laser in einem breiten Spektralgebiet in Verbindung mit Methoden der nichtlinearen Spektroskopie. Der instrumentelle Standard am MBI ist in diesem Gebiet in Deutschland einmalig, die Qualität vieler Instrumente ist derzeit weltweit unübertroffen. Die Applikationslabore des MBI, die ihre Ressourcen im Rahmen von Kooperationsprojekten externen Benutzern aus Wissenschaft und Industrie zur Verfügung stellen, erfüllen national und international eine wichtige Aufgabe. Das MBI hat seine Sichtbarkeit in den letzten Jahren erhöht und ist nun in vielen nationalen und internationalen Netzwerken wie LASER-LAB Europe und großen Kooperationsprojekten mit Einrichtungen wie DESY und BESSY in führender Rolle vertreten.

[1] Ausführungsvereinbarung zur Rahmenvereinbarung Forschungsförderung über die gemeinsame Förderung von Einrichtungen der wissenschaftlichen Forschung (AV-FE)

Als Folge der Empfehlungen des Wissenschaftsrates hat das MBI in den letzten Jahren erhebliche strukturelle Veränderungen vorgenommen. Die drei wissenschaftlichen Bereiche wurden teilweise neu organisiert und stehen nun in Bezug auf Ausstattung und wissenschaftliche Leistungsfähigkeit auf ähnlich hohem Niveau. Im Rahmen einer Matrixstruktur wurden bereichsübergreifend themenbezogene, interdisziplinäre Forschungs- und Infrastrukturprojekte definiert, die in vier Schwerpunkten organisiert sind. Die daraus resultierenden Kooperationen innerhalb und außerhalb des Instituts haben zu vermehrten gemeinsamen Publikationen und zu einer Erhöhung der Publikationszahlen insgesamt geführt, u.a. auch in den führenden internationalen Zeitschriften. Die neue Struktur ist effizient und wird das MBI in die Lage versetzen, auch in Zukunft eine wichtige Rolle in der Laserforschung zu spielen. Dem Institut wird empfohlen, diese erfolgreiche Entwicklung fortzusetzen und die Kooperationen, insbesondere im Hinblick auf die interdisziplinäre Zusammenarbeit, noch stärker auszubauen.

Nach der erfolgreich verlaufenen Umstrukturierung sollte sich das MBI nun verstärkt der Strategie für die langfristige Entwicklung des Instituts zuwenden. Die bisher erkennbaren Pläne für zukünftige Vorhaben sind im Wesentlichen Fortsetzungen der laufenden Projekte.

Die drei Direktoren des MBI haben in besonderer Weise zur Steigerung der wissenschaftlichen Leistungsfähigkeit und zur erfolgreichen Positionierung des Instituts in nationalen und internationalen Netzwerken beigetragen. Der Wissenschaftliche Beirat nimmt seine Beratungsaufgabe sehr gut wahr und hat den Umstrukturierungsprozess konstruktiv begleitet.

Während der letzten Evaluierung des MBI wurde eine unzureichende Unterstützung der Experimente durch theoretische Arbeiten festgestellt. Hier konnte eine Verbesserung erzielt werden, indem erfolgreiche Kooperationen mit Theorie-Gruppen an verschiedenen Universitäten aufgebaut und eigene Theoretiker des MBI in eine Reihe von Projekten einbezogen wurden. Die Theorie ist aber immer noch nicht stark genug am MBI vertreten und nicht hinreichend in das Forschungsprogramm integriert. Die theoretischen Arbeiten sollten am MBI eine eigenständige Rolle spielen, um neue Ideen für das Forschungsprogramm und die längerfristige Entwicklung des Instituts zu generieren. Um dies zu erreichen, sollte das MBI die Anzahl seiner Theoretiker erhöhen und eine Möglichkeit finden, Theorie dauerhaft in die Forschungsstruktur zu integrieren.

Das Institut ist derzeit noch sehr gut ausgestattet, und es ist sehr erfolgreich bei der Einwerbung von Drittmitteln von DFG, EU und BMBF. Durch Kooperationsprojekte mit der Industrie, deren Zahl sich in den letzten Jahren deutlich erhöht hat, werden zusätzliche Drittmittel eingeworben.

Fünfzehn Jahre nach der Gründung des Instituts hält es das MBI für erforderlich, wichtige Instrumente zu erneuern. Der Senat schließt sich der Unterstützung dieses Wunsches durch die Bewertungsgruppe an. Das MBI benötigt eine erstklassige Ausstattung, um auf dem sich schnell entwickelnden Feld der Kurzpuls-Physik kompetitiv bleiben zu können. Die Notwendigkeit neuer Instrumente sollte sich aus der Strategie für die langfristige Entwicklung des Instituts ableiten lassen.

Das MBI arbeitet sehr erfolgreich mit den drei Berliner Universitäten zusammen, an denen die drei Direktoren des Instituts im Rahmen gemeinsamer Berufungen als Professoren lehren. Die Kooperationen umfassen mehrere Sonderforschungsbereiche und eine Graduiertenschule.

Der Anteil an Frauen unter den wissenschaftlichen und leitenden Mitarbeitern ist zu gering. Dem MBI wird dringend empfohlen, dieses Defizit zu beheben.

Das MBI hat sowohl national als auch international eine führende Position in der Kurzpuls-Physik und der Laserforschung. Nach Auffassung des Senats erfüllt es ohne Einschränkung die Anforderungen, die an Einrichtungen von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischen Interesse zu stellen sind. Eine Eingliederung des MBI in eine Universität wird nicht empfohlen. Der Arbeitsauftrag des Instituts, der ein hohes Maß an Interdisziplinarität erfordert, kann nur in entsprechend vernetzten und betriebsförmig organisierten Strukturen erfüllt werden.

2. Zur Stellungnahme des MBI

Das MBI hat zum Bewertungsbericht Stellung genommen (Anlage C). Es begrüßt die ausgewogene Einschätzung der Bewertungsgruppe und sieht sich in seiner Leistungsfähigkeit und Stellung im internationalen wissenschaftlichen Umfeld bestätigt. Das Institut wird versuchen, die Handlungsempfehlungen der Gutachtergruppe umzusetzen.

Der Senat begrüßt die positive Aufnahme des Bewertungsberichts durch das MBI und den konstruktiven Umgang mit den Empfehlungen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das MBI als Forschungseinrichtung auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen weiter zu fördern.

Senate Evaluation Committee

SAE 0100/05
10.11.05

Annex A: Presentation

Max Born Institute (MBI)[1]
for Nonlinear Optics and Short Pulse Spectroscopy

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Appendices

[1] This presentation, compiled by the Evaluation Office, has been approved by the Institute and the relevant Federal and State departments.

List of Abbreviations

BAT	*Bundes-Angestellten-Tarif* „Salary scale for public employees in Germany“
BESSY	Berlin electron storage ring company for synchrotron radiation
BMBF	German Federal Ministry of Education and Research, *Bundesministerium für Bildung und Forschung*
CUOS	Center for Ultrafast Optical Science
DESY	*Deutsches Elektronen-Synchrotron*
DFG	German Research Foundation, *Deutsche Forschungsgemeinschaft*
DNA	Deoxyribonucleic acid
EU	European Union
EUV	Extreme ultra violet
FEE	*Forschungsinstitut für mineralische und metallische Werkstoffe-Edelsteine/Edelmetalle- GmbH*
FEL	Free electron laser
FIR	Far infrared
fs	femtosecond
FU	Free University
FVB	*Forschungsverbund Berlin e. V.*
FZR	Research Center Rossendorf
GSI Darmstadt	*Gesellschaft für Schwerionenforschung mbH in Darmstadt*
HU	Humboldt University
IR	Infrared
LOA	*Laboratoire d'Optique Appliquée*
LOB	Laser Optic Berlin – Congress and Trade Fair
MBI	Max Born Institute
MeV	Mega electron volt
MPQ	*Max-Planck-Institut für Quantenoptik*
OECD	Organisation for Economic Cooperation and Development
OpTecBB	*Optec-Berlin-Brandenburg e.V.*
RTG	Research training groups
SAB	Scientific Advisory Board
SenWFK-BE	*Senatsverwaltung für Wissenschaft, Forschung und Kultur Berlin*
SFB	Collaborative Research Centre, *Sonderforschungsbereich*
SME	Small and medium-sized enterprise
TR	Trans-regional

TU	Technical University
UV	Ultra violet
VUV	Vacuum ultra violet
XRL	X-ray laser
ZOS	*Zentralinstitut für Optik und Spektroskopie*

1. Development and Funding

The Max Born Institute (MBI) for Nonlinear Optics and Short Pulse Spectroscopy was founded in 1991, based on a recommendation by the German Science Council ("*Wissenschaftsrat*") following the evaluation of the institutes of the former Academy of Sciences of the German Democratic Republic.

The MBI developed out of the "*Zentralinstitut für Optik und Spektroskopie*" (ZOS) and, in 1992, was included in the so-called "*Blaue Liste*" in which associated institutes are jointly financed by the German Federal States ("*Länder*") and the German Federal Government ("Bund") according to the "*Ausführungsvereinbarung Forschungseinrichtungen*"[2] . By dint of its foundation, the MBI became a part of the "*Forschungsverbund Berlin e. V.*" (FVB), also founded in 1991, which is the legal entity responsible for the eight member institutes from the Berlin area. The State of Berlin, as sole state representative, and the German Federal Ministry of Education and Research (BMBF) agreed on the joint financing of the MBI in 1992 when MBI was included in the "*Blaue Liste*".

The previous evaluation of the MBI by the German Science Council took place in 1997/1998. Based on the statement by the German Science Council and a joint statement by the State of Berlin ("*Senatsverwaltung für Wissenschaft, Forschung und Kultur Berlin*", SenWFK-BE) and the responsible Ministry (BMBF), the committee of the Bund-*Länder* Commission for Educational Planning and Research Promotion subsequently decided to continue funding the MBI.

2. Mission, Tasks, Main Work Areas and Scientific Environment

The mission of the MBI is to conduct basic research in the field of nonlinear optics and ultrafast dynamics of the interaction of light with matter and follow up applications that emerge from this research. It develops and uses ultrafast and ultra-intense lasers and laser-driven short-pulse light sources in a broad spectral range in combination with nonlinear spectroscopy methods.

The **research structure** consists (see Appendix 1) of 10 research projects and 2 infrastructure projects, organised in the four focal areas: (1) Laser Research, (2) Ultrafast and nonlinear phenomena: atoms, molecules, clusters and plasma, (3) Ultrafast and nonlinear phenomena: solids and surfaces, and (4) Scientific Infrastructure: short pulse and high-field lasers.

Focus area 1 "Laser research" concentrates on the generation of extremely short and/or intense laser pulses with cutting edge parameters. As the MBI is a research institute devoted to short pulse spectroscopy and nonlinear optics, it considers the development of novel laser sources as of paramount importance, and lasers and laser-based sources developed in-house offer parameters that are at the scientific forefront, not provided by commercial lasers. In particular, the availability of a very broad spectral range from terahertz radiation up to hard X-rays allows for unique experiments. Few-cycle pulses, ultra-intense short laser pulses, compact, diode pumped laser sources, ultrafast nonlinear optics for frequency conversion and pulse characterisation, and new materials are presently the centre of MBI's attention.

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[2] Ausführungsvereinbarung zur Rahmenvereinbarung Forschungsförderung über die gemeinsame Förderung von Einrichtungen der wissenschaftlichen Forschung (AV-FE).

Focus area 2 "Ultrafast and nonlinear phenomena: atoms, molecules, clusters and plasma" is devoted to ultrafast and nonlinear processes in atoms, molecules, clusters and plasmas induced by short laser pulses. It covers a broad range of intensities from ultra-strong fields where the interaction due to external fields is dominant down to light-matter interaction at perturbative field strengths.

Few-particle interactions are typically investigated with novel spectroscopic methods yielding comprehensive kinematical information and allowing for detailed comparison with elaborate theories. According to the MBI, the detailed understanding of few-particle and plasma dynamics in ultrafast and strong laser pulses has proven to be one of the keys to novel applications in nonlinear optics.

Fundamental processes in strong fields presently focus on multi-electron dynamics and correlations in atoms, molecules and clusters, including multiple ionisation, harmonic generation and strong field reaction control. Processes in ultra-strong fields focus on relativistic effects in multi-electron ionisation of atoms and ions and on relativistic plasma dynamics including the generation and application of laser accelerated protons (proton imaging) and coherent EUV radiation ("X-ray lasers" (XRL)).

Studies of ultrafast processes and structural changes investigate nuclear and electronic dynamics as well as ultrafast chemical reactions. The work focuses on molecular clusters and biologically relevant molecules in the gas phase and molecular liquids and polyatomic molecules in the condensed phase using novel methods of multidimensional spectroscopy.

Focus area 3 "Ultrafast and nonlinear phenomena: solids and surfaces" investigates ultrafast and nonlinear phenomena in condensed matter and at solid surfaces. Ultrafast electron and structural dynamics and their interplay as well as the study of natural and artificially grown nano-systems represent long-term research topics in this focus area.

Using a broad, interdisciplinary approach a number of complementary systems are studied to unravel the elementary non-equilibrium dynamics and relaxation of elementary excitations as well as structure-changing processes, such as phase transitions. Different types of nano-systems, correlated materials, molecular layers at surfaces, and optoelectronic devices are investigated. For this kind of research novel experimental techniques of ultrafast spectroscopy are applied. At present, interest centres on time-resolved photoelectron spectroscopy with short pulse lasers, partly also in combination with synchrotron radiation, combining optical near-field techniques with ultra-high time resolution, nonlinear terahertz spectroscopy, and diffraction of femtosecond X-ray pulses. Applications, resulting from these studies, are actively followed up in collaboration with external partners from research and industry.

In the **Focus area 4 "Scientific infrastructure: short pulse and high-field lasers",** the MBI has chosen to concentrate some of its main experimental resources in the application laboratories, providing flexible, versatile and cost-effective access to expensive, state-of-the-art equipment for internal researchers. Thereby, it meets the requirements of interdisciplinarity in the scientific staff, flexibility in the definition and organisation of scientific projects, and a long-term scientific infrastructure. In addition, the application laboratories are particularly suited to the MBI's various access activities and collaboration offers extended to external partners from science and industry.

The scientific infrastructure generally consists of short pulse and high-field laser systems and their experimental periphery; developing and upgrading them is the subject of one infrastructure project, while the activities focussing on access and service are the subject of the other. The available light sources may be classified as:

- short pulse sources covering the spectral range from FIR to X-rays with pulse durations down to a few femtoseconds (fs)
- ultra-high intensity lasers
- special laser systems for applications

The application laboratories concentrate most of these laser systems in dedicated building space; they are basal to the scientific infrastructure. They also provide a platform for efficient feedback between the laser research projects in research focus 1 and the scientific applications in research foci 2 and 3.

On a **national level**, the MBI sees its strength not in being based on large and unique installations, as many national laboratories, but rather in the close, mission oriented co-operation between researchers developing light sources and researchers who use the systems first-hand. According to a Report of 2001 by the MBI's Scientific Advisory Board (SAB) the Institute offered by far the broadest range of ultrafast sources and technologies in Germany and probably even in Europe. The MBI has a leading and/or co-ordinating role in research collaboration with various universities, industry and research institutions. Germany is engaged in a number of large research projects of national and supranational interest, such as novel high-energy accelerators and IR, VUV- or X-ray free-electron lasers. The MBI has found itself becoming an essential strategic collaboration partner for research institutions like DESY, BESSY, and FZR in the development of optical short-pulse lasers with unprecedented specifications.

The MBI defines its role as a **non-university institute** of international standing by its long term mission which combines cutting-edge laser research and development with interdisciplinary applications in key areas of basic research. This also includes a flexible hiring strategy which allows to attract temporary staff at post-doc level, and rapidly build-up new expertise in strategic key areas. On the other hand, individual scientists or technicians can be hired for longer than the duration of a PhD thesis (ca. three years), for example. Such strategy allows for long-term commitments in terms of scientific competence and funding, and enables the Institute to develop and maintain a long-term, mission-oriented infrastructure involving state-of-the-art research equipment as well as specialised service infrastructures. Equally important, institutional funding makes it possible to initiate and explore new and high–risk research directions, and the MBI has repeatedly taken such initiatives.

The MBI participates in several **DFG Priority Programmes** ("*Schwerpunktprogramme*") and **Collaborative Research Centres** ("*Sonderforschungsbereiche*" and "Transregio-SFB"). The MBI co-ordinates the current DFG research programme 1134, devoted to ultrafast X-ray research, and participates in BMBF Joint Research Projects ("*Verbundprojekte*") together with partners from industry and small and medium enterprises (SMEs). The MBI belongs to a small number of national non-university institutes devoted to basic research on and with lasers, like MPQ and, to some extent, GSI Darmstadt. The MPQ Garching (www.mpq.mpg.de) focuses on precision spectroscopy applied to the hydrogen atom (antihydrogen atom) and to single trapped ions; the study of quantum processes in the interaction of radiation with single atoms in cavities; experiments with laser-cooled, ultracold atoms for the study of atom optics and Bose-Einstein condensation, attosecond and high-field light-matter interaction, as well as the study of quantum phenomena in molecular physics and chemistry. The PHELIX Petawatt laser facility at GSI

Darmstadt (www.gsi.de) plans to offer the world-wide unique combination of a high-current, high energy (GeV/u) heavy-ion beam with an intense laser beam. According to the MBI, this will open the door to a variety of fundamental science issues in the field of atomic physics, nuclear physics and plasma physics.

Institutes more closely linked to applied technologies or medicine, complementary to the MBI's mission, include some of the Fraunhofer Institutes, such as the Fraunhofer Institute for Laser Technology in Aachen, as well as state funded institutes.

Internationally, the MBI belongs to a small group of research institutes, (e.g. LOA, *Laboratoire d'Optique Appliquée*, Palaiseau, France; CUOS, Center for Ultrafast Optical Sciences, Michigan, USA) focussing on ultrafast spectroscopy, high field physics and nonlinear optics. In addition, a number of university and non-university institutions also cover part of the MBI's research structure. The MBI's **international visibility and recognition** have increased substantially since the last evaluation in 1997, as revealed by the significant number of guest scientists, among them five Humboldt Award winners, seeking to undertake joint research with the MBI, and by the interest in collaborations shown by other research institutions. Furthermore, this recognition is also demonstrated by the scientific publication records and the successful participation in different research networks where the MBI increasingly takes a leading role.

As to future developments, in agreement with the Scientific Advisory Board, the MBI has the following **medium-term objectives** (next 3-5 years):

Laser research (Focus area 1):

- Continuous improvement of temporal resolution in a wide spectral range.
- Ultrahigh intensities: The objective is the provision of laser parameters relevant for relativistic plasma dynamics, particularly laser-particle acceleration, using compact lasers with single- or multi-Joule pulse energies.
- New materials for efficient generation of ultra-short light pulses, in particular Yb-doped and/or micro-structures materials
- Design, construction, and characterisation of short pulse laser systems with special time structures (burst-mode laser) or controlled temporal and spatial pulse parameters.

Ultrafast and Nonlinear Phenomena: Atoms, Molecules, Clusters, and Plasma (Focus area 2):

- Fully ionized matter: The research strategy involves optimisation of the energy spectrum, emittance and energy of accelerated protons for imaging studies on relativistic plasmas, as well as the optimisation of coherent EUV-emission for use in a repetitively operating X-ray laser.
- Strong field ionisation dynamics: The general goal is to understand the interplay between electron-electron correlation and dynamics in ultra-strong fields, where detailed fragment spectroscopy will be applied to new targets and in new intensity regimes.
- Large finite systems: For atomic and molecular clusters and extended organic molecules both strong and weak laser pulses are exploited. Excitation, (multiple) ionization, fragmentation and reaction dynamics are studied in a broad intensity regime up to laser field strengths which significantly modify the potentials of the systems studied.
- Vibrational and reaction dynamics in the condensed phase: In the future, the quantitative measurements of microscopic molecular couplings in liquids and polyatomic molecules

determining structural and relaxation dynamics will be a major topic, both for electronic ground and excited states.

Ultrafast and Nonlinear Phenomena: Solids and Surfaces (Focus area 3)

- Electron dynamics and laser-induced reactions at clean and adsorbate covered surfaces: One focus will be on processes where element specific spectroscopy at elevated photon energies is essential to address diffusion of adsorbates and collective conformation dynamics in ensembles of molecular switches.
- Ultrafast dynamics of individual nano-systems: Combined semiconductor-metal nano-systems as well as (macro) molecular switches at surfaces will be major objects of future research.
- Low-energy excitations in bulk and nano-structured solids with a focus on quantum-coherent dynamics and correlation effects.
- Time-resolved experiments on highly correlated condensed-matter systems: An essential focus will be antiferromagnetic systems since many high-correlation phenomena like high-temperature superconductivity, colossal magnetoresistance, or exchange bias are closely related to the antiferromagnetic state.
- Transient structures in condensed matter investigated by ultrafast X-ray techniques: Based on the leading role of the MBI in high-repetition rate femtosecond X-ray plasma sources and first successful application on coherent lattice dynamics in solids, studies of reversible phase transitions in correlated condensed-matter systems and in molecular crystals will be a key area of MBI research in the next five years.
- Applied research on optoelectronic devices, in particular, device performance and ageing, and on novel materials for opto-electronic applications.

Scientific Infrastructure and Application Laboratories (Focus area 4)

- Special laser systems: The MBI considers the development and operation of a new generation of diode pumped solid-state lasers a key strategic demand, e.g. as drivers for secondary radiation generation, or special applications such as fs-beam slicing at synchrotrons. Another important application will be in material processing with femtosecond pulses where up to now repetition rate and average power were limiting factors for broader applications. A long term objective is the development of picosecond lasers of high average power in reaction to demands from the accelerator and FEL community.
- Application laboratories: The strategy to concentrate the MBI's specific experimental resources, providing a flexible, versatile and cost-effective use of expensive equipment by internal researchers as well as by external partners and visitors from science and industry, has proven to be very successful and will be continued.

In the **long-term strategy** (about ten years), the MBI, in agreement with the Scientific Advisory Board, considers the following topics a scientifically competitive and flexible basis:

Structural dynamics in complex systems

In these areas, phase transitions in solids with correlated electron and/or spin systems, the structure and function of thin layers and adsorbates on surfaces (e.g. molecular switches or nano-structures), and electronic and structural dynamics in large (bio) molecules will be studied by ultrafast X-ray techniques and femtosecond photoelectron spectroscopy. The MBI research, using table-top laser-based sources, will be complementary to work with free-electron lasers, extending already existing co-operation with BESSY and DESY.

Quantum coherences in condensed phase and nano-structured systems

Research in this area aims at observing and ultimately controlling coherent processes in liquids, solids, and at their surfaces. This includes studies on the quantum coherent dynamics of hydrogen-bonded systems, both disordered (water and alcohols) and structurally well-defined (dimers and base pairs in DNA), on adsorbate-surface systems, and the spatio-temporal dynamics of quantum transport.

Large molecular systems of biological relevance

MBI activities concentrate on the dynamics of liquid water on ultrafast time scales, the photophysics of DNA base pairs and amino acids, and the investigation of specific functional groups in DNA and small peptides or even whole segments of proteins. The Institute plans studies ranging from the isolated system with an interacting environment being gradually built up in the gas-phase (e.g. a solvation shell) to the situation pertinent to liquids, and to combine this with coherent control methods. It aims at exploring the potential offered for novel analytic tools in molecular biology.

Atoms, molecules, and clusters in strong laser fields

Two general directions are envisioned here: (i) utilizing novel light parameters such as phase-stabilised few-cycle pulses, VUV- and attosecond pulses, or relativistic intensities in order to reach yet unexplored strong-field manifestations of correlated multi-electron dynamics and (ii) investigating and controlling the correlated electron and ion dynamics in more complex targets, such as molecular clusters and extended organic molecules beyond simple wave-packet dynamics.

Relativistic laser plasma dynamics

The MBI plans to investigate processes driven by strong electric or magnetic fields in the relativistic laser-plasma interaction, like soliton propagation, laser beam filamentation, and channel formation using proton imaging with laser accelerated protons. Furthermore, the MBI will exploit and develop their unique experimental facilities for proton acceleration, with the goal of generating narrow-band spectral distributions of protons for use in time-resolved proton imaging experiments with two synchronised high-field lasers.

Laser research

The long-term objectives include: (i) control of the electric field of light pulses on the cycle level, employing carrier-envelope stabilisation schemes, (ii) development of 10 femtosecond sources in the UV and VUV range, where currently pulse durations of 100 fs or more prevail for most of the spectral range, (iii) high harmonic sources with increased average power and tunability, (iv) generation and shaping of pulses of yet higher relativistic intensities in excess of 10^{20} W/cm^2.

On their **future potential** on an international scale, the MBI states that future research in optics and photonics needs to exploit shorter wavelengths and shorter pulse widths, and as the MBI's research field encompasses both directions, considerable potential for future research and applications on an international scale is expected.

In their long-term strategy, the MBI also draws attention to the **retirement of the present Director** of Division A (Clusters and Interfaces) in 2009, which will provide an opportunity to expand scientific competencies and refocus the profile of Division A onto new fields of research.

3. Structural Features and Organisation

The MBI is part of the ***Forschungsverbund Berlin e.V.*** (FVB) which acts as the legal entity and provider for joint administrative services. The MBI is organised in **three scientific divisions and a technical and administrative infrastructure division**. The research structure, described in Chapter 2 (see also Appendix 1), is organised according to subject areas and interdisciplinary projects, whereas the organisational structure (Appendix 1, second chart) defines the areas of competence. The three scientific divisions at the MBI are: A. Clusters and Interfaces; B. Light Matter Interaction in Intense Laser Fields; C. Nonlinear Processes in Condensed Matter, each headed by a director who is jointly appointed with one of the three Berlin universities. The fourth division Z., Technical and Administrative Infrastructure, manages central service tasks arising from the Institute's scientific objectives and the requirements of research operation.

The FVB's supervisory committee is the **Board of Trustees (*Kuratorium*)**. This board consists of one representative each from the State of Berlin and from Federal Government as funding institutions, an academic representative jointly appointed by the three Berlin universities, four academic members from outside of Berlin, and three members from the industrial sector. The Institute's internal and technical matters are dealt with by its own subcommittee ("*Institutsausschuss*"), preparing decisions for the Board of Trustees. At the MBI, the division heads constitute the **Board of Directors** with joint responsibility for the research profile, the research projects and the distribution of resources. Legally, the MBI is represented by the Managing Director (on a three-year rotating term) together with the Chief Administrative Officer of the FVB. A **Scientific Advisory Board** (SAB) is part of the organisational structure, composed of up to 12 internationally recognised scientists closely linked to the working areas of the Institute. The SAB meets annually and advises the board of directors and the FVB's board of trustees in general questions of the scientific work programme and national and international co-operations. Furthermore, it evaluates the scientific performance biennially through a formal "assessment", and advises the Board of Trustees on appointment procedures for the directors and leading scientists.

Key measures for ensuring the **high quality of the scientific work,** according to the MBI, include:

- Open scientific exchange within the Institute, joint planning of future research directions and projects, including collaboration with external partners.
    - Future research is jointly planned by the directors, project leaders and other scientists.
    - An internal full-cost accounting system that contains scientific output parameters serves as a supporting planning and project management tool.
    - A new controlling system for project expenses has been implemented.
- Professional training of MBI staff
    - Participation in colloquia, seminars and lectures held in-house and/or at universities and other research institutions.
    - MBI researchers participate in international scientific events.

  - o Regular training events are held for non-scientific staff e.g. language courses, and an annual meeting for exchanging know-how and other information.
  - o All members of staff are required to observe the guidelines for good scientific practice.
- Continuous development and/or renewal of scientific infrastructure.

The Federal Government and the German *Länder* have committed themselves to adhere to the agreement on the implementation of **equal opportunities** in their joint promotion of research. In accordance with these guidelines and complementing already existing regulations, the FVB's Board of Trustees set out measures for the Institutes to carry out in October 2004. These include reporting the statistics on equal opportunity matters to the FVB "*Kuratorium*", detailed measures to promote the employment of women, appointing a representative to ensure the gender equality (both at the FVB and in the institutes).

The MBI has agreed on flexible working hours for all staff, part-time appointments are an option, and child care is available at a day-nursery on the campus. Furthermore, gender promotion programmes exist, including special awards for young female scientists.

On the reporting date 31.12.2004, the MBI staff comprised 45 (27 %) women out of a total of 167 employees. Of these, three (5%) were members of the academic and higher management staff and four (17 %) were doctoral candidates.

4. Resources and Personnel

The Max Born Institute is located in the science and technology park Berlin Adlershof that hosts 12 non-university research institutes and is near the Humboldt University. More than 360 small and medium-sized companies (SMEs) are also located there. The MBI has eight buildings with a usable area of 7473 square metres, accommodating offices and laboratories. As part of co-operation with the Erwin-Schrödinger Centre at the Humboldt University, the MBI has access to printed and online electronic journals as well as to media facilities and lecture halls. Therefore, the MBI itself only has a small library with a half-time position for a librarian. The computer facilities at the MBI consist of about 500 PCs and 40 servers, managed by the central IT unit in co-operation with decentralised IT staff. PC technology is central to nearly all activities in the laboratories and the Institute sees demand for IT services rising. Providing secure network accessibility is seen as a particularly major challenge.

The MBI does not provide service functions to external users as the MBI's mission is to perform basic research and develop related applications.

The Institute's annual **budget** amounted to a total of 15.5 Mio. € in 2004 (see Appendix 2). The institutional support thereof was 11.8 Mio. € (76 %) and has been at approximately this level for the last three years. Third-party funding in relation to total financial resources reached 19 % in 2004, and 23 % in 2003. Important sources of third-party funding are the German Research Foundation (DFG), the Federal Government and project funding from the EU. Both in 2003 and in 2004, the Institute received around 1 Mio. € (34 %) from the DFG.

In 2004, 8 Mio. € were provided for personnel, 3.5 Mio. € for materials, supplies and equipment, and 3 Mio. € for investments. On the report date 31.12.2004, the Institute had a total of 167 employees (151.2 full-time equivalents) (see Appendix 4). Of these, 42 % of the positions were for academic and higher management staff. Not including doctoral candidates, 54 % of the academic and higher management were paid according to BAT Ib or higher, and were exclusively financed by institutional resources.

The doctoral candidates (14.7 full-time equivalents) were all, on the report date 31.12.2004, employed on a temporary basis and were 46% financed from institutional resources and 54 % from third-party resources. Other staff (technicians, administration) were essentially (91 %) financed by institutional resources. Among the academic and higher management staff, 48 % were employed on temporary contracts. There were 63 employees paid in the BAT I to BAT IIa range, 50 (79 %) of those were financed through institutional resources. Of these 50 persons 38 % were employed on permanent contracts and 62 % on temporary contracts.

Approximately 27 % of the academic staff were aged 39 or younger, 42 % were 40 to 49, and 31 % were aged 50 or older. At the Institute, approximately 40 % have worked at the establishment for less than five years, 19 % for five to nine, and 41 % for 10 to 14 years. A total of 45 (27 %) women were employed at the MBI as of 31.12.2004. All the women on the academic and higher management staff were on temporary contracts, whereas of the women listed as other staff, 32 % were on temporary contracts.

Since the last evaluation, the staff at the Institute has become **much more international**, in particular the post-doctoral employees. In addition, approximately 50 % of the graduate students at the MBI are non-German. The level of international co-operation is shown by the following figures: 30 members of the MBI staff visited other establishments between 2002 and 2004, while the Institute received 324 guest visits, 92 of them for longer than three months. Between 1998 and 2004, six employees were offered and accepted chairs or professorships at other universities.

In their **assessment of resources**, the Institute points out that, along with the increase in salaries not compensated for in the institutional budget, there is a serious need for dedicated funding and a flexible legal framework for hiring first-class scientists. The Institute stresses that the lack of funding for a guest programme makes the MBI less competitive than institutes funded through the Max Planck Society, for example, and renders the Institute less attractive for both guest researchers and for collaborations with non-European partners. After being founded in 1991, most of the equipment at the MBI was acquired in the period 1993 to 1996. In order to maintain its mid-term competitiveness, additional institutional resources for the renewal of equipment are required. Presently, this deficit is enhanced by an insufficient budget for operational costs. These costs are partially to be taken from the investment budget as there is insufficient institutional funding.

Cooperation on a national and international level is central to the MBI's mission and is partly financed by collaborative third-party funding. The Institute foresees that this area will have to increase due to limited institutional funding. A strategy for acquiring third-party funding laid out by the Institute includes basic research collaborations with external partners, particularly using funding from the DFG's Collaborative Research Centres (*Sonderforschungsbereiche*, SFB) and Priority Programmes (Schwerpunktprogramme), the BMBF "*Verbundforschung*", and from EU-projects. The MBI also points to its very active role in establishing SFB 450, 658 and TR 18. Networking with external partners and hosting guest scientists, in particular younger researchers and graduate students, will continue as well as the transfer of technology to research and industry partners. Opportunities for patenting results are routinely checked before publication, the strategy being to sell patents to companies instead of building a large patent portfolio.

5. Promotion of Junior Academics and Cooperation

The MBI collaborates with the three Berlin universities, namely the Free University (FU), the Humboldt University (HU) and the Technical University (TU) on the basis of four jointly appointed professors, one of whom also holds an honorary professorship at the University of Potsdam. Five MBI employees with professorial qualifications (*Habilitation*) also teach regularly at the TU Berlin, HU Berlin as well as at the University of Dortmund. In addition, MBI scientists are involved in student tutorials, exercises, research labs and seminars in the framework of the regular course system at the three Berlin universities and a number of *Fachhochschulen* (Universities of Applied Sciences). MBI scientists participate actively in **university research programmes:** in the three SFBs and one trans-regional SFB (TR 18) as well as in the Research Focus on Photonics (TU Berlin) and in Research Training Groups ("*Graduierten-kollegs*").

- SFB 296: Growth-correlated properties of low-dimensional semiconductor structures (TU Berlin, one subproject)
- SFB 450: Analysis and control of ultrafast photoinduced reactions (FU Berlin, three subprojects)
- SFB 658: Elementary processes in molecular switches at surfaces (FU Berlin, two subprojects)
- Transregio-SFB 18: Relativistic laser-plasma dynamics (University of Düsseldorf, two subprojects)

MBI also participates in Research Training Groups

- DFG RTG 1025: Basic properties and functionality of size- and interface-determined materials (HU Berlin)
- DFG RTG 788: Hydrogen bonding and hydrogen transfer (FU Berlin)

Academic and professional **training for young researchers** in the form of lectures, seminars and colloquia are key activities. Experimental research at the MBI is combined with lectures and courses for the students and researchers, also providing interaction in small groups with guest researchers as well as promoting informal meetings like students' "tea-meetings". The Institute plays an active role in the International Humboldt Graduate School on Structure, Function and Application of New Materials that started in 2001, as well as in planning a joint master programme for all Berlin universities in optical technologies. A programme for exchanging summer students with American universities, in particular the University of Central Florida, has been in existence since 2002. The MBI also participates in the Leibniz Association's summer student programme and MBI scientists teach regularly in international summer schools.

The **teaching** at the different academic institutions provides one basis for attracting Diploma students, and the MBI also receives an increasing number of doctoral students recommended by colleagues and/or collaborating groups. In the period 2002 to 2004, 11 Diploma and 20 doctoral students completed their theses. The Institute is also active in vocational training and, between 1998 and 2004, 7 physics laboratory assistants and 3 administrators completed their training at the MBI in the framework of the German "Dual Education System".

The Institute is presently co-ordinating **major EU networks** within the 5th and 6th Framework Programme. One is named “Lasernet, European Coordinated Network of Laser Infrastructures”, with 10 participating members and 10 associate members. Another, “Integrated Initiative of European Laser Laboratories, LASERLAB-EUROPE”, comprises 17 major laser laboratories from 9 European countries. The objectives of this latter co-operation are to improve the quality of the participating infrastructures and, on a longer-term perspective, to lay the foundation for a sustainable network among these infrastructures. The LASERLAB-EUROPE project has a four-year budget of 14 Mio € and co-ordinates and provides nearly 4000 days of access for European researchers to the participating infrastructures. The MBI provides 340 days. The MBI also co-ordinates one Specific Target Research Project (STREP) “DT-CRYS”, devoted to new solid-state materials for lasers. In addition, the MBI is work-package leader in one Integrated Project (BRIGHT.EU) and project partner in one Design Study (EUROFEL) and one Network of Excellence (ePIXnet).

Within the framework of the EU- and BMBF-funded research projects listed below, the MBI also co-operates with various **industrial partners**:

- BRIGHT (EU): Wide wavelength light for public welfare: high-brightness laser diode systems for health, telecom and environment use. BRILASI (BMBF): Brilliant high-power diode lasers for industrial applications, co-ordinated by OSRAM Opto Semiconductors, Regensburg.
- DT-CRYS (EU): Double tungstate crystals: synthesis, characterisation and applications. This project includes cooperation with three European SME partners (High Q Laser, Monocrom, and FEE).
- TRUST (BMBF): Reliability analysis of brilliant high-power diode lasers in industrially relevant operation modes, co-ordinated by Jenoptik Laserdiode, Jena.

Although not a regular service laboratory, the MBI does offer its expertise to industrial partners in Germany and abroad, including licensing and patenting know-how in laser technology. The Institute also draws attention to the particular strength of collaborations evolving through the OpTecBB (Optical Technologies for Berlin and Brandenburg) network between science and local enterprises which have led to a number of joint projects funded by the BMBF and the regional funding programme PROFIT.

6. Results – Research, Development and Services

As the mission of the MBI is basic research in the field of nonlinear optics and ultrafast dynamics of the interaction of light with matter and exploring applications resulting from this research, publication of results in internationally high-ranking scientific journals is a key activity. However, the mutual benefits arising from **interaction with external groups and industrial enterprises** has been very successful, according to the MBI, and has increasingly grown into a natural component of the MBI’s research structure.

In particular, the MBI has been actively involved in the relevant EU “Access to Large Scale Infrastructures” programmes since they were started in 1995. Since the last evaluation, the MBI Application Laboratories that were originally designed as a main resource for external users have now evolved into centres for internal and external cooperation rather than services. The EU contract also requires a number of internal and external **quality assurance**

measures, including confidential user feedback to the EU and periodic external reviews of the facility, its organisation and scientific quality. The most recent “Technical Review” (2002) revealed that the MBI works at a high scientific level, seems to be efficient and has high-quality scientific output.

The number of publications has increased substantially since the last evaluation. In the previous reference years 1994 to 1996, 297 reviewed papers were published, and during the present reference years 2002 to 2004, there were 417 publications (see Appendix 7). Moreover, the journal impact factor of the journals in which the MBI publishes has substantially increased: Examples include three papers in Science, two in Nature and 32 in Physical Review Letters. The MBI aims at continuing to improve the quality of the publications, rather than the number of publications. Presentations at conferences are also an important aspect of the publication concept, for example at: Ultrafast Phenomena; Ultrafast Optics; the Conference on Lasers and Electrooptics; and the International Quantum Electronics Conference.

Checking results for potential **patenting prior to publication** is routine at the MBI and the Institute now holds and/or has applied for **52 national and international patents** covering a wide range of laser and optical technology and, to a lesser extent, preparation techniques for new materials. For cost reasons, the MBI has mainly filed German patents and follows a strategy to sell patents to companies rather than building up a large patent portfolio. Between 1998 and 2004, the total revenue from selling patents (3) and licences (1) was 25.000 €. Return from **technology transfer**, chiefly to other research institutions and SMEs, has furthermore established the MBI as a consulting partner and provider of technical support for companies active in laser technologies and optoelectronics. The MBI has developed and sold scientific instrumentation and technological prototype solutions with total revenues of about 650 k €. A few examples include: Near-field scanning optical microscopes for cryogenic temperatures; methods to polish glass ceramics on a nanometer scale with femtosecond technology; specialised lasers for various FEL and synchrotron applications.

Technology transfer is complemented by extensive **knowledge transfer**. The MBI has a large number of cooperative projects with universities, other research institutions, and industrial partners (see also Section 5). The Institute sees its cooperation with guest scientists as a main channel for such transfer; in 2004, more than 100 guest scientists worked at the MBI for extended periods. The MBI is also very involved in organisations, networks and committees of importance for science policy and is active in **communicating results** to a scientific audience, to students and to the general public. Examples include hosting and coordinating:

- Functions and offices in local and regional organisations like
    - “*WissenSchafftZukunft*”
    - „*Optische Technologien für Berlin und Brandenburg*“ (OpTecBB)
    - IGAFA (Joint Initiative of Non-University Organisations in Berlin Adlershof)
    - “Laser-Optik Berlin (LOB), a biennial, combined scientific meeting and trade fair with 1500-2000 visitors and many media reports
    - The 7th European Conference on Atomic and Molecular Physics (ECAMP VII) in 2001, with more than 1600 participants
    - The 7th International Workshop on Laser Physics (LPHYS’98) in 1998, with more than 200 scientists

  - The trade fair “Laser-World of Photonics” in Munich (2003, 2005)
  - „*Lange Nacht der Wissenschaften*” (Science Night) with 500-1000 visitors at the MBI
  - A large number of activities at the MBI, on the Adlershof campus and at the Humboldt University to promote science especially to students
- Science policy and consulting functions
  - within the OECD
  - in EU committees preparing future Framework Programmes
  - with the Federal Ministry of Education and Research

MBI scientists have received a number of **prizes, awards and honorary titles** indicating the degree of national and international recognition that the MBI enjoys. Among 14 such occasions since 1998, five MBI researchers received stipends/visiting professorships to foreign universities.

7. Implementation of German Science Council’s Recommendations

The German Science Council’s (“*Wissenschaftsrat*”) decision to continue funding in July 1998 included the recommendations listed below (in *italics*). The measures introduced in response to the recommendations have also been developed further in cooperation with the Scientific Advisory Board, and are briefly described, according to the Institute, below each paragraph.

a) *“Structural modifications have to be introduced for the Institute in order to be competitive with international top research.*

In future, division B should play a major part. It requires a consistent direction and a highbrow programme pointing the way ahead. This has to be taken into account when internal resources are distributed.”

The three scientific divisions have been partially restructured (see Appendix 1) into three well defined and homogeneous areas. The Scientific Advisory Board plays an important role in reviewing projects and advising the MBI Board of Directors on allocating resources. According to the MBI, the structure is particularly adapted to taking up emerging research topics utilising the concerted efforts of all divisions. A novel inter-divisional research area “Physics of and with ultra-short X-ray pulses” represents such an example.

Division B now focuses exclusively on “Light Matter Interaction in Intense Laser Fields”, having three main scientific fields (see Appendix 1). The restructuring has been achieved as follows: The projects and most of the staff involved in photobiology and photomedicine have been moved to Division C (Nonlinear Processes in Condensed Matter). However, some of the staff with specific chemical competence have been included in Division A (Clusters and Interfaces), and some have been retained in Division B to strengthen new activities. Two scientists and one technician from Divisions A and C have joined Division B.

The Institute states that, as a result, the MBI has increasingly become a visible and respected partner in the relevant scientific community, not only playing a major part but also assuming leading roles in international cooperation.

b) *"The Institute has to improve its publication activities."*

The MBI has improved its publication rate both quantitatively and qualitatively since the last evaluation in 1997. The total number of refereed papers published has increased from 297 in the years 1994 to 1996 to a total of 417 in 2002 to 2004 (see Appendix 7). Publications have shifted significantly towards higher impact factors.

In 2002 to 2004, three papers were published in Science, two in Nature, 32 in Physical Review Letters, and two in major review journals while the corresponding numbers in 1994 to 1996 were 1, 1, 9, and 0 respectively.

c) *"Furthermore, a continuous high-quality theoretical support of MBI research is required; this should also be done by collaborations with the respective groups at the Berlin Universities."*

In-house theoreticians, guest scientists and a large number of external collaborations complement the experimental research. In particular, there are cooperations with six theory groups from Berlin universities under and beyond the DFG-funded Collaborative Research Centres platform. In all, there are collaborations with 36 external theory groups, and also 84 joint publications with external theory groups in 2002-2004.

d) *"The Institute should intensify its contribution to university teaching and the promotion of young scientists."*

The MBI has intensified its contribution to teaching at the Berlin and other universities and is hosting a substantial number of young scientists, both graduate students and postdoctoral researchers. Between 2002 and 2004, 20 doctoral students completed their theses compared with 11 between 1994 and 1996. One member of the MBI staff received an *Habilitation* in this period. Several doctoral students won prizes for the work carried out at the MBI. The Institute also participates in a Humboldt International Graduate School, summer schools, and student exchange programmes with American universities.

e) *"Besides, the application laboratories should be used for strengthening contacts with industrial users and – in this way – for orienting scientific work more towards applications."*

The MBI systematically patents results suitable for application, builds and sells prototype equipment, and offers highly specialised services. This has resulted in links to industry and SMEs through a number of BMBF-, EU- and Senate of Berlin-funded Joint Research Projects ("*Verbundprojekte*") and bilateral collaboration agreements, including licence agreements. The MBI also points to its key role in the OpTecBB network that involves more than 80 partners in industry and science.

f) *"Femtosecond lasers as well as the procedures for frequency mixing and tunable laser sources are widespread in university establishments. Spectroscopic measurements with lasers are everyday practice in many research labs. It is, therefore, even more essential for the MBI to achieve top-class results in these areas and to use the synergy effects offered by collaboration between its departments."*

Research at the MBI combines work on novel lasers and laser-based sources with their application in a wide range of research. This synergy has led to a larger number of sources with cutting-edge parameters far beyond commercially available technology. Examples are a laser-driven plasma source for hard x-ray pulses working at a 1 kHz repetition rate, ultrashort pulses in the VUV, and mid-infrared and THz pulses with electric field amplitudes up to several MV/cm. Such work on sources is complemented by the development of new schemes for pulse characterisation and measurement, allowing for experiments with unprecedeted sensitivity.

g) "*Generally, in Division A (Clusters and Interfaces), care should be taken to ensure that work is carried out according to the superordinate points of the MBI's mission. Looking at the development of short and high-energy lasers as well as the use of these lasers for examining the interaction with material, the choice of experiments should take greater account of the necessity for feedback in developing these fields further. By comparison with institutions of higher education which handle similar research themes to Division A, the department is well-equipped. This competitive advantage – by comparison with the equipment at institutes of higher education – should be reflected in qualitatively even more outstanding research results in future."*

The above mentioned research on Clusters and Interfaces, now embedded in focus area 2, concentrates on prototypes of ultrafast dynamical processes at surfaces and in free molecules and clusters. Research on fullerenes and nanotubes e.g. has been replaced by studies on strong-field reaction control in large, finite molecular systems (project 2-03). Laser research is fully integrated into the interdivisional projects 1-01 and 1-02 and is guided by two general goals: to push the limits of laser parameters to new frontiers and to enable new types of time resolved experiments. This includes extension of the wavelengths' range and improvement of temporal resolution. Close feedback between laser research and such studies of ultrafast dynamics is a key to success as documented by milestones such as: shortest pulses in the visible (3.8 fs), 1kHz laser driven hard X-ray plasma source, first femtosecond time resolved photo-electron photo-ion coincidences from clusters, first shaped pulses and optimal control in fs material processing, ultrafast VUV pulses down to 103 nm, being among the first groups worldwide to study ultrafast dynamics in isolated biologically relevant molecules. The recent appointment of M. Weinelt enforces this strategy, e.g. by combining state of the art surface techniques with a novel multi kHz high-harmonic XUV facility – a project funded through the Leibniz-competition in the framework of the "*Pakt für Forschung und Innovation".*

h) "*For an institute running application labs it is important to have qualified contacts to deal with issues pertaining to biology and medicine. In this context, Department B3, which works on issues of fast procedures in biology and medicine, can make its contribution. This department is not embedded in the activities of Division B with highest-performance lasers; rather, the work is equivalent to that carried out in Division C.*"

As explained in the response to recommendation (a), members of the former Dept. B3 have been transferred to Dept. C1. Research is now focused on large molecular systems of biological relevance (research project 2-04), including structural and vibrational dynamics in the electronic ground state, as well as photoinduced chemical processes and relaxation phenomena in systems like nucleic base pairs (both in the gas and condensed phase), DNA, the green fluorescent protein and others. In contrast to work in the former Dept. B3, present and future experiments are entirely based on methods of time-resolved nonlinear spectroscopy in the ultrafast time domain. Such research is embedded in a number of international collaborations both with experimental and theory groups and has led to joint publications in high-ranked journals, for example in “Science”.

i) *“Very good work has been done building up Division C (Nonlinear Processes in Condensed Matter). Despite these achievements, due not least to the Director’s forceful scientific-technical leadership, in order to ensure that the Division maintains a leading position in its field, it is necessary to continue striving for even more far-reaching new research results and become geared to new themes. It also seems necessary to strengthen cooperation with the theoretical side.”*

Since the last evaluation, the research on Nonlinear Processes in Condensed Matter has been extended to the new fields of high current interest in the international community, reflected by the MBI research structure, both in focus areas 2 and 3. For example: Nonlinear vibrational spectroscopy of hydrogen bonds and hydrogen transfer processes in the electronic ground state, phase-resolved mid-infrared spectroscopy of intersubband excitations and transport coherences in quantum cascade lasers, ultrafast optical near-field spectroscopy of individual nanostructures, and ultrafast x-ray diffraction of semiconductor nanostructures, materials with correlated electron systems and molecular crystals (embedded in project 3-04 - a project in which scientists of all three divisions co-operate). Experimental work in such fields is closely connected with theoretical work, both in-house and in collaboration with external theory groups, e.g., Shaul Mukamel, UC Irvine, Andreas Knorr, TU Berlin, O. Kuehn, FU Berlin and others. In the 4 topical areas named, 110 papers have been published, among them 1 in Nature, 3 in Science, 15 in Physical Review Letters, 1 in Chemical Reviews, and 1 in the Annual Review of Physical Chemistry.

j) *”The themes dealt with by the department “Nonlinear Processes of Special Laser Systems” are of particular significance to industry. The results are of good quality while the work on fibre lasers should receive special mention. Existing engineering knowledge should, however, be utilised better. The same is true for the work on laser degradation. Cooperation with the relevant department at the neighbouring Ferdinand Braun Institute (FBH), which has a stronger engineering bent, should be strengthened.”*

The department is now named "Solid State Light Sources" and - since 2002 - led by G. Steinmeyer. Laser research is now carried out in the framework of the interdivisional projects 1-01 and 1-02. Research topics significant for industry are studies of aging and degradation processes of optoelectronic devices, the characterisation of new materials for optoelectronics and solid state lasers, and new concepts for short-pulse solid state lasers, the latter including microstructured fiber lasers. Such work is embedded in networks with industry on the national and European level, e.g., in BRIGHT and DT-CRYS (EU), as well as BRILASI and TRUST (BMBF). The collaboration with the FBH has been enhanced substantially and concentrates presently on ultrashort pulse generation in semiconductor lasers (joint BMBF project), fabrication and characterisation of nonlinear semiconductor absorbers for femtosecond pulse generation, characterisation of degradation processes of high-power diode lasers, and the implementation of FBH high-power diode lasers in femtosecond solid state lasers developed at MBI.

k) *"The successful operation of the application labs could be facilitated by introducing a binding users' order, clearly stating the access regulations for users. External users should be given priority access by comparison with internal departments."*

The application laboratories are an essential part of MBI's internal research structure and, they are not primarily designed as service facilities for external users. Hence, priority access cannot be granted to external users in general. Rather, the MBI has committed itself contractually (e.g. within various "Access to Large Infrastructure Programmes" of the EU since 1995) to provide certain numbers of experiment days exclusively to external users. This Access is governed by clear regulations, involving e.g. external review of the scientific proposals, various user feedback mechanisms to the EU, periodic external reviews of the facility, its organisation and scientific quality, as well as quality control by the "Access Board" of the governing EU network under which this activity is funded. In addition, access is granted outside the EU programmes for collaborative research with German and non-EU visitors. The mutual benefit arising from interactions with external groups and industrial enterprises has been very successful. The most recent "Technical Review" (2002) conducted by the EU found that MBI "works at a high scientific level, its efficiency seems good and the scientific output is of high quality".

l) *"Currently, certain projects at the MBI are under the theoretical supervision of members of staff. Their contributions are of high quality and are published in recognised journals. At the moment, the computing potential is adequate in respect of the hard- and software utilised; however, it has to be improved when there are complicated problems to be solved relating to the physics of condensed systems, for example."*

The MBI has followed this recommendation and pursued a flexible strategy, installing special hard- and software if (and only if) special demands need to be met in order to solve special problems. For instance, a cluster of 12 DEC-Alpha stations, running in parallel mode under Linux, has been installed in 2001 for the special requirements of large-scale PIC code simulations for relativistic plasma dynamics (H. Ruhl, N. Naumova). This cluster has been used in remote mode even after H. Ruhl followed an offer on positions in the United States and later in Bochum.

m) "*In future, the Advisory Board should continue with the same intensity as it has done in the past, to intervene in an advisory capacity in steering the MBI. It should also make recommendations for setting work focus areas and ensure that the Institute's work is oriented towards internationally valid standards. The scientific work in the divisions should be critically evaluated by the Advisory Board at regular intervals."*

The Scientific Advisory Board (SAB) holds annual meetings at the MBI, evaluates the research done in the past year, discusses general directions to be taken in the future and gives advice to the Board of Directors and the funding Government agencies. Biennially it performs a formal assessment of the research results of the MBI and submits proposals for possible improvements where necessary. The SAB was involved very much in the reorganisation of the MBI following the recommendations of the last evaluation and participates actively in the hiring of department heads of the MBI. In addition, the chair of the SAB is a member of the "*Institutsausschuss*" which makes recommendations concerning the annual budget ("*Programmbudget*") of the MBI.

n) "*30% of the positions financed by basic funding are fixed-term. The proportion is in line with the lower value cited in the Recommendations of the Scientific Council on the Reorganisation of the Blue List*[3]*. When making appointments in future the Institute should seek to increase the number of fixed-term positions."*

46 % are now on fixed-term positions.

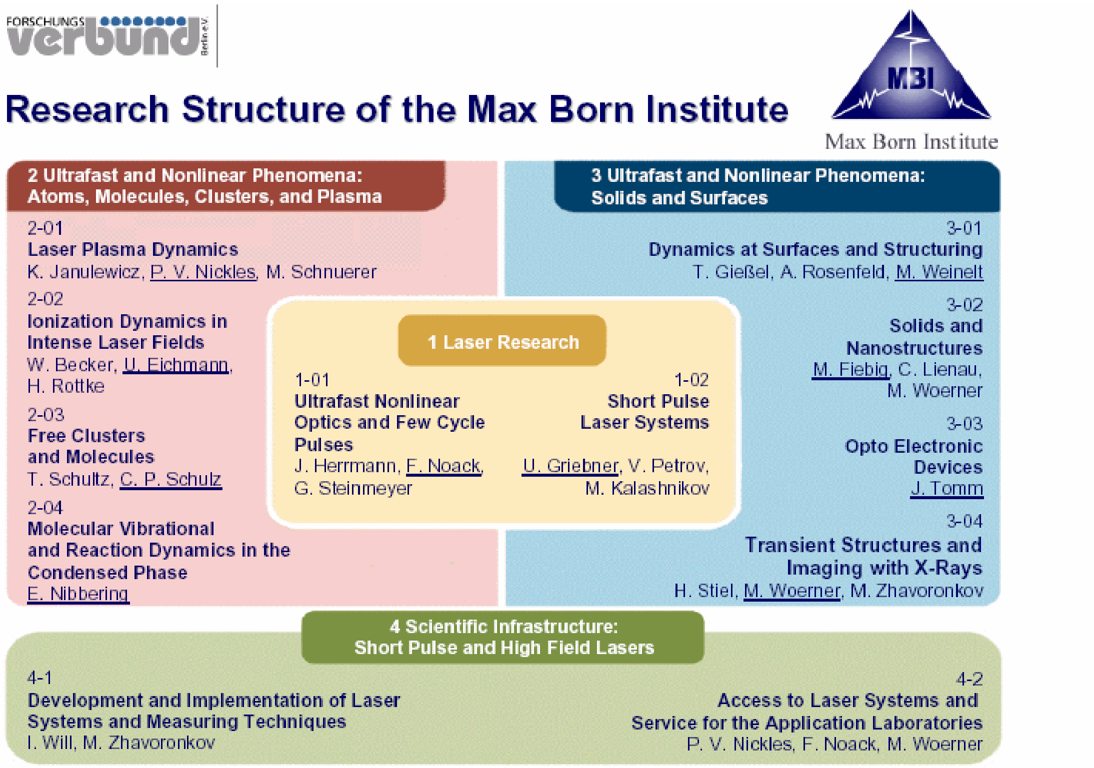
o) *"The MBI is involved sufficiently in the training of diploma and doctoral students; however, the number could and should be increased in future. It is pleasing to note that the Institute attracts a comparatively large number of doctoral students from abroad. The number of early-stage researchers from the Berlin vicinity should be pushed up significantly."*

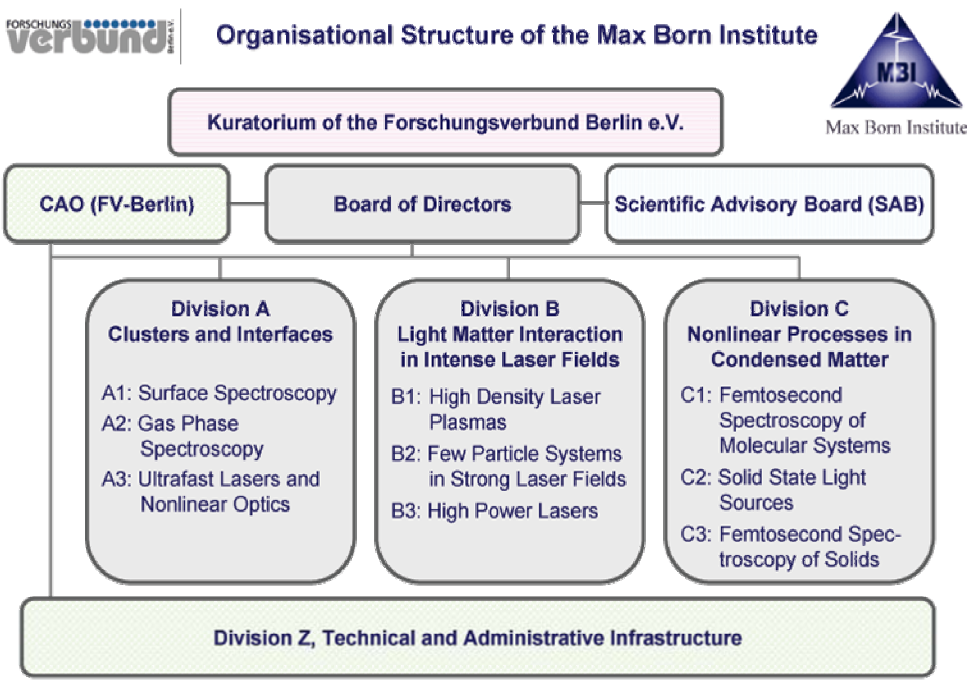
See d) above.

[3] Cf. Wissenschaftsrat: Empfehlungen zur Neuordnung der Blauen Liste, in: Empfehlungen und Stellungnahme 1993, Köln 1994, S. 453 ff.

Appendix 1

Organisation





Appendix 2

Financial Resources and Allocation of Resources

(Figures in € 1.000)

		2004	2003	2002
I. Financial Resources (income)[1]		**15,504**	**15,848**	**15,718**
1.1	**Institutional Funding**	**11,842**	**11,490**	**11,582**
	-Federal States[2]	5,658,5	5,482	5,528
	-Federal Government[2]	5,657,5	5,482	5,528
	-Other institutional funding[3]	526	526	526
	Insitutional funding as a proportion of total financial resources	*76%*	*73 %*	*74 %*
1.2	**Research Support**	**2,777**	**3,185**	**3,115**
	As a proportion of total financial resources	*18 %*	*20 %*	*20 %*
1.3	**Services, contracts, licences, publications**	**58**	**177**	**130**
	As a proportion of total financial resources	*0.4 %*	*1 %*	*1 %*
1.4	**Other third-party Resources**	**144**	**204**	**130**
	As a proportion of total financial resources	*1 %*	*1 %*	*1 %*
1.5	**Balance from previous year**	**683**	**792**	**761**
II. Expenditures		**15,504**	**15,834**	**15,718**
2.1	Personnel	8,035	8,185	7,650
2.2	Materials, supplies, equipment	3,458	3,323	3,355
2.3	Investments (not including building investments)	3,085	2,833	3,177
2.4	Building investments[4]	0	10	2
2.5	Special positions (where applicable)[5]	526	526	526
2.6	Allocation to Reserves	117	683	792
2.7	DFG charges (directly transferred by the State of Berlin)	283	274	276

[1] Actual revenues in each year classified by financial resource; not incl. money in transit
[2] Support according to BLK decision
[3] Special financing, see No. 7.
[4] Building investments, multi-annual measures for building maintenance, land acquisition, incl. demolition
[5] Rent budget from the federal government for building maintenance, land acquisition, incl. demolition

Appendix 3

Third-party resources classified by organisational / scientific unit[1]

(Figures in € 1000)

	2004	2003	2002
I. Total	**2,979**	**3,566**	**3,375**
- DFG (German Research Foundation)	1,005	1,010	794
- Federal Government	608	925	1,139
- Federal States (German *Länder*)	0	0	0
- EU project funding	331	385	431
- Foundations, other research support	833	865	751
- R&D ass., industry, services, licences	58	177	130
- Other third-party resources[2]	144	204	130
II. By organisational unit			
RD 1:Laser Research	**611**	**907**	**1,129**
- DFG (German Research Foundation)	92	93	97
- Federal Government	271	501	752
- Federal States (German *Länder*)	0	0	0
- EU project funding	115	123	98
- Foundations, other research support	117	141	175
- R&D ass., industry, services, licences	16	49	7
- Other third-party resources[2]	0	0	0
RD 2: Ultrafast and Nonlinear Phenomena – Atoms, Molecules, Clusters, and Plasma	**636**	**842**	**754**
- DFG (German Research Foundation)	490	488	507
- Federal Government	11	55	70
- Federal States (German *Länder*)	0	0	0
- EU project funding	15	70	50
- Foundations, other research support	96	229	98
- R&D ass., industry, services, licences	24	0	29
- Other third-party resources[2]	0	0	0

[1] Actual expenditure in each year classified by financial resource; not incl. money in transit unless explicitly specified

[2] Donations, membership fees etc.

	2004	2003	2002
RD 3: Ultrafast and Nonlinear Phenomena – Solids and Surfaces	**724**	**1.056**	**979**
- DFG (German Research Foundation)	423	429	190
- Federal Government	222	369	317
- Federal States (German *Länder*)	0	0	0
- EU project funding	26	103	215
- Foundations, other research support	35	57	180
- R&D ass., industry, services, licences	18	98	77
- Other third-party resources[2]	0	0	0
RD 4: Scientific Infrastructure	**864**	**557**	**383**
- DFG (German Research Foundation)	0	0	0
- Federal Government	104	0	0
- Federal States (German *Länder*)	0	0	0
- EU project funding	175	89	68
- Foundations, other research support	585	438	298
- R&D ass., industry, services, licences	0	30	17
- Other third-party resources[2]	0	0	0
Other third-party resources	**144**	**204**	**130**
- Other third-party resources (Management, EFRE etc.)			

Appendix 4

Staffing acc. to Sources of Funding and Pay Scale[1]

- Personnel (financed by institutional and third-party resources) in terms of full-time equivalents [reporting date 31.12.2004])-

	Total number[2,3]	Number financed by	
		Institutional resources[2]	Third-party resources[2]
Total	**151.2**	**124**	**27.2**
1. Academic and higher management staff	**64.1**	**51.6**	**12.5**
- S (B4 and above)	3	3	0
- S (B2, B3)	1	1	0
- I, A 16	2	2	0
- Ia, A 15	4.4	4.4	0
- Ib, A 14	24.2	24.2	0
- IIa, A 13	29.5	17	12.5
2. Doctoral candidates[4]	**14.7**	**6.8**	**7.9**
3. Other staff	**72.4**	**65.6**	**6.8**
- III, IV, A 12, A 11, A 10	22.1	19.1	3
- V, A 9, A 8	20	17	3
- VI, A7	5.5	5.5	0
- VII, VIII, A 6, A 5	7.3	6.5	0.8
- Wage groups, other staff	11.5	11.5	0
- Trainees	6	6	0

[1] Employment positions acc. to BAT or other collective pay agreements for staff financed by institutional or third-party resources (incl. trainees and guest scientists, but excluding diploma students, student assistants and contracts for work and services)
[2] In full time equivalents
[3] Values in column 2 ("Total number") for "Total", "1. Academic and management staff", 2. "Doctoral candidates" and 3."Other staff" correspond to the respective values in Appendix 5.
[4] Excluding scholarship holders

Appendix 5

Staffing acc. to Organisational / Scientific Unit

-Personnel (financed by institutional and third-party resources) in terms of full-time equivalents
[reporting date 31.12.2004-])

	Total	Academic and higher management staff[1]	Doctoral candidates[2]	Other staff, trainees
Entire establishment	**151.5[3]**	**64.3**	**14.7**	**72.5**
Management, local administration, technical infrastructure, library	40.5	6.8	0	33.7
RD 1: Laser research	26.9	15.9	2.6	8.4
RD 2: Ultrafast and Nonlinear Phenomena – Atoms, Molecules, Clusters, and Plasma	31.8	14.9	8.1	8.8
RD 3: Ultrafast and Nonlinear Phenomena – Solids and Surfaces	25.6	15.5	3.4	6.7
Focus 4: Scientific Infrastructure and Scientific Education	26.7	11.2	0.6	14.9

[1] Employment positions acc. to BAT IIa and above (not incl. doctoral candidates)
[2] Doctoral candidates financed by institutional or third-party resources
[3] The number differs in comparison with Appendix 4, due to rounding differences.

Appendix 6

Personnel

-In Persons (financed by institutional and third-party resources) acc. to pay scale [reporting date 31.12.2004])-

	Total number	Financed by third-party resources		Temporary contracts		Women		Women on temporary contracts[1]	
		Number	%	Number	%	Number	%	Number	%
I. Total	**167**	**32**	**19.2**	**77**	**46.1**	**45**	**26.9**	**19**	**42.2**
1. Academic and higher management staff	**67**	**13**	**19.4**	**32**	**47.8**	**3**	**4.5**	**3**	**100**
- S (B4 and above)	3	0	0	0	0	0	0	0	0
- S (B2, B3)	1	0	0	0	0	0	0	0	0
- I, A 16	2	0	0	0	0	0	0	0	0
- Ia, A 15	6	0	0	2	33.3	0	0	0	0
- Ib, A 14	25	0	0	5	20	0	0	0	0
- IIa, A 13	30	13	43.3	25	83.3	3	1.8	3	100
2. Doctoral candidates	**23**	**12**	**52.2**	**23**	**100**	**4**	**17.4**	**4**	**100**
3. Other staff	**77**	**7**	**9.1**	**22**	**28.6**	**38**	**49.4**	**12**	**31.6**
- III, IV, A 12, A 11, A 10	23	-	-	-	-	-	-	-	-
- V, A 9, A 8	21	-	-	-	-	-	-	-	-
- VI, A7	6	-	-	-	-	-	-	-	-
- VII, VIII, A 6, A 5	9	-	-	-	-	-	-	-	-
- Wage groups, other staff	12	-	-	-	-	-	-	-	-
- Trainees	6	-	-	-	-	-	-	-	-

[1] Women on temporary contracts / number of women

Appendix 7

Publications[1]

Total number and classification by organisational unit[2]

	2004	2003	2002
I. Total	**162**	**132**	**123**
- Monographs (authorship)	1	0	0
- Monographs (editorship)	2	0	0
- Papers in peer-reviewed journals and books	159	132	123
II. By organisational units			
RD 1: Laser research	**31**	**33**	**20**
- Monographs (authorship)	0	0	0
- Monographs (editorship)	0	0	0
- Papers in peer-reviewed journals and books	31	33	20
RD 2: Ultrafast and Nonlinear Phenomena – Atoms, Molecules, Clusters, and Plasma	**59**	**58**	**55**
- Monographs (authorship)	1	0	0
- Monographs (editorship)	1	0	0
- Papers in peer-reviewed journals and books	57	58	55
RD 3: Ultrafast and Nonlinear Phenomena – Solids and Surfaces	**72**	**41**	**48**
- Monographs (authorship)	0	0	0
- Monographs (editorship)	1	0	0
- Papers in peer-reviewed journals and books	71	41	48

[1] The MBI has documented its publications since 1992 according to monographs and papers in peer-reviewed journals and books. Any subdivision into journals, collective works and other media would be highly ambiguous. However, non-peer-reviewed publications in general are discouraged and are not listed here at all. Hence, the entries here differ slightly from the original categories of the Leibniz Senate.

[2] Each publication is counted only once and has been assigned to one organisational unit.

Appendix 8

Documents submitted by the MBI

- Evaluation report according to the Evaluation Questionnaire for the Leibniz Association Research and Service Facilities (including tables)
- Organisation Charts
- Research Plan, Programme Budget 2006; *Wirtschaftsplan 2005*
- Lists: Invited Lectures at Conferences; *Mitglieder des Kuratoriums des Forschungsverbundes Berlin; Mitglieder des Wissenschaftlichen Beirats des MBI*; List of Employees who have been offered a chair or professorship
- *Satzung des Forschungsverbundes Berlin e.V. mit Übersicht und Satzung des Instituts*
- Reports of the 10th, 11th, 12th Meeting of the Scientific Advisory Board of the MBI
- *Verfahrensordnung: Verfahren bei Verdacht auf wissenschaftliches Fehlverhalten im Forschungsverbund Berlin e.V.*
- Binding guidelines for the implementation of the rules to ensure good scientific practice at the MBI
- *Vereinbarung zur Förderung der Chancengleichheit*
- Lists: Projects funded by third-parties; Visiting scientists 2002–2004; Fellowships, Stipends and Scholarships 1998-2004; Visits of MBI staff to other establishments 2002-2004; Listing of visits by the establishment's staff to other establishments 2002-2004; List of lectures and courses; List of publications 2002-2004; Most important publications in the period from 2002 to 2004; Cooperation 2002-2004; Scientific meetings organised by the MBI/Participation in the organisation/management of external events

Senate Evaluation Committee

SAE 0100/06
01.10.06

Annex B: Evaluation Report

Max Born Institute (MBI) for Nonlinear Optics and Short Pulse Spectroscopy

Contents

List of Abbreviations

BESSY	Berlin Electron Storage Ring Company for Synchrotron Radiation
BMBF	German Federal Ministry of Education and Research (*Bundesministerium für Bildung und Forschung*)
BRIGHT	High-Brightness Laser Diode Systems for Health, Telecom and Environment Use
CPA	Chirped Pulse Amplification
DESY	German Electron Synchrotron
DFG	German Research Foundation, *Deutsche Forschungsgemeinschaft*
DT-CRYS	Double Tungstate Crystals
EU	European Union
FBH	*Ferdinand-Braun-Institut für Höchstfrequenztechnik*
FEL	Free Electron Laser
FVB	*Forschungsverbund Berlin e. V.*
KLR	Efficiency-related cost calculation system
MBI	Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy
OpTecBB	Optical technology for Berlin and Brandenburg, *Optec-Berlin-Brandenburg e.V.*
SAB	Scientific Advisory Board
SAE	Senate Evaluation Committee, *Senatsausschuss Evaluierung*
SFB	Collaborative Research Centre, *Sonderforschungsbereich*
SME	Small and Medium-Sized Enterprise
TRUST	The Federal Trust for Education and Research

1. Summarised Evaluation and Relevance of the Facility

The MBI is one of the leading institutes in ultrafast and high intensity laser matter interactions worldwide. Over the past few years, the Institute has undergone major structural changes which have sharpened the focus within its areas of research. These changes have resulted in a higher degree of internal and external collaboration and a substantial increase in scientific output. The Institute now holds a unique position in Germany, and compares well with the top institutions in Europe and North America.

Measured against international standards, many instruments at the MBI have unsurpassed qualities. In the field of ultrafast and high field lasers, no German university can compete with the technical scope and instrumental standard found at the MBI. Similarly, the broad research scope of the MBI, which stretches from physics to biology, cannot be found elsewhere.

Since the last evaluation, there has been a substantial rise in cooperation projects, and the MBI now enjoys a high level of recognition within the scientific community of laser research institutes. This higher visibility is both regional, e.g. through the OpTec-Berlin-Brandenburg initiative, and nation- and European-wide thanks to the Institute's leadership in networks such as LASER-LAB Europe and larger cooperation projects with institutions such as BESSY and DESY. The number of publications and, in particular, publication quality, which is outstanding, have both increased substantially, a fact which can be attributed in part to the increase in the number and strength of collaboration projects.

Following a recommendation made during the previous evaluation in 1998, support for experimental research studies at the MBI through a greater focus on theoretical research aspects has improved. Nevertheless, the theoretical research is not strong enough and not sufficiently integrated in the research programme. Theory should play an independent role at the MBI and should be implemented in the scientific structure of the Institute permanently.

Following the major restructuring and the successful promotion of research collaboration between the divisions, the MBI has to develop now its long-term strategy for the future of the Institute.

2. Mission, Tasks, Main Work Areas

The MBI fulfils its **mission** to conduct basic research in the field of nonlinear optics and ultrafast dynamics of the interaction of light with matter, as well as to follow up applications that emerge from this research. The Institute develops and uses state-of-the-art ultrafast and ultra-intense lasers and laser-driven short-pulse light sources in a broad spectral range from the near infrared up to the X-ray region in combination with nonlinear spectroscopy methods. Thanks to the use of a common technology that interweaves a variety of scientific fields, a wide range of disciplines stretching from physics to biology work together in a way that could not be achieved at any university in Germany.

The MBI has a leadership position in the development of ultrashort and ultraintense pulsing laser sources with relevant applications in different research areas. These high performance systems provide national and international users with important experimental facilities and allow high-quality research to be performed in-house by staff scientists. The Institute plays a leading role in short pulse physics and laser research both nationally and internationally. The MBI is excellent in its core fields and enjoys high international visibility. Examples of their excellent, pioneering and/or unique research include the activities on time-resolved X-ray diffraction, combined femtosecond and optical near-field spectroscopy, mid-IR spectroscopy, the spectroscopy of magnetic materials, “high-field” THz experiments, the development of CPA laser systems and table-top-scale collisionally pumped X-ray lasers, the synchronization of a 20 TW (soon to be 100 TW) Ti:sapphire laser with an Nd:Glass laser, spin dynamics, time-resolved photoelectron spectroscopy, levitated nanoparticles, photo-induced switching of self-assembled monolayers, plasmonic crystals, ultrafast and magnetoelastic phase control in antiferromagnets, and the dynamics of hydrogen bonds in water.

During the last evaluation in 1998, a lack of continuous theoretical support was identified, in particular for Division C. Since then, extended and successful cooperation with several university groups that work on theoretical research aspects has been developed. In addition, in-house theoreticians are involved in a number of projects. Stronger theoretical support is, however, still clearly needed at the MBI. Thus, in order to strengthen this research area it is recommended that the number of theoreticians be increased and that theoretical research be integrated into the scientific structure of the MBI permanently. Theory should play an independent role at the Institute in order to inject ideas into the scientific programme and the vision of the MBI rather than just explaining experiments. The MBI should consider the possibility of creating a new research focus dedicated to theoretical research, headed by a senior scientist who has the expertise and vision to oversee the area of theory for the entire Institute. Alternatively, a Junior Research Group *(Nachwuchsgruppe)* could be established at the MBI within the framework of one of the different SFBs in which the Institute is involved. The head of this group should be independent of any particular director and build up an additional research group which covers work on theoretical research aspects that are relevant for the scientific work of the Institute as a whole. The necessary filling of a director’s position in 2009 could also be used to further strengthen the work on theoretical research aspects.

The organisational structure of the MBI contains three scientific divisions covering the following areas of research: Division A - Clusters and Interfaces, Division B - Light Matter Interaction in Intense Laser Fields, Division C - Nonlinear Processes in Condensed Matter. The research structure of the MBI consists of ten interdivisional research projects and two infrastructure projects, organised in four areas of focus. After the successful promotion of research collaboration between the divisions, it is recommended that the MBI now improve on its **long-term strategic vision** of the future of the Institute. So far, most projects listed as mid-term visions have essentially continued in the same direction as on-going projects and have not ventured in new directions.

Focus Area 1 “Laser Research”

Ultrafast Nonlinear Optics and Few Cycle Pulses and **Short Pulse Laser Systems:** This research focus area is evaluated as very good, and some experiments, e.g. on the self-compression of 5 mJ pulses and the use of photonic band-gap material as superfocussing material, are regarded as unique. Similarly, the projects on the improvement and simplification of femtosecond laser oscillators are highly regarded. Work on theoretical aspects seems well integrated in the projects and the groups are cooperating well with other areas of the MBI. The development of lasers and the work on the improvement of the contrast of lasers are not seen as high-profile scientific research, but as important for the Institute and instrumental for the success in other research areas. Short pulse lasers combined with SR radiation sources in novel pump-probe experiments are a growing field of interest. The DESY X-FEL project, with the important MBI contribution of the photoinjector, may represent a significant opportunity for the Institute to become involved in a very high-profile undertaking, and become part of a major national science project with potential increases in third-party funding. Further, it is recommended that the good, close external cooperation with the *Ferdinand-Braun-Institut für Höchstfrequenztechnik* (FBH) continue.

Focus Area 2 "Ultrafast and Nonlinear Phenomena: Atoms, Molecules, Clusters, and Plasma"

Laser Plasma Dynamics: The work in this area, e.g. the experiments on accelerated protons with a narrow band kinetic energy distribution and the development of table-top-scale collisionally pumped X-ray lasers, is both unique and impressive. Nevertheless, more theoretical support is needed and should bolster the present research. The group focuses its vision on the high-power laser, which is regarded as somewhat narrow a focus.

Ionization Dynamics in Intense Laser Fields: The group has many achievements to its credit and is one of the world leaders in the use of the reaction microscope for diagnosing strong field ionization of atoms and small molecules. Their publications are highly cited in high-ranking scientific journals. The work of the group is well positioned on one branch of attosecond physics. They are combining optical technology with collision techniques to measure multi-electron and multi-particle dynamics. This work may have a major impact on both collision science and attosecond science. The group is a model for the Institute in another way as well. Theory and experiment work hand-in-hand in the group, each augmenting the impact of the other. The Institute should invest heavily in this group, allowing them to expand into attosecond optical science. This investment will pay off in scientific output and simultaneously prepare for a future in which attosecond methods can be applied at MBI to a wide range of molecular and solid state science problems.

Free Clusters and Molecules: This group is one of the leading groups in the field of photo electron spectroscopy at ultrafast time scales. There are a number of outstanding projects in this area. Particularly exceptional are the photochemical experiments on hydrogen bonds in DNA base pairs, as well as the experiments with chloride ions and their charge transfer to water after excitation. The water-jet project is rated as important for the Institute since it bridges the gas and liquid phases. Due to the technical limitations of X-ray femtosecond experiments for the observation of internal motions, it is recommended that more experiments be conducted in the gas phase.

Molecular Vibrational and Reaction Dynamics in the Condensed Phase: The research results in this field are rated excellent. They are highly regarded in the scientific community and the publications of this group appear in high-ranking journals. Particular highlights in molecular physics are the results on the dynamics of hydrogen bonds in water. Some of the work on multi-dimensional IR spectroscopy is outstanding. Although one key scientist of this field left the MBI four years ago, the Institute has still succeeded in maintaining its expertise and techniques and continues its excellent research work. In addition, more research activities on theoretical aspects would be an even greater benefit to the research work.

Focus Area 3 "Ultrafast and Nonlinear Phenomena: Solids and Surfaces"

Dynamics at Surfaces and Structuring: The research in this field is considered creative, original and outstanding. The work of this group is seen as a good example of application-oriented research work leading to the development of optoelectronic devices. The group is collaborating successfully with industrial partners and attracts considerable amounts of third-party funding. The peers see the need for more theoretical support of these investigations.

Solids and Nanostructures: The MBI is one of the leading institutions in the field of combined ultrafast spectroscopy and surface science and low-temperature processes. The THz experiments, which were developed in this group, are regarded as very good, as is the development of molecular plasmonics. Publications appear in high-ranking scientific journals. The consistently broad scientific base in this research area, the fostering of external cooperation in the field of theory, as well as the good perspectives for younger researchers are highly valued merits.

Optoelectronic Devices: This rather small research group performs application-oriented research work using transient technologies. The work of this group focuses on the reliability and life-time of high-power GaAs-based laser diodes and on MIR-laser diodes. The group demonstrates a wealth of experience, very good laboratories, and has published in important scientific journals. It is well equipped with third-party funding (EU, BMBF). The group should seek new future ideas for its mid-term perspective in order to incorporate the femtosecond potential of the MBI. Close cooperation with the FBH is recommended.

Transient Structures and Imaging with X-rays: The research in this area encompasses all three divisions of the MBI, and it is strongly driven by division C. The group is working on imaging with X-rays, diffraction and the development of light sources. It has also opened up an entirely new research area with femtosecond X-ray diffraction experiments in order to study inorganic and organic molecular crystals. The group has been successful in obtaining the first ever X-ray diffraction data on a molecular crystal. The biological studies being conducted are considered highly promising for the future. The publication record of the group is outstanding.

Focus Area 4 "Scientific Infrastructure: Short Pulse and High Field Lasers"

Development and Implementation of Laser Systems and Measuring Techniques and **Access to Laser Systems and Service for the Application Laboratories:** This scientific infrastructure, which provides dedicated application laboratories, is valued highly. It is strongly recommended that this structure be kept. The application laboratories are part of the LASER-LAB-EUROPE network of laboratories and offer their resources to the scientific community and to industrial collaborators. External users are attracted to this facility and it is rated as highly valuable and unique, both in Germany and Europe. The management of the MBI has decided to organise this participation not in the form of a user facility but in the form of collaboration work. This approach is strongly supported. If approached wisely, this will create a better quality of research than if the laboratories are operated as a user facility.

3. Structural Features and Organisation

As a result of the recommendations of the last evaluation with respect to the **organisational structure** of the MBI, the three scientific divisions have been partially restructured. The activities of Division B have been focused, and more resources have been allocated to it. The three divisions are now essentially equal in terms of staff, resources and productivity. All matters relating to technical and administrative infrastructure are included in a fourth area, Division Z. These changes have resulted in a much more streamlined organisational structure within the Institute.

In a matrix structure, interdivisional collaboration projects have also been initiated. At present the **research structure** of the MBI consists of ten research projects and two infrastructure projects, organised in four areas of focus. This research structure is arranged according to interdisciplinary subject areas, thereby strengthening internal and external collaboration. The money flow is now directed at projects in these research areas. The successful interdivisional collaboration is manifested by a number of joint publications and an overall better publication record. Additive effects from the allocation of common resources have also been achieved.

The very positive development of the MBI throughout the last few years is duly recognised, and the present structure is seen to work well and will enable the MBI to play a major role also in future laser research. It is strongly recommended to continue this successful development in order to further enhance collaboration between groups, projects and divisions. The interdisciplinarity within the Institute could be even more far-reaching.

Over the last few years, the scientific quality of the MBI has been enhanced thanks to the highly capable **management**. The three directors of the Institute have demonstrated strong leadership and have given very good scientific guidance. At the same time, they leave the young researchers enough freedom to develop new ideas. They have also been very successful in creating a diverse network for laser research with the MBI in a key position. Not only the MBI's academic contacts in the Berlin area, but also its contacts in industry and the networking and lobbying work for the support of laser research within the EU framework programme are highly appreciated.

The **Scientific Advisory Board (SAB)** has very actively participated in guiding the MBI through the structural changes of the past few years. To some extent, the MBI's substantial rise in scientific output and visibility can be clearly attributed to the work of the SAB. The minutes of the meetings, however, do not reflect the critical evaluation of the Institute by the SAB. As the MBI is involved in cooperation with industry, the inclusion of a member from industry in the SAB may be advisable.

The administration is run effectively and an **efficiency-related cost calculation system (*KLR*)**, which was developed as a pilot project by the MBI within the frame of the FVB (*Forschungsverbund Berlin*), is firmly established at the Institute. Reports deduced from the KLR are used only to coordinate investments on a yearly basis and not as a means for internal competition or to allocate physical resources. IT-personnel are located mainly within the individual divisions, and only two IT-employees are responsible for central service tasks. A reorganisation of the IT-service is recommended.

4. Resources, Expenditure and Personnel

The MBI is equipped with excellent instruments and a good infrastructure. The Institute is very successful in acquiring **third-party funding** from DFG, the EU and BMBF. A considerable number of collaboration projects with industrial partners, also within EU contracts, have been established. This brings in considerable amounts of third-party funding per year. In this respect, the MBI clearly fulfils its mission to provide scientific input to advanced technologies.

The Institute wishes to renew several pieces of vital **equipment** ten years after the initial investment. This wish is strongly supported by the peers. The MBI needs state-of-the-art instruments to stay internationally competitive in the rapidly developing field of short pulse physics. Upgraded instruments would allow some research groups of the MBI to enter into new areas of their research fields. The Institute's request for additional replacement funding should be backed by a sharpened long-term vision for future MBI research activities.

The MBI has also applied for additional funding to the value of € 200,000 for a MBI Guest Programme. This programme is meant to further promote the Institute's visibility and external cooperation by allowing for two high-ranking visiting scientists per year to stay at the MBI for a period of 6-12 months. The guest programme is strongly supported by the peers. If properly positioned and if the multidisciplinarity of the MBI is exploited wisely, it might be a valuable asset to both the MBI and the scientific community in Germany.

Besides the necessary additional institutional funding for equipment and the proposed guest programme, the MBI is advised to consider funding possibilities such as the Pact for Research and Innovation *(Pakt für Forschung und Innovation)*.

The MBI has furthermore expressed the need for the compensation of a structural deficit in its basic institutional funding for material and smaller equipment. This deficit has hitherto been compensated by using other funds, e.g. for investments. To overcome this structural deficit the MBI asks for an increase in its annual budget by € 300,000. It is rated that the MBI should be able to compensate this deficit by reallocating its annual budget wisely, especially if some of the larger key replacement investments requested are funded by extra means.

As of 31.12.2004, the MBI staff comprises 45 women (27 % of the total staff), three of which were in the academic and higher management staff and four (17 %) were doctoral candidates. Since the last evaluation in 1998 the number of women among academic and upper-level management staff increased from one to three. This female quota is too low. It is recommended that the MBI develop a strategy for increasing the quota of female students and female scientific employees over the next few years.

The MBI staff has become more international over the years. Several post-docs come from outside Germany. MBI's young scientists, by way of contrast, have found prestigious positions at universities around the world. Six MBI researchers received an offer for a professorship at universities in Germany and abroad between 1998 and 2004.

5. Promotion of Junior Academics and Cooperation

The Institute is well integrated into the scientific community of Berlin. Directors of the Max Born Institute play a very active role in the German scientific community, for instance in EU research programmes or as coordinators in the Priority Programmes of the German Research Foundation *(DFG).* The Institute is also active in the cooperation between science and technology in the Berlin area.

The three MBI directors are jointly appointed professors at the three Berlin universities, and MBI scientists regularly teach at these universities and at the University of Dortmund. These lectures are the main recruitment path and are instrumental in attracting students to the MBI. The MBI also receives an increasing number of doctoral students recommended by colleagues and collaborating groups.

In the period 2002 to 2004, 11 diploma candidates and 20 doctoral candidates completed their theses. The Institute is also active in vocational training and, between 1998 and 2004, 7 physics laboratory assistants and 3 administrators completed their training at the MBI in the framework of the German Dual Education System.

The **relations between the universities and the MBI** are very good, and the teaching and technical support is rated highly. The success of research collaboration can also be clearly seen in the cooperation in three SFBs, one trans-regional SFB and a graduate school. Furthermore, the participation of the MBI in the centres for optical research at the universities and in initiatives to apply for excellence clusters are likewise highly valued.

Academic and professional **training for young researchers** in the form of lectures, seminars and colloquia are key activities at the MBI. Experimental research at the Institute is combined with lectures and courses for the students and researchers. At the students' level, a lack of transparency is noted as communication structures, such as seminars, are separately maintained within each division. As a consequence, there is room for improvement with regard to student awareness of research in other divisions. It is recommended that further structures, such as interdivisional seminars, be introduced in order to promote contacts between the different divisions.

The MBI also fosters interaction in small groups with visiting researchers, as well as the promotion of informal meetings. The Institute plays an active role in the International Humboldt Graduate School on Structure, Function and Application of New Materials, which started in 2001. It is also an active partner in the planning of a joint master programme for all Berlin universities in the field of optical technologies. A summer exchange programme for students from American universities, in particular the University of Central Florida, has been in existence since 2002. The MBI also participates in national and international summer student programmes. This development, and the resulting higher visibility of the MBI, is highly rated. Efforts to broaden the recruiting base for students should be continued. Appointments for joint junior professors may be possible ways of deepening the ties between the Institute and universities.

There has been a substantial rise in the number of **cooperation projects** with other laser research institutes and the MBI is well recognized in the respective scientific community. The higher visibility is regional, e.g. thanks to the OpTec-Berlin-Brandenburg initiative involving more than 80 partners from industry and science, as well as nationwide and European-wide thanks to its leading role in major networks. The DFG Priority Programme *(Schwerpunktprogramm)* 1134, which is co-ordinated by the MBI, is expected to have an important impact on the scientific community in Germany. The participation of the MBI in EU projects and initiatives is also of high quality. MBI's co-ordinating function in LASERLAB-EUROPE, a network of the major large-scale laser facilities in Europe, is a clear example of the recognition that MBI enjoys in the European research scene, in terms of both scientific output and management skill. The MBI's involvement in EUROFEL, which aims at the development of Free Electron Laser Sources, is a clear indication of the quality of laser system development performed at the Institute over the last few years. The current managing director's participation in the major initiatives for the preparation of the Seventh EU Framework Programme (Photonics Technology Platform, Strategic forum on Research Infrastructures and Forum of Integrated Initiative Infrastructures) demonstrates the strategic view taken with regard to the future development of research. Within the LASERLAB-EUROPE network, the MBI offers external users access to its application laboratories including relevant scientific, technical and logistical support. The facilities include the femtosecond application laboratory and the high field laser laboratory.

Minor concerns are raised with respect to the present legal framework for cooperation at the MBI, in particular on patenting issues; specifically, this may be a possible hindrance to scientific development and the publication of scientific results. It is suggested that the framework be revised such as not to compromise the success of future cooperation.

The MBI played an important role in the setting up of the TESLA Test Facility (TTF) at the German Electron Synchrotron (DESY) in Hamburg. The Institute is involved in the development of the photoinjector of the free electron laser sources (FEL) both at DESY and BESSY. This involvement is rated as very valuable. Although the development of the laser applications may not directly lead to a high scientific output on a short-term basis, the MBI will most certainly gain visibility with this activity.

Cooperation between the MBI and industrial partners has substantially increased over the last few years. Such cooperation exists both on a local level, e.g. through the WISTA initiative at the Adlershof Campus, and within larger frameworks funded by the EU or BMBF. Examples of such cooperation include (i) building high-brightness laser diode systems for health, telecoms and environmental applications within the European BRIGHT project, (ii) synthesis and characterisation of double tungsten crystals as part of the European DT-CRYS project, and (iii) reliability analyses of brilliant high-power diode lasers in industrially relevant operation modes as part of the German TRUST project.

6. Results and Scientific Resonance

The number of **publications** with contributions by MBI personnel has increased significantly since the last evaluation. During the past reference years 1994 to 1996, 297 reviewed papers were published, while during the current reference years 2002 to 2004, there were 417 publications. Moreover, the impact factor of the journals in which these MBI publications appeared has substantially increased. It is highly appreciated that the MBI aims to further improve the quality of its publications, rather than the number of publications. The scientific quality of the work presented by MBI is outstanding, a fact that can be seen in its publications in top international scientific journals (*Nature, Science*, *Physical Review Letters*, etc.) and invited talks at top international conferences.

Assessing results for potential **patenting** prior to publication is routine at the MBI. The Institute now holds or has applied for 52 national and international patents covering a wide range of laser and optical technology. To a lesser extent, some patents also include preparation techniques for new materials. For cost reasons, the MBI has filed predominantly German patents and follows a strategy of selling patents to companies rather than building up a large patent portfolio itself. Between 1998 and 2004, the total revenue from the sale of three patents and one licence was € 25,000. Patent annuities of MBI sum up on average to € 17,000. It is recommended that the MBI thoroughly reviews its patenting strategy. Special emphasis should be placed on the time and man-power invested in patent applications versus the revenue of patents sold.

The MBI is a **consulting partner** and provider of technical support for companies from the fields of laser technologies and optoelectronics. Over the last few years, the Institute has developed and sold scientific instruments and technological prototype solutions, bringing in a total revenue of € 650,000. The instruments sold included, among others, near-field scanning optical microscopes for cryogenic temperatures, specialised lasers for various FEL and synchrotron applications, as well as polishing methods for glass ceramics on a nanometre scale using femtosecond technology. Further profits are realized by **technology transfer** to other research institutions as well as to small and medium-sized enterprises (SMEs). Over the last year MBI has developed contacts with industrial users. It is important to continue in this direction by developing and strengthening these kinds of relationships so that scientific work can be tailored towards potential commercial applications.

Technology transfer at the MBI is matched with extensive **knowledge transfer**. The MBI has a large number of cooperative projects with universities, other research institutions, and industrial partners. The cooperation with guest scientists is undoubtedly one of the main channels for such transfer. For example in 2004, more than 100 guest scientists worked at the MBI for at least two weeks. About half of them stayed over a month.

The MBI has significantly increased its presence in organisations, networks and committees which are instrumental in the area of science policy. Further, the MBI actively communicates its results to a scientific audience, students and the general public.

Between 1998 and 2004, six MBI researchers received an offer for a professorship at universities in Germany and abroad. MBI scientists have also been awarded a number of prizes, awards and honorary titles. This achievement of the MBI personnel is rated as very good.

7. Implementation of German Science Council's Recommendations

The MBI has followed the recommendations of the last evaluation by the German Science Council (*Wissenschaftsrat*) in 1998 to a very large extent. This encompasses a considerable structural reorganisation, whereby Division B has improved significantly and the three research divisions are now equal in personnel and financial resources. Numerous internal collaborations have been created, too. Furthermore, external cooperation with industrial enterprises and research institutes has been intensified. Cooperation with external groups working on theoretical research aspects has been strengthened. The Institute has enhanced its national and international visibility over the last few years and is actively involved in several large-scale networks, both nationally and internationally. The Scientific Advisory Board has had an important role in providing advice on the restructuring process and in the recruitment of higher-ranking staff to the Institute. The number of guest researchers has increased, as has the number of students. The number of women in academic and higher-level management staff still needs to be improved. The MBI's work on theoretical research aspects has improved considerably but is still not strong enough. It should be implemented in the scientific structure of the Institute permanently.

8. Summary of the Evaluation Committee's Recommendations

1) The Institute has realized major structural changes that have resulted in a much more streamlined organisational structure within the Institute. Internal and external collaborations have been strengthened and additive effects from the allocation of common resources have been achieved. It is recommended that this successful development continue to further strengthen collaborations between groups, projects and divisions. The new structure of the Institute appears to work very well and should be retained in the future.
2) A convincing long-term vision of the Institute is missing. So far, most projects essentially pursue existing project directions only. The Institute has to improve in this respect in view of the pending retirement of one of the directors and the necessary replacement of major equipment.
3) Following a recommendation made at the last evaluation, support for experimental research studies at the MBI through more theoretical research has improved but is still not strong enough. It is recommended that this research area be strengthened by increasing the number of theoreticians and by integrating theoretical research into the scientific structure of the MBI permanently. Theory should play an independent role at the Institute in order to inject ideas into the scientific programme and the vision of MBI. The MBI may consider creating a new research focus dedicated to theoretical research, headed by a senior scientist, or setting up a Junior Research Group *(Nachwuchsgruppe)* to work on theoretical research aspects that are relevant for the scientific work of the Institute as a whole. The pending renewal of a director's position in 2009 could also be used to further strengthen the work on theoretical research aspects.
4) The Institute wishes to renew several pieces of vital equipment ten years after the initial investment. This wish is strongly supported by the peers. The MBI needs state-of-the-art instruments to stay internationally competitive in the rapidly developing field of short pulse physics. The Institute's request for additional replacement funding should be backed by a sharpened long-term vision for future MBI research activities.
5) The MBI's plan for the implementation of a guest programme for senior scientists is strongly supported.
6) Besides the necessary additional institutional funding for equipment and the proposed guest programme, the MBI is advised to consider funding possibilities such as the Pact for Research and Innovation *(Pakt für Forschung und Innovation)*.
7) It is expected that the MBI will be able to compensate the structural deficit in institutional funding for materials and small-scale equipment if it reallocates its annual budget properly.
8) The scientific infrastructure of dedicated application laboratories for internal and external collaborations is highly appreciated. It is strongly recommended that this structure be retained. The present legal framework for cooperation at the MBI, in particular on patenting issues, should be revised with the aim of enabling successful future cooperation and scientific development.
9) The research group that focuses on ionization dynamics in intense laser fields is a model for the Institute on how theory and experiment can complement each other, strengthening both.

10) For the research work on free clusters and molecules it is advised that more experiments be conducted in the gas phase to avoid the potential technical limitations of using X-ray femtosecond experiments to observe internal motions.

11) The group working on optoelectronic devices should seek new future ideas for its mid-term perspective. Close cooperation with the FBH is recommended.

12) The part played by the Scientific Advisory Board (SAB) in the successful structural change of the MBI is duly acknowledged. The inclusion of a member from industry in the SAB may be advisable.

13) A reorganisation of the IT-service is recommended in order to allow for the improvement of IT-service quality and response times.

14) The female quota among academic and higher-level management staff is still considered too low. The MBI should develop a strategy to reduce this deficit and implement further measures to promote female scientists and attract more female students to the MBI over the next few years.

15) The MBI's participation in summer student programmes is highly rated. The efforts to broaden the recruitment base for students should be continued.

16) Appointments for joint junior professors may be possible ways of deepening the ties between the Institute and universities.

17) The MBI should thoroughly analyse its patenting strategy. Special emphasis should be placed on the time and man-power invested in patent applications versus the revenue of patents sold.

Appendix

Participants:

1. Evaluation Team

Chairman (Member of the Senate Evaluation Committee, SAE)

Prof. Dr. Dietrich **Wegener**	University of Dortmund, Experimental Physics V, Dortmund

Vice Chairwoman (Member of the Senate Evaluation Committee, SAE)

Prof. Dr. Dr. h. c. Ulrike **Beisiegel**	University Medical Center Hamburg-Eppendorf, Center of Experimental Medicine, Department of Molecular Cell Biology, Hamburg

External Experts

Prof. Dr. John S. **Briggs**	University of Freiburg, Faculty for Mathematics and Physics, Theoretical Quantum Dynamics, Freiburg
Prof. Dr. Paul **Corkum**	Steacie Institute for Molecular Sciences, National Research Council Canada, Ottawa, Canada
Prof. Dr. Sandro **de Silvestri**	Polytechnic of Milan, Department of Physics, Milan, Italy
Prof. Dr. Todd **Ditmire**	The University of Texas at Austin, Department of Physics, Austin, USA
Prof. Dr. Detlef **Heitmann**	University of Hamburg, Institute for Applied Physics, Hamburg
Prof. Dr. Jürgen **Kirschner**	Max Planck Institute for Microstructural Physics, Halle
Prof. Dr. Karl **Kleinermanns**	Heinrich-Heine University of Düsseldorf, Institute for Physical Chemistry, Düsseldorf
Prof. Dr. Jan-Michael **Rost**	Max Planck Institute for Physics of Complex Systems, Dresden
Prof. Dr. Rainer **Ulbrich**	University of Göttingen, IV. Physical Institute – Semiconductor Physics, Göttingen
Prof. Dr. Edgar **Voges**	University of Dortmund, Faculty for Electrical Engineering and Information Technology, Chair of High Frequency Technology, Dortmund
Prof. Dr. Martin **Wegener**	University of Karlsruhe, Institute for Applied Physics, Karlsruhe
Prof. Dr. Wolfgang **Zinth**	Ludwig Maximilian University of Munich, Department of Physics, BioMolecular Optics, Munich

Federal Representative

RD Dr. Thomas **Roth**	Federal Ministry of Education and Research, Bonn

Representative of the States

MinR’in Dr. Renate **Fischer**	Ministry of Science, Research and the Arts, Baden-Württemberg, Stuttgart

2. Guests

Representative of the relevant Federal Department

RD Prof. Dr. Jürgen **Richter**	Federal Ministry of Education and Research, Bonn

Representative of the relevant State Department

Dr. Rainer **Schuchardt**	Senate Administration for Science, Research and Culture, Berlin

Representative of the Bund-Länder Commission for Educational Planning and Research Promotion, Bonn

MinDirig Jürgen **Schlegel**

Representative of the Leibniz Association

Prof. Dr. Dr. h. c. Wolfgang **Eberhardt**	Director, Berlin Electron Storage Ring Company for Synchrotron Radiation (BESSY), Berlin

Representative of the Advisory Committee

Prof. Dr. Ferenc **Krausz**	Director, Max-Planck-Institute of Quantum Optics, Garching

Representatives of Cooperating Institutions

The following representatives of cooperating institutions took part in a one hour interview:

Dr. Ulrich **Gensch**	Representative of the Directorate, German Electron Synchrotron (DESY), Zeuthen
Prof. Dr. Fritz **Henneberger**	Director, Institute for Physics, Humboldt University of Berlin
Dr. Karlheinz **Schönborn**	CEO, CLYXON Laser GmbH (Ltd.), Berlin, and Chairman of the Board of OpTecBB, Berlin
Prof. Dr. Dietmar **Stehlik**	Institute for Experimental Physics, Free University of Berlin
Prof. Dr. Christian **Thomsen**	Technical University of Berlin, Dean of the Faculty for Mathematics and Natural Sciences, Berlin

17.10.06

Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht

Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (MBI)

The MBI is pleased to acknowledge and accept the report. It is well balanced between the assessment of the present status and constructive suggestions towards further improvement. The MBI appreciates that this Evaluation Group, having a strong international component, has emphasized both the national and the international aspects in the evaluation. In view of the Institute's mission and research area this is considered indispensable.

The MBI appreciates the overall recognition as one of the leading institutes worldwide in ultra-fast and high-intensity laser-matter interactions, holding a unique position in Germany and comparing well with the top institutions in Europe and North America.

In particular, the MBI is pleased by the fact that the present international standing and the quality of the scientific output (which is considered "outstanding") have been related to recent internal structural changes and quality control measures. The Institute agrees on the valuable and constructive role of the Scientific Advisory Board in this process. It wishes to add that these changes have been fully accepted and backed by a highly motivated and competent staff, which was one of the underlying reasons for the present status.

With the structural changes being a continuing process, the Evaluation Group has pointed to a few areas that the Institute should emphasize in the future. They are summarized on page B-12 of the report. There is no fundamental disagreement with any of the recommendations and the Institute will endeavor to follow them (we note in passing that item 13, re-organization of the IT-service, has already been initiated and nears completion). Here we wish to comment on three issues from the top part of the list:

<u>1. Long-term vision of the Institute</u>: The MBI acknowledges the fact that, particularly in view of the pending retirement of one of the directors, the scientific profile and vision should be revised and updated in the near future. To some extent this will depend on the scientific profile of the successor, where the Institute will place individual excellence as the first priority. Still, the MBI management accepts the responsibility to continuously sharpen the scientific vision and will increase its efforts in close consultation with both the scientific staff and the Scientific Advisory Board (SAB).

<u>2. In-house theory support</u>: The MBI fully agrees that a broad theoretical support is indispensable for its scientific work. It also agrees that efforts in this direction, which have already been considerably improved, should be continued and intensified.

The Institute understands that its broad research scope, which stretches from physics to biology, is one of its unique characteristics and assets. Hence, the MBI definitely plans to maintain its broad experimental profile, particularly through the upcoming change in one of the director positions. As a consequence, this breadth is difficult to be completely mirrored by in-house theory without major additions in staff. This is one of the reasons why much of the present theory support stems from external collaborations, a situation, which accounts to a major extent for the strong collaboration with universities and which will certainly be continued.

In addition, the Institute accepts the recommendation to put even stronger emphasis on integrating theoretical research into the scientific structure of the Institute, also with the goal of receiving immediate input into the scientific programme and visions. Given the limited personal resources, the concept of Junior Research Groups presently appears easier to implement than that of a major new research focus. The Institute will seriously pursue these recommendations, again in consultation with its SAB.

3. Resources for structural measures: The clear and strong support of the Evaluation Group for the requested extra institutional funding is considered an essential basis for the continuation of the structural changes and the development of a long-term strategy. The Institute will also apply for additional resources from the Pact for Research and Innovation, in which it has already successfully participated. However, in addition to state-of-the-art instruments the MBI needs to be competitive in employing qualified scientists at an appropriate salary level. We emphasize in this context that the recently imposed legal constraints of the present salary scheme (TVöD), which did not exist at the time of the MBI evaluation, need to be modified or lifted in order to maintain the Institute's international competitiveness and to allow for the implementation of the recommended long-term strategy.