Der Senat

26. November 2015

Stellungnahme zum
Leibniz-Institut für Astrophysik Potsdam (AIP)

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Vorbemerkung

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

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

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 28. und 29. Januar 2015 das Leibniz-Institut für Astrophysik in Potsdam (AIP). Ihr stand eine vom AIP erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das AIP nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 26. November 2015 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

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

Seinem **Auftrag** entsprechend betreibt das Leibniz-Institut für Astrophysik Potsdam (AIP) Grundlagenforschung zu wichtigen und aktuellen astrophysikalischen Fragen, die von der Sonne bis zur Entwicklung des Kosmos reichen. Die Schwerpunkte liegen dabei auf dem Gebiet der kosmischen Magnetfelder sowie in der extragalaktischen Astrophysik. In unmittelbarem Bezug dazu leistet das Institut äußerst relevante Beiträge zur Entwicklung von Forschungstechnologien in den Bereichen Spektroskopie, robotische Teleskope und *E-Science*.

Seit der letzten Evaluierung hat sich das AIP ausgesprochen positiv entwickelt. Das ist auch auf den konsequenten Ausbau der instrumentellen und computergestützten Infrastruktur am Institut zurückzuführen. Das AIP hat große Erfolge bei der Beteiligung an bzw. Führungsverantwortung in anspruchsvollen Großprojekten für die Entwicklung von Beobachtungs- und Messinstrumenten erzielt. Erstmals hat es die Federführung beim Bau eines Instruments für die Europäische Südsternwarte (ESO) übernommen. Im Zuge dieser Arbeiten wurden wertvolle Beobachtungszeiten an den weltweit besten Teleskopen eingeworben, woraus sich weiteres großes Forschungspotenzial ergibt.

Die **Arbeitsergebnisse** des AIP werden im In- und Ausland wahrgenommen und anerkannt. Im Einzelnen werden die Sektionen einmal als „gut bis sehr gut“, drei Mal als „sehr

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

gut“, vier Mal als „sehr gut bis exzellent“ und zwei Mal als „exzellent“ bewertet. Die Publikationsleistung ist sehr gut. Nachdem das Institut in den letzten Jahren wichtige Instrumentierungsbeiträge geleistet hat, ist künftig sogar noch eine weitere Steigerung möglich. Zudem erbringt das AIP wertvolle wissenschaftliche Dienstleistungen: Es ist am Betrieb von international stark nachgefragten Forschungsinfrastrukturen beteiligt und stellt der wissenschaftlichen Community Datenbanken sowie Software-Plattformen zur Verfügung. Der Senat rechnet damit, dass das gewachsene Potenzial für Wissens- und Technologietransfer am AIP in den nächsten Jahren noch weiter ausgeschöpft wird.

Die **Ausstattung** des AIP mit Mitteln der institutionellen Förderung ist zur Erfüllung seiner Aufgaben auskömmlich. Bei der Einwerbung von Drittmitteln ist es sehr erfolgreich, allerdings sollte eine Steigerung im Bereich der EU-Förderung erreicht werden. Die Labore und Werkstätten des AIP sind hervorragend ausgestattet, und es ist erfreulich, dass die räumliche Situation mit dem Bau eines Funktionsgebäudes stark verbessert wurde. Die Bürokapazitäten des AIP liegen jedoch unterhalb des tatsächlichen Bedarfs. Da auch dank erfolgreicher Drittmitteleinwerbungen der Personalbestand seit 2008 nochmals stark gewachsen ist, sind zusätzliche Büroräume dringend erforderlich. Die Planungen für einen bilateral zu finanzierenden Neubau sollten daher zügig umgesetzt werden.

Die **Personalstruktur** des AIP ist den Aufgaben grundsätzlich angemessen. Durch den Infrastrukturausbau und die gewachsene Bedeutung des Instituts in internationalen Großprojekten sind am AIP jedoch neue Daueraufgaben entstanden, denen insbesondere die Personalausstattung im technischen Bereich nicht mehr entspricht. Für die strategische Weiterentwicklung und Sicherung der Konkurrenzfähigkeit des AIP ist es deshalb notwendig, diese Aufgaben über zusätzliche Mittel der institutionellen Förderung von Bund und Ländern zu finanzieren. Das AIP hat dazu einen Entwicklungsplan für den technischen Bereich vorgelegt, der inhaltlich sehr gut begründet ist und weiterverfolgt werden sollte. Der noch zu präzisierende finanzielle Umfang wird mit maximal 950.000 € p. a. für einen Sondertatbestand mit einer Laufzeit von bis zu vier Jahren angegeben.

Auch wenn der Anteil von **Wissenschaftlerinnen** für ein physikalisches Institut am AIP vergleichsweise hoch ist, sind Frauen dennoch unterrepräsentiert, insbesondere in Positionen mit Leitungsaufgaben. Der Senat erwartet, dass der Frauenanteil weiter gesteigert wird. Es ist erfreulich, dass das Institut eine familienfreundliche Personalpolitik betreibt.

Der wissenschaftliche **Nachwuchs** wird am AIP sehr gut ausgebildet und betreut. Im Leibniz-Wettbewerb hat das Institut gemeinsam mit der Universität Potsdam eine Graduiertenschule eingeworben, die ein wichtiger Bestandteil der strukturierten astrophysikalischen Promotionsausbildung am Standort ist. Auch Post-Doktorandinnen und -Doktoranden werden sehr gut gefördert. Mit dem Karl-Schwarzschild-Fellowship-Programm hat das AIP ein geeignetes Instrument eingeführt, um begabten Nachwuchs für das Institut zu gewinnen, das es nun auch gezielt zur Förderung der Gleichstellung der Geschlechter einsetzen möchte.

Zur Umsetzung seines Auftrags arbeitet das AIP intensiv mit renommierten Institutionen im In- und Ausland zusammen. Die **Kooperationsbeziehungen** mit der Universität Potsdam sind sehr gut entwickelt, die beiden Direktoren des Instituts sowie zwei weitere Professoren wurden hier gemeinsam berufen. Es wird begrüßt, dass weitere gemeinsame Be-

rufungen mit Universitäten geplant sind und 2016 mit der Universität Potsdam ein Masterprogramm Astrophysik eingerichtet werden soll. Auch die Zusammenarbeit mit außeruniversitären Partnern wie Sternwarten, Observatorien und Forschungszentren ist ausgesprochen vielfältig und sehr ergiebig. Innerhalb der Leibniz-Gemeinschaft ist das AIP aktiv und wirkt in Verbünden und Netzwerken mit. Im Bereich der optischen Technologien wird noch Potenzial für weitere Kooperationen gesehen.

Das AIP schöpft die Möglichkeiten der langfristigen Planung und Durchführung umfangreicher Forschungsvorhaben, die an einer außeruniversitären Einrichtung in besonderem Maße gegeben sind, sehr effizient und effektiv aus. Mit seiner auf einer komplexen Technologieentwicklung beruhenden Grundlagenforschung übernimmt das AIP Aufgaben, die in dieser Form nicht an einer Hochschule erfüllt werden können. Eine Eingliederung des AIP in eine Hochschule wird daher nicht empfohlen. Das AIP erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischem Interesse zu stellen sind.

2. Zur Stellungnahme des AIP

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

3. Förderempfehlung

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

7 January 2015

Annex A: Status Report

Leibniz Institute for Astrophysics Potsdam (AIP)

Contents

1. Structure, tasks and institutional environment

Development and funding

The Leibniz Institute for Astrophysics Potsdam (AIP) is the successor to one of the oldest observatories in Germany – the Berlin Observatory founded in 1700 – and at the same time the successor to the first institution worldwide devoted explicitly to the field of astrophysics, the Astrophysical Observatory Potsdam established in 1874.

In 1992, AIP was re-founded as a foundation under civil law. Since then, the institute has been jointly funded by the federal and *Länder* governments as member of the *Blaue Liste* and, as an institute of Leibniz Association subsequently. Its national importance was confirmed in external evaluations by the German Council of Science and Humanities (*Wissenschaftsrat*) in 1999/2000 and by the Senate of the Leibniz Association in 2007/2008.

Responsible department at *Länder* level: Ministry of Science, Research and Culture, Brandenburg (MWFK)

Responsible department at federal level: Federal Ministry of Education and Research (BMBF)

Mission and tasks

AIP has a broad research profile covering the fields of astronomy and astrophysics from the physics of the Sun to the evolution of the cosmos on its largest scales. Its two main research branches are “Cosmic Magnetic Fields” and “Extragalactic Astrophysics”. AIP is involved in the area of astronomical instrumentation, optical technologies, supercomputing, astronomical techniques and the management and analysis of large data sets. It also administers an extensive historical scientific legacy.

Legal form and organisation

AIP is a foundation under civil law.

The Board of Trustees has four members: the State of Brandenburg with the Ministry of Science Research and Culture (MWFK), the German Federal Ministry of Education and Research (BMBF), the chair of the Science Advisory Board and the President of the University of Potsdam. The state and the federal ministry hold two votes each. The representative of the State of Brandenburg chairs the Board of Trustees.

The Executive Board, consisting of a Scientific and an Administrative Member, heads the foundation. The Scientific Member serves as the Chairman of the Board and represents the foundation to the outside. The Board of Trustees appoints the Members of the Board for a term up to five years. Reappointments are possible.

The Science Advisory Board (SAB) gives advice to the Board of Trustees and to the Executive Board on major scientific and technical issues, on strategic planning and on the research and development programmes. Moreover, it regularly evaluates research accomplishments. The SAB consists of 6 to 9 scientists from Germany and abroad covering

AIP's fields of research, who are nominated by the institute and the Science Advisory Board and are appointed by the Board of Trustees for a four-year term. A re-appointment for a second term is possible.

Further panels of the AIP are:

- The Extended Management Panel: both scientific directors and the administrative director represent the institute management within the institute
- The Internal Scientific Committee (ISC)
- Workers' participation panels, e.g. the Works Council and the Equal Opportunities Officers (see Section 6.2)
- Miscellaneous working groups, e.g. for IT and data security, IT User Committee, Telescope Time Allocation Committee.

Research structure

The two main research branches "Cosmic Magnetic Fields" and "Extragalactic Astrophysics" are each led by a director and divided in three scientific sections and two associated research and development (R&D) sections, which are strongly meshed with respect to their thematic, methodological, and technological aspects. The scientific sections define the long-term scientific research portfolio of the institute. The R&D sections design and develop future astronomical instrumentation, data analysis tools and computing services that are required for fulfilling the institute's science goals. The R&D sections are to a considerable extent project-funded. A special research and development section is innoFSPEC, the BMBF-funded Excellence Centre operated jointly by University of Potsdam and AIP, with main focus on the development of new optical technologies for future use in astronomical (and other) instrumentation.

National and international scientific environment

According to AIP, it is one of the largest institutes for astronomical research in Germany and the largest in Eastern Germany. While other German non-university astrophysical institutes focus their research on specific topics (e.g., solar physics), methods (e.g., theory) or technologies (e.g., radio astronomy), AIP is unique in utilising its resources to run broadly based research and development programmes that cover a large fraction of astronomical themes.

There are 37 professional astrophysical institutions (members in the Council of German Observatories) in Germany. The largest institutions are the non-university institutes of the Max Planck Society and the Leibniz Association together with the Universities of Bonn, Heidelberg, and Munich, followed by the universities in Cologne, Hamburg, Göttingen and Tübingen. Internationally, a similar breadth can be found in various national observatories and astronomy centres (e.g. NOAO in the US, IAC Spain, GEPI France), though these institutions are usually considerably larger and/or also have a distinct service function (e.g. operating a large observatory). A rigorous productivity and impact analysis performed by FZ Jülich in 2006 showed AIP's performance to lie in the midfield of the astronomical Max Planck Institutes, which compete well with the leading international institutions (e.g. Princeton, Cambridge).

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

According to AIP, its national interest and supra-regional significance manifests itself in

(1) scientific excellence, leadership, and competitiveness

(2) international visibility and standing

(3) a central role in national and international collaboration networks and large projects

(4) the internationality of staff and in the career paths of AIP scientists

(5) a high level of third-party funding from competitive resources.

Astrophysical research and large-scale astronomical projects require, according to AIP, national centres of expertise in order to guarantee the competitiveness of German astronomy on the international level and to ensure significant participation of the German astronomical community in the large endeavours, in particular those of the European Southern Observatory (ESO) and the European Space Agency (ESA).

The institute operates, pursuant to AIP, a research infrastructure that is incompatible with the usual capacities of a university in Germany or any other European country. In particular, guaranteeing the long-term availability of data archives and the preservation of key expertise especially in the area of astronomical instrumentation are services and tasks that could not be realised by a combination of independent chairs and purely project-oriented funding.

2. General concept and profile

Appendix 1 gives an overview of the research structure at AIP. All research related data communicated in this report refer to the organization as shown in appendix 1. The various scientific and R&D sections are woven together by a number of strategic themes that are addressed in a concerted effort across the scientific sections of the institute with several sections contributing to each strategic theme:

- The Solar-Stellar Connection
- Magnetic fields of Stars
- Imaging of Stellar Surfaces
- The Milky Way as a Galaxy Prototype
- The Milky Way-Galaxy Connection: Twins Siblings and Ancestors
- Cosmic Flows
- Quantitative Spectroscopy
- Surveys and Monitoring

Development of the institution since the last evaluation

The current evaluation period (2007-2013) has seen a steady development of the research programme and a considerable growth of the institute. While in 2006 AIP employed 143 staff, this number increased to 198 in 2013. Third-party funding expendi-

tures increased by more than 60%, from 2.9 M€ to 4.7 M€ in 2013. In the same time period, institutional funding increased by 40%, from 7.52 M€ to 10.78 M€.

Probably the most significant change over the past few years has been that many projects that in 2007 were still in the early design and construction phase have now come to fruition and are either in data-acquisition or commissioning phase. Consequently, the focus has shifted to the scientific exploitation of these facilities, for which several strategic staff retreats were organised.

On the technological and instrumentation side, the infrastructure of the AIP enjoyed a considerable upgrade with the establishment of the *Leibnizhaus*, which offers additional optical laboratories, laser facilities, cooling chambers, a large integration hall and temperature-controlled computer rooms. These facilities have been a key ingredient for the innoFSPEC Centre of Excellence as well as for other projects. Furthermore, it provides office space for 56 members of the institute. The *Leibnizhaus* follows a green energy concept with the heating system recycling the heat dissipated in the computer rooms.

The most significant change in the research portfolio since the previous evaluation has been the establishment of the BMBF funded innoFSPEC Centre of Excellence, a joint venture between the University of Potsdam and the AIP. The AIP hosts the centre management as well as an independent research group on "Astrophotonics". Within the AIP structure, innoFSPEC is implemented as an additional section.

A further significant restructuring concerns the section "Star Formation and Interstellar Medium". Following a recommendation of the 2007 evaluation, a new section on Milky Way science was established in order to support the scientific exploitation of the RAVE[1] project and to prepare for the Gaia[2] era. The section on "Star Formation and Interstellar Medium" was discontinued.

Results

In the period 2011-2013, a total of 568 scientific papers appeared in peer-reviewed international journals (see appendix 3). Some research highlights in the period 2007 to 2014 include

- the first-ever demonstration of the Magneto-Rotational Instability in a magneto-hydrodynamical laboratory experiment. This discovery was awarded with the "Science Needs Society Prize" by the *Stifterverband für die Deutsche Wissenschaft,*
- the discovery that exomoons, i.e. moons of planets orbiting other stars, are capable of supporting life,
- the first measurement of the magnetic field and its geometry in a star spot (2012), thereby verifying that starspots are indeed caused by magnetic fields just like sunspots,

[1] RAdial Velocity Experiment, a multi-fiber spectroscopic astronomical survey of half a million stars in the Milky Way, initiated and coordinated by AIP.

[2] Global Astrometric Interferometer for Astrophysics (original name), ESA cornerstone mission to chart a six-dimensional map of the Milky Way.

- the detection of a wave-like bending pattern in the Galactic Disk with RAVE (2013),
- the discovery of the (then) most massive distant X-ray selected galaxy cluster and its optical verification with the Large Binocular Telescope LBT (2008),
- a Nature article on SPINSTARS, possibly the first stellar generation of the Universe, deduced from imprints of fast rotating massive stars in the bulge of our galaxy (2011),
- the identification of "Cosmic Web stripping" as a new astrophysical effect to explain the famous missing satellite problem (2013),
- the discovery of solar-like oscillations on a magnetically active spotted star with an oscillation amplitude of just 15 cm/s in radial velocity and a period of 50 minutes (2010),
- the first conclusive numerical simulations of a supernova-driven galactic dynamo presented with the in-house 3D AMR[3] code NIRVANA (2008),
- the discovery of a new stellar stream (Aquarius stream) with RAVE, probably a tidally disrupted dwarf galaxy or globular cluster (2011). For this discovery, the Young Researcher's Award of the State of Brandenburg was awarded.

With respect to the instrumentation project portfolio, noteworthy highlights include

- the inauguration of the STELLA[4] robotic telescope twins on Tenerife in 2006 and the transition to routine operations in 2008 and 2010,
- the inauguration of the GREGOR[5] solar telescope on Tenerife, currently the most powerful solar telescope in the world,
- the delivery and implementation of the AGW[6] units for the Large Binocular Telescope at Mount Graham, Arizona, USA,
- the successful installation and commissioning of the MUSE[7] integral field spectrograph on UT4 of the European Southern Observatory's Very Large Telescope in 2013/2014,
- the establishment of the Centre of Excellence for innovation in fibre optical technologies innoFSPEC at the AIP and the University of Potsdam,
- the selection by ESO of the 4MOST[8] facility to be implemented at the VISTA telescope.

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[3] Adaptive Mesh Refinement (numerical simulation technique).

[4] Two 1.2 m fully automatic telescopes for STELLar Activity research, built and operated by the AIP, located at the Teide Observatory in Tenerife, Spain.

[5] Solar telescope on Tenerife, its predecessor was named after James Gregory.

[6] Acquisition-, Guiding- & Wavefront-sensing.

[7] Multi Unit Spectroscopic Explorer, 2nd generation VLT instrument coordinated by Lyon (France) with strong AIP contribution.

[8] 4m-Multi Object Spectroscopic Survey Telescope, fibre-fed spectroscopic survey facility.

AIP also offers a number of public services including the editorial of *Astronomische Nachrichten* (Astronomical Notes – AN; Wiley VCH), the provision of several databases for astronomical research, and the development of software platforms and frameworks.

Consultancy activities focus on the evaluation of research, research infrastructure, or particular R&D projects. Scientists at AIP engage in science policy consulting, e.g. as members of academies (*Berlin-Brandenburgische Akademie der Wissenschaften*), of steering committees for funding programmes of the BMBF, of review boards of the DFG, and of advisory boards for large international facilities (e.g. ESO). AIP scientists are involved in peer-review processes for scientific journals and funding agencies, and also serve as members of editorial boards.

Moreover, according to AIP, it has very good contacts to the industrial sector through its memberships in various networks and special efforts to involve industrial partners in proposals for funding from programmes of the European Commission. In the context of the newly established innoFSPEC Centre of Excellence, AIP has reinforced its efforts towards implementing technology, knowledge transfer and innovation in particular for fibre optical spectroscopy and sensing through a number of successful grant applications.

Between 2011 and 2013, the AIP received six invention disclosures. At present, two of these are registered and being further processed by the national patent office. The remaining four have been thoroughly analysed but will not be pursued further.

Academic events and public relations

In total, the AIP (co-)organised some 30 larger international conferences and workshops. Furthermore, it offered Summer Schools on specific topics, e.g. Opto-Mechanical Design in Astronomy (2011) and on CCD detectors (2013).

Highlights in the period since the previous evaluation were the organisation of the National Annual Meeting of the German Astronomical Society in Potsdam in 2009 (together with the University of Potsdam), the organisation of two IAU symposia, one in Tenerife, Spain, in 2008 and one in Ventura, California in 2010, and an international conference to conclude the DFG priority programme "Witnesses of Cosmic History: Formation and evolution of galaxies, black holes, and their environment" in 2010. Since 2002, the AIP runs a series of international workshops (so-called "Thinkshops"). So far, eleven Thinkshops have been held with topics ranging from star spots to Lyman-alpha emitters in the early Universe.

In order to ensure dialogue with the public, AIP is engaged in a broad variety of press and public outreach activities. Science communication has also been implemented as a structural goal in AIP's programme budgets. Besides the general public, AIP's PR strategy addresses dedicated target groups like journalists, state and federal political bodies, funding agencies, industry partners, potential employees, and the next generation of scientists and engineers.

In 2007, the staff unit of the Executive Board has been enlarged by the post of a scientific coordinator, who since then heads the press and public outreach activities, supported by

one full-time PR staff member. In 2009, AIP assumed a leading role in Germany in co-coordinating the German activities and shaping the programme of the UN International Year of Astronomy 2009. As one long-term outcome, a German web portal by the professional astronomy community (initiated by AIP) is currently being setup in collaboration with the BMBF supported "Welt der Physik".

Strategic work planning for the next few years

The primary objectives of research conducted at AIP are, first, to disentangle the structure, formation and evolution of the objects in our cosmos, from the sun, individual stars and our Milky Way to other galaxies and the universe as a whole, and, second, to understand the underlying physical processes acting on those scales, such as magnetic dynamos, turbulence, feedback by stars and supermassive black holes, and the effects of Dark Matter and Dark Energy. Research is inspired by the juxtaposition of neighbouring versus remote cosmic objects:

- The Solar-Stellar Connection links the structure, activity and magnetic phenomena of the sun and its heliosphere, seen at great detail, to that of other stars and their diversity and evolution. The underlying processes of convection, magnetic field generation, formation of active regions and particle acceleration are the key research drivers. Traditionally different methods of analysis and observing instrumentation are brought together, with future applications also envisaged in exploring the habitability of extra-solar planets.
- In Near-Field Cosmology, nearby galaxies (in particular, the Milky Way) are decomposed into individual stars or stellar complexes. Formation and evolution history is deconvolved and put in a cosmological context. Contrasted with the study of galaxies as integral objects at various redshifts across cosmic time, this allows new insights to be made into the structure formation process in the Universe.

According to AIP, it's science mission thus closely resonates with the two central questions of the four major questions raised in the report "A Science Vision for European Astronomy" published in 2007 (revised in 2012) by the Astronet consortium of European funding agencies: (2) How do galaxies form and evolve? (3) What is the evolution and origin of stars and planets? In its effort to conduct these research lines, the institute strives to maintain a balance between theory, simulations, observations and instrumentation.

Modern astronomical instrumentation has typical development times of 10 years between the beginning of conceptual design and the commissioning at the telescope. For space- based projects, cycles are even longer. Similarly, coordinated programmes that scientifically exploit these facilities are of multi-yearly time scales. For the next evaluation period (2015-2022), the available facilities, instrumentation, and to some extent also the available telescope time is thus already set.

As an institution devoted to fundamental research in astrophysics, AIP does not focus on application-oriented technology. However, according to AIP exploring the depths of the universe, detecting faintest signals and extracting them from background noises, requires technologies and algorithms at the cutting edge of technology. Astronomical in-

strumentation has therefore always been a technology driver with many spin-offs in the applied sciences.

Appropriateness of facilities, equipment and staffing

Funding

According to the institute, its overall funding situation is sound thanks to the budget increases of the Joint Initiative for Research and Innovation and a considerable increase in project funding. In 2014, the institute had an annual investment budget of 2.3 M€, an operation budget of 2.6 M€, and a personnel budget of 6.7 M€ (institutional funding), complemented by some 5 M€ in grant income (c. f. annex 3). Overall, AIP acknowledges that these conditions put the institute in a very good position to actively participate in (and in some instances also take the lead of) major international endeavours in astronomy.

Buildings and working space

AIP administers and maintains the compound of the Babelsberg Observatory for its research activities, as well as the Great Refractor and Einstein Tower buildings at the historical Telegrafenberg site. The real estate administered at Babelsberg encompasses an area of about 5.7 ha. The historic buildings are subject of a preservation order, and the whole Observatory area is listed as part of UNESCO's "Prussian Castles and Gardens" world cultural heritage. Therefore several requirements, bans and rules have to be observed in administration and further development of the infrastructure.

In preparation for the construction of the *Leibnizhaus*, a plan for the required laboratory and office space of the institute was developed and approved by the responsible state department in 2006. It attests to the AIP's need for 6,098 square metres of office space, assuming 144 employees plus the technical infrastructure. The use of the facilities in a way that is economic and suitable is hindered, however, by the constraints of use of the historical buildings that are subject to preservation order.

The institute currently has some 190 employees plus some 20 guests; hence the usage of available space is already much compressed, nevertheless, considering its upcoming project portfolio and attractiveness to postdocs and junior researcher groups, further growth in the coming years is anticipated. AIP's vision is a stable size of at least 200 employees plus students and guests over a longer term. Against this background, the institute is lacking office space for some 60 people. According to AIP, temporary measures, such as containers, or building modifications are not a viable option owing to the site's UNESCO world heritage status.

The institute has repeatedly raised the need for additional office and laboratory space at the meetings of the Board of Trustees. During the approval process for the *Leibnizhaus*, potential development sites could be identified nearby for buildings of limited size. As it is not possible to resolve the office space problems and providing adequate working space and conditions for its staff and guests within the boundaries of the regular institutional funding, an extraordinary item of expenditure (*Sondertatbestand – bilateral zu*

finanzierende Bauinvestition i.S. § 5 AV-WGL), will be needed in order to construct an additional building. AIP envisages the start of its realisation in 2018/19.

Facilities

AIP scientists have access to a number of world-leading observing facilities and data sources. Furthermore, with the two technology buildings, *Schwarzschildhaus* (inauguration 2000) and *Leibnizhaus* (2010), AIP is well equipped for major instrumentation projects for even some of the largest telescopes. The facilities of the Technical Section include workshops and laboratories for optics, mechanics, electronics, as well as integration space for assembly and testing.

AIP's part in GREGOR (Tenerife) and the Vacuum Tower Telescope VTT is managed and represented by the Kiepenheuer Institute for Solar Physics (KIS, also member of the Leibniz Association). The STELLA facility (Tenerife) is a robotic observatory with two fully automated 1.2-m telescopes owned by AIP and jointly run by AIP and the Instituto de Astrofísica de Canarias (IAC).

As a result of a strategic scientific decision, the operation of the Observatory for Solar Radio Astronomy in Tremsdorf (25km south of Berlin) was discontinued a few years ago; the site is currently being cleared of any remaining items and lease-contracts have been terminated.

Staffing

AIP has gained considerable flexibility in administering its institutional funding owing to the waiver of a formal staffing plan and permission to reallocate funds between investments and personnel or operations. Nevertheless, no more than 70% of the scientific staff on institutional funding should be hired on the base of tenured contracts according to the recommendations of the German Council of Science and Humanities for institutes of the Leibniz association.

According to the institute, the personnel situation in the Technical Section is critical. It is in need of technical expertise in more areas, such as in intelligent software and electronics, optical and mechanical design. Furthermore, projects with large international agencies like ESO and ESA increasingly require resources for project management, system engineering, and project documentation. In addition, personnel for the maintenance of existing facilities like STELLA and GREGOR, and soon PEPSI at the LBT, and warranty duties for MUSE and 4MOST instruments at ESO's Paranal Observatory are required. Currently, AIP addresses these issues by outsourcing, employing technical personnel on project grants, and reallocating some of these tasks to research personnel, but these measures are not considered to be adequate solutions.

Therefore, in October 2014, the institute has devised a mid-term development plan envisaging the enlargement of the Technical Section. According to AIP this should be funded on the base of an extraordinary item of expenditure (*Sondertatbestand*) amounting to 950 k€ per year, staggered over a 3 to 4 years period beginning in 2017, which afterwards should be transferred in the institutional funding of AIP. Provisions include the reallocation of institute resources in the Technical Section, a shifting of key person-

nel from project to institutional funding, and the hiring of additional personnel. The realisation of this strategy will be the prime objective for the budget negotiations in the coming years. The general concept has been discussed with and is endorsed by the Science Advisory Board and the Board of Trustees, subject to the outcome of the evaluation.

3. Scientific and R&D sections of AIP

(1) Scientific section "Magnetohydrodynamics and Turbulence" (9 FTE)

The topics of this scientific section are focused on turbulence and magnetic fields in stars. The core vision is the understanding of solar and stellar dynamos. At the end of 2009, the section head retired. The group's traditional focus on general problems of Magnetohydrodynamics (MHD) has been continued and enlarged towards closer links to observations. The stability of magnetic fields and the universal dynamo problem will remain the key topics of the section, while the emphasis on global magnetic properties of the Sun and stars within the solar-stellar connection will be strengthened. The road map also includes the derivation of the properties of turbulence – the transport coefficients – in specific stellar contexts, and their application in models of large-scale flows and magnetic fields.

(2) Scientific section "Physics of the sun" (14 FTE)

This section explores the magnetic activity in the solar atmosphere across a broad range of temporal and spatial scales with the ultimate aim to understand how the sun influences the earth's climate and the near-earth environment ("space weather"). The section focuses on solar radio and optical astronomy and participates in two new research infrastructures, the ILT (International LOFAR Telescope) and the German optical solar telescope GREGOR. Since the last evaluation, the involvements in LOFAR and GREGOR have restructured the section's observational basis. It is planned to continue to study processes that are related to the magnetic field on different temporal and spatial scales in the solar atmosphere. Emphasis will be put on the topics evolution of magnetic structures, dynamics of solar filaments, comparisons of observations with numerical simulations of dynamical processes, sun-as-a-star studies, kinetic plasmas processes, and space weather.

(3) Scientific section "Stellar Physics and Stellar Activity" (10 FTE)

The section focuses on the solar-stellar connection (stellar rotation, cycles, convection, abundances, etc.), with particular emphasis on the development and application of Doppler imaging methods as well as next-generation 3D model atmospheres. Main observational facilities used are European Southern Observatory (ESO) telescopes, STELLA and the LBT. The core vision is the understanding of stellar evolution in the presence of stellar rotation and magnetic fields. In 2008, the section head retired. Under his successor, observations and characterisation of magnetic fields of intermediate- to high-mass stars at different evolutionary stages were added to the scientific portfolio. The main scientific programme activities in 2007-2013 were planetary nebulae, 3D modelling of atmospheres, the solar-stellar connection, and massive stars**.** The future long-term goal

is to understand the relationship between matter and magnetic fields with particular focus on solar and stellar magnetic fields and their connections.

(4) Scientific section "Milky Way and the Local Volume" (19 FTE)

This section studies the Milky Way and its neighbouring galaxies. These nearby galactic stellar systems are close enough to be studied in great detail, star by star. The main research area of the section is sometimes called Galactic Archaeology and Near-field Cosmology, i.e. the study of the formation and evolution of galactic systems within a cosmological context through investigations of resolved stellar populations and their chemistry and dynamics. The research has an observational orientation, but has also theoretical and instrumentation components. The AIP is the lead institute of the largest Milky Way spectroscopic survey conducted so far (RAVE) and is furthermore participating in all other ongoing major spectroscopic surveys in this area. Furthermore AIP involved in the data reduction of the ESA satellite Gaia. The scientific exploitation of the data delivered by these surveys with respect to the chemo-dynamical evolution of the Milky Way will be the prime research objective in the coming years. In conjunction with the "3D- and Multi-Object Spectroscopy" and the innoFSPEC section, AIP is leading the international effort to build the 4-meter Multi-Object Spectroscopic Survey Telescope (4MOST) for the European Southern Observatory.

(5) Scientific section "Galaxies and Quasars" (14 FTE)

This section is dedicated to investigating the structure and evolution of galaxies across cosmic times. Special attention is paid to the spectroscopic exploration of relatively nearby galaxies, to the role of nuclear activity in galaxy evolution, and also increasingly to the properties of high-redshift galaxies. The section is mainly oriented to an observational approach, which complements and links to the theoretical and simulation expertise in the sections "Milky Way and the Local Volume" and "Cosmology and Large-Scale Structures". The activities are focused on employing the technology of 3D spectroscopy for galaxy surveys at low and high redshifts in close cooperation with the "3D- and Multi-Object Spectroscopy" section. Special focus in the years to come will be the analysis of the Guaranteed Observing Programme (255 nights at the VLT) with MUSE. "Galaxies and Quasars" also hosts the independent "X-ray Astronomy" research group dealing with compact objects such as neutron stars or cataclysmic variables and their progenitors, and with large-scale X-ray surveys, especially for massive high-redshift galaxy clusters.

(6) Scientific section "Cosmology and Large-scale Structure" (14 FTE)

The main research of this section deals with the origin and properties of the cosmic web in relation to cosmological evolution. The object of study is galaxy diversity within the cosmic web including satellite systems of local galaxies, galaxy groups, and clusters up to super-clusters. The study of the intergalactic medium with the imprints of the cosmic web on the cosmic microwave background and on quasar absorption lines is closely related. The section is mainly oriented toward theory with strong impetus on the generation of high-resolution and large-scale simulations. The section coordinates the in-

ternational Constrained Local Universe Simulation project CLUES, which is of particular importance for providing cosmologically based models of the Milky Way and the Local Group, which will be the theoretical backbone for the data driven studies in the "Milky Way" and "Galaxies" sections. These simulations are performed and analysed on German and other European supercomputers. Supported by the "Supercomputing and E-Science" section, simulation data are supplied to the international astrophysics community (CosmoSim database of the AIP). The work includes analysis of wide-field and deep redshift surveys of galaxies and clusters of galaxies. The section also hosts an independent research group on simulating the formation of disc galaxies.

(7) R&D section "Telescope Control and Robotics" (5 FTE)

This section focuses on the development of autonomous telescopes and robotic observatories through software solutions and provides special-purpose hardware for telescope control beyond the standard equipment. The AIP was one of the first institutes to build a truly robotic observatory, the STELLA robotic observatory on Tenerife including an imaging and a spectroscopic 1.2m telescope that are running on a common software platform. The software approach allows for the robotisation of any telescope hardware capable of autonomous observations. The section was also responsible for building six "Acquisition, Guiding & Wavefront-sensing" (AGW) units for the Large Binocular Telescope. These units provide real-time information on the dynamic state of the atmosphere, in turn allowing the Adaptive Optics system to compensate for the telescope's own optical defects.

(8) R&D section "High-Resolution Spectroscopy and Polarimetry" (5 FTE)

This section is dedicated to building high-resolution spectrographs and spectropolarimeters. These instruments open up new possibilities for astrophysics by transferring well-proven techniques of solar physics to stellar physics. The most prominent example of such an instrument is AIP's PEPSI spectropolarimeter for the Large Binocular Telescope, the only high-resolution spectropolarimetric capability on a telescope with an aperture of more than 4m, which is currently being commissioned on Mt. Graham. Other examples are the STELLA échelle spectrograph (SES), in operation on Tenerife since 2006 and the future GREGOR@night spectrograph for night use of the GREGOR solar telescope that is currently under construction. Over the longer run, the section will focus on HIRES and its polarimeter for ESO's 39m E-ELT. The section closely collaborates with the section "Telescope Control and Robotics" because the acquisition and guiding units as well as the robotic control software are essential parts of the spectrographs and their operations model.

(9) R&D section "3D and Multi-Object Spectroscopy" (7 FTE)

This section provides the R&D for new instrumentation for multi-object and 3Dspectroscopy, from the concept study, via the realisation, to the commissioning at the telescope. It also develops the software for the reduction, analyses, and visualisation of 3DS and MOS data. It engages in international consortia, in particular to build instruments for the European Southern Observatory (ESO) and other world-class facilities. The training of

students and young scientists is also a part of this section's portfolio. The scientific use of these instruments is partly done within this section, but mainly in cooperation with the appropriate scientists at AIP. During the last years, the section worked closely together with "Galaxies and Quasars" with respect to the use of the PMAS and MUSE instruments, with "Milky Way and the Local Volume" that scientifically leads the 4MOST project, with "Cosmology and Large-Scale Structures" for the involvement in the Dark Energy Experiment HETDEX, and with the "Stellar Physics and Stellar Activity" group to study planetary nebulae using 3D-spectroscopy. On the technology side, a close interaction exists between this section and the Centre of Excellence for fibre-spectroscopy and sensing, "innoFSPEC". The data management for MUSE and PMAS is done together with the "Supercomputing and E-Science" section.

(10) R&D section "E-Science and Supercomputing" (8 FTE)

This section provides the development of research IT infrastructure and services including IT integration of new instruments, data management facilities for huge data sets from instruments, observational and computational astronomy, and high-performance computing facilities. AIP participated in all efforts within Germany to improve the IT infrastructures for collaborative scientific work, for instance by leading the AstroGrid-D within the D-Grid Initiative, and by participating in the core group of WissGrid, which focused on the support of academia within D-Grid. AIP is also a founding member of the German Astrophysical Virtual Observatory (GAVO) and has participated in this endeavour since its start in 2003. The section further provides a data centre with collaborative research environments for CLUES and for the data from the MUSE instrument. It publishes data from cosmological simulations and hosts the main archive for RAVE. Future efforts will focus on data archives in particular in the context of Gaia and 4MOST as well as accompanying large simulation projects. Moreover, computing facilities are provided for various groups at AIP. The different developments and services provided by the section are also used in national and international astronomical research.

(11) R&D section "innoFSPEC" (15 FTE)

innoFSPEC Potsdam was created in 2009 as a BMBF Centre of Excellence jointly operated by AIP and University of Potsdam (Institute for Physical Chemistry) with two research groups. Whereas the UP research group focuses on fibre-based chemical sensing, the AIP "Astrophotonics" group is dedicated to multichannel spectroscopy. In line with a recommendation from the 2007 evaluation, the innoFSPEC research strategy builds on existing knowledge in astronomical instrumentation at AIP (PMAS, MUSE, RAVE, STELLA, PEPSI) and focuses particularly on fibre-based spectroscopy. It addresses promising new developments in the area of optical fibres, waveguides, and other photonics devices. As photonics is spreading from the classical sector of telecommunication technologies to other disciplines such as biophotonics, the emerging field of astrophotonics is considered to be highly relevant for improvements of future instrumentation of ground-based telescopes and in space. In 2013, a third group was established in order to work on multiplex Raman spectroscopy as a promising new minimally invasive

optical cancer diagnostic technique. The section also coordinates the knowledge and technology transfer at AIP.

4. Collaboration and networking

Collaboration with universities

AIP cooperates closely with many universities in the region, on national level, and with universities abroad. As a result, among 224 third-party funded projects in the reporting period 2007 to 2013, 105 where joint projects with university partners in Germany, 105 with partners at European universities and 47 with partners outside Europe, primarily Australia and the USA.

A particularly close relationship exists with the University of Potsdam (UP) where both AIP directors are full professors since 2000 and 2002. In the past seven years, UP and its non-university partners AIP and DESY[9] Zeuthen have established two new joint professorships (W2) in Astrophysics at AIP, two new joint appointments (W3) in Particle-Astrophysics at DESY Zeuthen, a joint structured PhD programme, the Leibniz Graduate School for Quantitative Spectroscopy, and the joint innoFSPEC centre of excellence for fibre optics. In order to further strengthen astrophysics at UP, the Potsdam Research Initiative for Astrophysics (PRIA) has been initiated; measures include:

- the application for funding for a joint appointment in the field of cosmology and extragalactic astrophysics,
- the establishment of a joint professorship (tenure-track) in the field of extragalactic astrophysics and / or astrophysical cosmology,
- the appointment of a Helmholtz-professor (chair) in the field of plasma astrophysics,
- the appointment of a successor for the existing chair “stellar astrophysics” in the field of either theoretical or observational stellar astrophysics,
- the strengthening of the scientific collaboration with the Max Planck Institute for Gravitational Physics (Albert Einstein Institute, AEI),
- the initiation of a master programme in astrophysics (with English as teaching language) starting in winter term 2016,
- the continuation and development of innoFSPEC and its astrophysical applications.

On the longer timescale, a further joint appointment in the area of Extrasolar Planets / Astrobiology is foreseen as well as applications for coordinated DFG-programmes.

At Berlin, AIP has one lectureship (*Privatdozentur*) at the physics department of Technische Universität (TU) Berlin. In order to strengthen the ties between AIP, UP and TU, the joint “Berlin-Potsdam-Kolloquium” has been initiated. Moreover, AIP scientists usually teach the introductory astronomy course for physics students at Humboldt-Universität (HU) Berlin. Ties between those Universities are likely to increase further

[9] German Electron Synchrotron (Helmholtz-Association), located in Hamburg (headquarters) and Zeuthen near Berlin.

with the newly established chair for Astro-Particle Physics and Cosmology (joint appointment with DESY).

Abroad, there are collaborations with Université Claude Bernard, Lyon (two joint PhD theses), the Universities of Graz, Vienna, Barcelona, Paris (one joint PhD thesis each), and Oulu (Finnland, two joint PhD theses). Members of the AIP also hold adjunct positions or guest professorships with a number of universities worldwide.

Collaboration with international institutions

AIP is set-up as an international research centre in astrophysics with extensive ties to other research institutions worldwide and a large number of joint research projects spanning the full range from small individual scientific cooperation to large international instrumentation consortia. AIP scientists hold colloquia at international institutions, give invited talks at international conferences, and participate in longer-term workshops at international centres, also in coordinating functions. A further indication of the international networking of the institute is given by the percentage of scientists from abroad in relation to all scientific personnel at the AIP: In 2013, this percentage was slightly above 50%.

AIP runs a guest programme that is financed by institutional funding. The visiting scientists typically stay one to two weeks and present their research at the weekly seminars or colloquia. Between 2011 and 2013, AIP has received 104 scientific guests, ten out which stayed longer than three month. In the same period, 48 scientists from AIP stayed at research institutes abroad, among them two who stayed for longer than three month. Furthermore, the AIP annually awards the Wempe award.

Other collaborations and networks

AIP is member of (and currently chairs) the German Observatory Council. As Chair of the Council, it also serves as National Member for Germany in the International Astronomical Union (IAU), where AIP scientists are active members.

Within the Leibniz Association, AIP is networked through activities in the presidium, several working groups and via the Leibniz transfer portal (Leibniz application lab).

AIP is a member in the OpTecBB (a competence network for optical technologies) and PhotonikBB networks. Member institutions are small and medium-size companies and research institutions of the Berlin-Brandenburg region. Moreover, AIP is member of various regional networks, e. g., the Climate Research Platform Brandenburg, the State Association of Brandenburg's Non-University Research Institutions LAUF (political focus), the *Pro Wissen Potsdam e. V.* network of all scientific institutions in the Potsdam and Berlin-Brandenburg region. It participates in the *Lange Nacht der Wissenschaft* (public outreach focus), and the Potsdam Research Network PEARLS (focus on postgraduate programmes and senior scientist networking seminars). AIP is member of the interdisciplinary network of German foundations (*Bundesverband Deutscher Stiftungen*). Since 2012, AIP's library is participating in Electronic Journals Library.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

At 31 December 2013, AIP employed 192 people (164.5 fulltime equivalents), 121 out of which were scientists, 36 working at service positions and 17 at the administration (see annex 4 for details).

In 2010, the AIP's mandatory staffing plan has been substituted by global budgets for different groups of staff. In addition, since 2015, the institute is allowed to issue up to six tenured working contracts for researchers financed via third-party funds. Personnel outside the tariff categories are limited by number and budget (7 appointments and 830 k€ in 2015). Currently this includes provision for 3 joint appointments at the W3 professor level, 2 at the W2 professor level and 2 non-tariff contracts. One W3 slot is currently vacant in preparation for a third joint appointment with UP (section head Cosmology). One of the two non-tariff slots will be upgraded to a fourth joint professorship (W2) in the 2015 programme budget, in preparation for a replacement that will take place in 2018 (Stellar Physics).

Promotion of gender equality

The AIP promotes gender equality on the basis of guidelines in the "*Ausführungsvereinbarung Gleichstellung*" (Implementation Agreement on equal opportunities for the Leibniz-Association), the DFG's "Research Oriented Standards on Gender Equality" and the "*Gleichstellungsverordnung Brandenburg*" (Regulations of Gender Equality of the Land Brandenburg).

Since the last evaluation, AIP significantly raised the share of its female staff (13% in 2006). At 31 December 2013, 27 out of 121 scientists (22%) were women. Based on the current status quo and taking into account all positions becoming available at the higher levels, the AIP has extrapolated target quota for 2017 according to the binding regulations of the Joint Research Conference (GWK) relying on the DFG equal opportunity standards in research (so-called cascade model).

At PhD and postdoc level (E13), AIP already fulfils a quota over average of 29% and does not expect significant changes. At the E14 salary level (senior scientists, group leaders, section heads), AIP intends to increase the share of females to 17% (10% at present), by 2017 consistent with upcoming vacancies. At E15 salary level (group leaders and section heads, 11% of females at present), one scientist will retire before 2017. This position is planned to be refilled as a joint professorship. Other retirements will occur only in 2018 and 2019. AIP intends to establish an Emmy Noether research group headed by a woman and reach 15% in 2017, subject to considerable fluctuations. At director's level, no changes are expected until 2017.

Of the staff who left the institute (or received offers) to assume a tenure-track or permanent position at other institutions or who was promoted at AIP, 9 (out of 34) offers were made to female scientists. According to AIP, female scientists who received their training at AIP thus compete very well in the international job market for tenure-track and permanent positions.

As part of its successful certification process berufundfamilie ("family and career" audit), AIP signed a memorandum of understanding in 2013 and committed itself to actively adapting the staffing schedule as well as family policies in order to realise an equal opportunity environment. A number of measures have already been implemented, such as mobile offices for parents with small children, a flexibilisation of the work hours and emergency childcare.

The Equal Opportunities Officers take part in the internal management meetings and have access to their own budget for further education measures in the area of equal opportunity. From 2015, part of the central budget is earmarked for management courses for scientific leadership positions, with priority for female scientists.

Promotion of junior researchers

Most of the roundabout 30 PhD students at AIP are registered at the University of Potsdam. All advisors of PhD theses in astronomy and astrophysics have agreed to a Structured Research and Training Doctoral Programme and signed a respective commitment in December 2011. Key components are supervision through thesis committees, mentoring by senior students, joint colloquia, and dedicated teaching and training courses as well as soft skills.

The Structured Research and Training Doctoral Programme also provides a framework for more topically focused and third-party-funded graduate programmes such as the Leibniz Graduate School for Quantitative Spectroscopy acquired in the Leibniz Competition Programme and complemented by funding from DAAD. The infrastructure set-up by these programmes is open to all graduate students of the AIP. Despite continuing third party fundraising efforts, it is the intent and commitment of AIP to secure the already established PhD programme by institutional resources. The institute's goal for the duration of PhD projects is three years. At present, however, the average time to PhD is 4.15 years because of various reasons (administrative procedures, additional requirements for admission etc.).

In order to attract promising junior researchers at the postdoctoral level, the AIP has initiated the Karl Schwarzschild Fellowship. AIP does not award stipends, neither for PhD students nor for postdocs. The few PhD students (and even fewer postdocs) who are supported on a stipend receive their funding via external sources such as DAAD, Humboldt Foundation, or funding agencies of their home countries. They have full access to the AIP infrastructure via guest contracts.

Vocational training for non-academic staff

For a number of professions (administration, mechanics, IT support), AIP offers apprentice positions. Three apprentices (2011: 1; 2013: 2) completed their training during the past three years. Since the beginning of 2014, AIP employs four apprentices.

In order to increase the individual, professional, working and social skills of its staff, AIP has issued a human resources development plan. Proper budgets for the financial support of vocational training are assigned to every individual administrative section, to central services, to the equal opportunities officers and to the works council. Since 2009,

AIP has also financially and organisationally supported five college and university bachelor and master degrees. If training involves multi-day work trips, AIP's childcare programme will broaden the opportunities for the staff.

6. Quality assurance

Internal quality management

According to AIP, a number of internal measures to ensure a high quality of scientific work have been established. Since 2005, the institute operates a cost-performance accounting system as a basis for the annual programme budget representing, since 2007, the basis of the annual budget negotiations. The directors of the research branches and the heads of the scientific and R&D sections (also called programme areas) define the long-term goals and a set of annual milestones together with the resources necessary for their implementation. The programme budget meets commercial as well as public finance standards and is presented and reviewed annually by the Science Advisory Board and the Board of Trustees.

In accordance with the statutes, the scientific staff may elect an Internal Scientific Committee (ISC) ensuring the scientific staff's participation in a more formalised way. The ISC organises scientific events and is involved in key decisions affecting the working conditions of the institute with focus on scientific issues.

All scientific members of the institute are obliged to act according to the guidelines for good scientific practice of AIP, which closely follow the corresponding recommendations by DFG and the Leibniz Association. An independent ombudsperson and a vice ombudsperson are nominated by ISC who can be addressed in matters of scientific misconduct.

Publications are prepared following the DFG guidelines for good scientific practice and are reviewed internally before submission. AIP's goal is to publish in high-impact international peer-reviewed journals, in particular the four key journals in astronomy and astrophysics. It is also increasingly common to make simulation data publicly available in order to allow for additional data scrutiny.

The institute has established a system of performance-based allocation of resources. These include access to the Large Binocular Telescope (AIP's share is approximately 10 nights per year), to travel funds, to resources for guests and exchange programmes, to surpluses from reserves and other incentives. Requests are served roughly in proportion to the third-party funding raised by the respective section or research group.

Quality management by the Scientific Advisory Board and Supervisory Board

The Science Advisory Board (SAB) meets once per year to consult about the achievements of the past year, the handling of previous recommendations, and future strategic planning. In addition, the programme budget is discussed, as well as new project ideas, significant long-term commitments and intended senior hires. An annual progress report by AIP is submitted to the SAB four weeks ahead of the meeting. As a result of its meeting, SAB writes a short report including recommendations to the institute management. These reports are also discussed at the following Board of Trustees meetings. Four

years after an evaluation, the SAB performs an audit that closely follows the external evaluation procedures of the Leibniz Association's senate.

Implementation of recommendations from the last external evaluation

AIP responded to the ten recommendations of the last external evaluation (highlighted in italics, see also statement of the Senate of the Leibniz Association from 9 July 2008 pages B-15/16) as follows:

(1) *AIP should review whether it is capable of successfully participating in all the current and future projects with its available manpower, or whether focussing on a smaller number of projects could be of advantage.*

According to the institute, with the introduction of programme budgets in 2006, the AIP had already started focussing its technical project portfolio on four main areas of expertise: Robotics and Telescope Control, High-resolution Spectroscopy and Polarimetry, 3D and Multi-Object Spectroscopy, and Supercomputing and E-Science. With the establishment of the innoFSPEC Centre of Excellence, a fifth R&D section was established in 2010. In 2007, most of the technical AIP projects were still in the design or early construction phase. Meanwhile they are in operation and have already produced a lot of data.

Consequently the strategic decisions during the last few years have not been driven by a possible reduction in the number of projects but rather where to best invest AIP resources for future projects in the 2015-2025 period.

(2) *The institute should consider increasing the fraction of fundamental theoretical studies to support its astrophysical observations and measurement activities.*

The AIP has discussed this issue extensively with the Board of Trustees and with the Science Advisory Board. The parties in charge agreed that further increase in personnel for fundamental theoretical studies is not advisable considering that in 2007 already about 50% of the AIP scientists already primarily work in the area of theoretical astrophysics. A further increase would be at the expense of staff resources for the preparation and exploitation of the instrumentation projects.

(3) *In the programme area "Star Formation and Interstellar Medium" vacant positions should be filled at an adequate level in the near future. Alternatively the institute should consider a change in focus for this area*.

The vacant position (there was only one) had already been filled in 2007. In 2010, for several reasons, AIP decided to restructure the sections "Galaxies and Quasars" and "Star Formation and the Interstellar Medium". The newly established "Milky Way and Local Volume" Section includes the former Galactic Archaeology group from the "Galaxies and Quasars" Section as well as the remaining programme of the former "Star Formation and Interstellar Medium" Section (see also next paragraph).

(4) *The AIP should review whether there is sufficient manpower planned for at the institute to exploit the RAVE project.*

In 2009, a senior researcher with focus in the area of "Galactic Archaeology / Near-field Cosmology" and several postdocs of this field were hired. In 2010, this group was strengthened by another senior researcher. With the establishment of the "Milky Way and the Local Volume" section in 2011, activities have increased further. As a result, data collection for RAVE was completed successfully in 2013. A total of 41 refereed RAVE papers have been published by the consortium over the reporting period, eleven out of them with an AIP first author and twelve more with AIP authors in the core groups.

(5) *In order to improve the communication between the institute management and the employees, regular staff appraisals should be introduced.*

The institute has introduced formal annual staff appraisals. Minutes of the appraisals are taken and collected in the personal file of each employee.

(6) *The Internal Scientific Committee (ISC) should more act as an internal advisory committee in future, with the duties and rights of the ISC adjusted accordingly.*

AIP has enhanced the rights and responsibilities of the ISC. It now has regular meetings with the extended management panel the SAB.

(7) *The Equal Opportunity Programme at the institute should be augmented.*

This recommendation has been implemented (c. f. chapter 5).

(8) *In order to enable AIP to continue operating in an economic fashion, greater flexibility in the administration of resources from the funding agencies is absolutely necessary.*

The flexibility in administering institute funds has considerably increased.

(9) *Future flexibility in the administration of the annex fund should be used by the AIP to regain flexibility in hiring personnel that is currently missing.*

AIP uses its enhanced flexibility for more effective management of staff resources.

(10) *The institute should develop a long-term plan for its future IT structure. The institute should consider an increase the staff in the IT area and – in the interests of establishing a sustainable infrastructure in the medium term and firmly anchor its IT services – also develop this plan as soon as possible.*

AIP has developed an E-Science strategy. Thanks to the support of the BMBF, seed funding for a long-term E-Science infrastructure was made available in 2009. Funding for this infrastructure was successively carried-over into the institutional budget in the years 2011-2014. For 2015, the institute put in a request for an extraordinary item of expenditure (*Sondertatbestand*) that was granted for the years 2015-2018. The AIP has applied for a transfer of this item to the institutional funding post 2018, however a decision on this was put on hold by the funding agencies subject to the outcome of the 2015 evaluation.

Appendix 1

Organisational Chart

Wissenschaftlicher Beirat / Science Advisory Board
Prof. Dr. Peter Schneider (Vorsitzender Chair)
Prof. Dr. Michael Kramer (Stv. Vorsitzender Vice Chair)

Kuratorium / Board of Trustees
Dr. Claudia Herok (Vorsitzende Chair)
Ministerium für Wissenschaft, Forschung und Kultur des Landes Brandenburg
Dr. Renata Ch. Feldmann (Stv. Vorsitzende Vice Chair)
Bundesministerium für Bildung und Forschung

Vorstand / Executive Board
Prof. Dr. Matthias Steinmetz (Sprecher Chairman)
Dr. Ulrich Müller

Vorstandsreferentin Scientific Coordinator
Dr. Gabriele Schönherr

Presse- und Öffentlichkeitsarbeit Public Relations
Kerstin Mork

Betriebsrat Works Council
Dr. Olivier Schnurr

Internes Wissenschaftliches Komitee
Internal Scientific Commitee
Dr. Adriane Liermann

Ombudsmann für gute wissenschaftliche Praxis
Ombudsman for Good Scientific Practice
Dr. Matthias Steffen

Gleichstellung Gender Equality
Petra Nihsen

Datenschutz Data Protection
Dr. Harry Enke

IT Sicherheit IT Security
Mario Dionies

Kosmische Magnetfelder
Cosmic Magnetic Fields
Prof. Dr. Klaus Strassmeier

4.1 Magnetohydrodynamik und Turbulenz
Magnetohydrodynamics and Turbulence
Dr. Rainer Arlt

4.2 Physik der Sonne Solar Physics
apl. Prof. Dr. Gottfried Mann

Optische Sonnenphysik Optical Solar Physics
apl. Prof. Dr. Carsten Denker

4.3 Sternphysik und Sternaktivität
Stellar Physics and Stellar Activity
Dr. Swetlana Hubrig

Extragalaktische Astrophysik
Extragalactic Astrophysics
Prof. Dr. Matthias Steinmetz

4.4 Milchstraße und die lokale Umgebung
Milky Way and the Local Volume
Dr. Roelof de Jong

4.5 Galaxien und Quasare Galaxies and Quasars
Prof. Dr. Lutz Wisotzki

Röntgenastronomie X-ray Astronomy
PD Dr. Axel Schwope

4.6 Kosmologie und großräumige Strukturen
Cosmology and Large-scale Structure
Dr. Stefan Gottlöber

Galaxienentstehung Galaxy Formation
Dr. Cecilia Scannapieco

Administration
Administration
Dr. Ulrich Müller

Personal und Recht Personnel and Legal Affairs
Gernot Rosenkranz

Finanzen Finance
Herbert Klein

Zentrale Dienste Central Services
Torsten Krüger

Zentrale Einrichtungen
Research Infrastructure
Prof. Dr. Matthias Steinmetz

Forschungstechnik Technical Division
Dr. Roger Haynes

IT-Service IT Services
André Saar

Wissenschaftliche Bibliothek und Dokumentationszentrum
Scientific Library and Documentation Centre
Regina v. Berlepsch

Entwicklung von Forschungstechnologie und -infrastruktur
Development of Research Technology and Infrastructure
Prof. Dr. Klaus Strassmeier
Prof Dr. Matthias Steinmetz

4.7 Teleskopsteuerung und Robotik
Telescope Control and Robotics
Dr. Thomas Granzer

4.8 Hochauflösende Spektroskopie und Polarimetrie
High-resolution Spectroscopy and Polarimetry
Dr. Michael Weber

4.9 3D- und Multi-Objekt-Spektroskopie
3D and Multi Object Spectroscopy
Dr. Andreas Kelz

4.10 Supercomputing und E-Science
Supercomputing and E-Science
Dr. Detlef Elstner

4.11 innoFSPEC
innoFSPEC
Prof. Dr. Martin Roth

Astrophotonik Astrophotonics
Dr. Domenico Giannone (acting)

Wissens- und Technologietransfer
Knowledge and Technology Transfer
Dr. Silvia Adelhelm, Marvin Stolz

AIP Leibniz-Institut für Astrophysik Potsdam

Leibniz-Institut für Astrophysik Potsdam (AIP)
An der Sternwarte 16
14482 Potsdam
info@aip.de
+49 331 7499-0
www.aip.de
(as of 01.2015)

Appendix 2

Publications and patents

	Period		
	2011	**2012**	**2013**
Total number of publications	**290**	**289**	**265**
Monographs	1	2	3
Articles in peer-reviewed journals	197	171	200
Articles in other journals	81	106	52
Editorship of edited volumes	11	10	10

Industrial property rights (2011–2013) [1)]	Granted	Registered
Patents	0	2
Other industrial property rights	0	0
Exploitation rights / licences (number)	0	

[1] Concerning financial expenditures for revenues from patents, other industrial property rights and licences see appendix 3.

Appendix 3

Revenue and Expenditure

Revenue		2011			2012			2013		
		k€	% [1]	% [2]	k€	% [1]	% [2]	k€	% [1]	% [2]
Total revenue (sum of I., II. and III.; excluding DFG fees)		14,802			15,298			16,274		
I.	Revenue (sum of I.1.; I.2. and I.3)	14,625	100		15,225	100		16,178	100	
1.	Institutional funding (excluding construction projects and acquisition of property)	9,917	68		10,336	68		10,781	67	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	9,917			10,336			10,780		
1.1.1	Proportion of these funds received through the Leibniz competitive procedure (SAW procedure) [3]	371			168			0		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	0			0			0		
2.	Revenue from project grants	4,708	32	100	4,889	32	100	5,397	33	100
2.1	DFG	774		16	1,055		22	911		17
2.2	Leibniz Association (competitive procedure) [3]	0		0	10		0	360		7
2.3	Federal, *Länder* State governments	3,834		82	3,626		74	3,615		67
2.4	EU	81		2	131		3	398		7
2.5	Industry	0		0	0		0	0		0
2.6	Foundations (Alexander von Humboldt Foundation)	19		0	9		0	10		0
2.7	Other sponsors (ESO)	0		0	58		1	32		1
	Other sponsors (University of Potsdam)	0		0	0		0	71		1
3.	Revenue from services	0	0		0	0		0	0	
3.1	Revenue from commissioned work	0			0			0		
3.2	Revenue from publications	0			0			0		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models etc.)	0			0			0		
3.4	Revenue from exploitation of intellectual property without industrial property rights	0			0			0		
3.5	Revenue from other services, if applicable; please specify	0			0			0		
II.	Miscellaneous Revenue (e.g. membership fees, rental income, funds drawn from reserves)	177			73			96		
III.	Revenue for construction projects (institutional funding by Federal and *Länder* State governments, EU structural funds, etc.)	0			0			0		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		14,802	15,298	16,274
1.	Personnel	8,424	8,963	9,613
2.	Material resources	3,119	3,306	3,346
2.1	Proportion of these expenditures used for registering industrial property rights (patents, etc.)	0	0	0
3.	Equipment investments and acquisitions	2,588	2,170	2,607
4.	Construction projects, acquisitions of property	0	0	0
5.	"Reserves" (e.g. cash assets, unused funds)	671	859	708
6.	Miscellaneous items	0	0	0
DFG fees (2.5% of revenue from institutional funding)		242	254	267

[1] Figures I.1, I.2 and I.3 add up to 100%. The information requested here is thus the percentage of "Institutional funding (excluding construction projects and acquisition of property)" in relation to "Revenue from project grants" and "Revenue from services".
[2] Figures I.2.1 to I.2.7 add up to 100%. The information requested here is thus the percentage of the various sources of "Revenue from project grants".

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31/12/2013)

	Full time equivalents		Employees		Female employees	
	Total	3rd-party funding	Total	temporary contracts	Total	temporary contracts
	Number	Percent	Number	Percent	Number	Percent
Research and scientific services	**105.1**	**50.2 %**	**121.0**	**75.2**	**27**	**88.9 %**
Professors / Directors (C4, W3, or equivalent)	2.0	0.0 %	2.0	0.0	0	0.0 %
Professors / Directors (C3, W2, A16, or equivalent)	2.0	0.0 %	2.0	0.0	0	0.0 %
Academic staff in executive positions (A15, A16, E15, or equivalent)	11,0	18,2 %	11,0	0,0	1	0,0 %
Junior research group leaders / junior professors / post-doctoral fellows (C1, W1, A14, E14, or equivalent)	2.0	100 %	2.0	100.0	1	100 %
Scientists in non-executive positions (A13, A14, E13, E14, or equivalent)	76.1	51.9 %	80.0	81.3	18	88.9 %
Doctoral candidates (A13, E13, E13/2, or equivalent)	12.0	77.1 %	24.0	100.0	7	100.0 %
Service positions	**34.4**	**11.1 %**	**36**			
Laboratory (from E13, senior service)	2	0 %	2			
Laboratory (E9 to E12, upper-mid-level service)	10.7	26.2 %	11			
Laboratory (E5 to E8, mid-level service)	3	0 %	3			
Library (from E13, senior service)	0	0 %	0			
Library (E9 to E12, upper-mid-level service)	1	0 %	1			
Library (E5 to E8, mid-level service)	1	0 %	1			
Information technology – IT (from E 13, senior service)	1	0 %	1			
Information technology – IT (E9 to E12, upper-mid-level service)	3	0 %	3			
Information technology - IT (E5 to E8 mid-level service)	3	33.3 %	3			
Support (E9 to E12, upper-mid level)	1.8	0 %	2			
Support (E5 to E8, mid level)	7.9	0 %	9			
Administration	**16.5**	**0 %**	**17**			
Administrative Director	1	0 %	1			
Staff position (E9 to E12, upper-mid-level service)	1	0 %	1			
Internal administration (financial administration, personnel, etc.) (from E13, senior service)	1	0 %	1			
Internal administration (financial administration, personnel, etc.) (E9 to E12, upper-mid-level service)	6	0 %	6			
Internal administration (financial administration, personnel, etc.) (E5 to E8, mid-level service)	5.5	0 %	6			
Building service (E5 to E8)	2	0 %	2			
Student assistants	**8.5**	**61.8 %**	**18**			
Trainees	**3**	**0 %**	**3**			
Scholarship recipients at the institution	**3**	**100 %**	**3**		**0**	
Doctoral candidates	2	100 %	2		0	
Post-doctoral researchers	1	100 %	1		0	

14 July 2015

Annex B: Evaluation Report

Leibniz Institute for Astrophysics Potsdam (AIP)

Contents

Appendix:
Members of review board and guests; Representatives of collaborative partners

1. Summary and main recommendations

The Leibniz Institute for Astrophysics Potsdam (AIP) conducts research in astrophysics ranging from the study of the sun to the evolution of the cosmos. Research focusses on "Cosmic Magnetic Fields" and "Extragalactic Astrophysics" as well as on developing research technologies in spectroscopy, robotic telescopes and e-science. The results of AIP's basic research are known and recognised across the world. The institute provides valuable infrastructure services (e.g. databases and simulations) for the international astrophysics community and also makes relevant scientific contributions to applied research.

Since the last evaluation, AIP has developed very well, consistently extending its instrumentation and computer-assisted infrastructure. It has been remarkably successful in participating in, and even leading, challenging instrumentation projects. Once these have been implemented it is to be expected that the institute's very good publication record will grow even more in the next few years. Overall, the outcomes of AIP's research and development efforts are very good to excellent. One section was rated as "good to very good", three as "very good", four as "very good to excellent" and two as "excellent".

In order to fulfil its mission, AIP cooperates intensively and productively with distinguished institutions at home and abroad. Collaborative relations with the University of Potsdam are very good. The plans to establish further joint appointments are welcomed. Junior researchers at AIP receive very good training and supervision.

The institute pursues a convincing strategy and is very well managed, both scientifically and administratively. The facilities are adequate for purpose, the personnel structure appropriate. AIP is very successful in its acquisition of third-party funding; it could, however, aim to increase the volume of EU funding.

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

GENERAL CONCEPT AND PROFILE

1. In terms of its expertise in astrophysics, AIP is firmly and broadly based. This is one of its great strengths that enables it to implement a comprehensive, cross-disciplinary research strategy. At the same time, AIP has defined appropriate cross-cutting themes which allow it to set priorities. The institute is encouraged to continue along this path in order to maintain and further develop its standing as an internationally competitive research institution.
2. Due to the development of the institute's technology and infrastructure sector in the last few years, the potential for knowledge and technology transfer (KTT) outcomes has grown but is not yet being fully exploited. The Review Board assumes that further interesting transfers will be forthcoming in the future.
3. Due to the central importance of the Technical Section for AIP's strategic development and competitiveness, the plans to strengthen it and to ensure permanent employment for the highly-qualified personnel are logical. AIP has developed a coherent

mid-term development plan for the enlargement of the Technical Section. From 2017, for implementation it envisages additional funding of up to approximately €950k per year (extraordinary item of expenditure, see Status Report, p. A-10), staggered over a three- to four-year period. This is well justified. The implementation of these plans is explicitly supported.

4. AIP is encouraged to continue focusing on projects that reflect the institute's particular strengths and promote its scientific work. By boosting the Technical Section, the best possible preconditions for this mission will be created.
5. AIP's office capacity, however, has long lagged behind actual needs. Moreover, thanks to the institute's success in acquiring third-party funding, the workforce has grown significantly since the last evaluation; additional office space is urgently required. Consequently, the ongoing plans to construct a new, bilaterally-financed building are strongly supported.

STAFF DEVELOPMENT

6. Women are clearly underrepresented in AIP's scientific sector, particularly in leadership positions. AIP is called upon to achieve the binding quotas determined for this institute in the cascade model.

2. General concept and profile

AIP conducts research in astrophysics and its results are known and recognised across the world. It focusses on current issues relating to cosmic magnetic fields, solar and stellar activity, extragalactic astrophysics and cosmology. AIP's theoretical work is based on computer simulations carried out on high-performance computers. Observational data are collected with the aid of state-of-the-art technology at terrestrial and space telescopes. For this purpose, the institute actively develops research technologies in spectroscopy, robotic telescopes, e-science and supercomputing, thus also making relevant contributions to applied research. In order to fulfil its mission it cooperates intensively and productively with distinguished national and international institutions, often in large consortia.

AIP has taken important and clever strategic decisions in continually developing and extending its instrumentation and computer-aided infrastructure. By doing so, it is able to make efficient and effective use of the opportunities for long-term planning and conducting complex research projects which are characteristic of non-university institutions.

In terms of its expertise in astrophysics, AIP is firmly and broadly based. This is one of its great strengths that enables it to implement a comprehensive, cross-disciplinary research strategy. At the same time, AIP has defined appropriate cross-cutting themes which allow it to set priorities. The institute is encouraged to continue along this path in order to maintain and further develop its standing as an internationally competitive research institution.

Development of the institution since the last evaluation

At the last evaluation (2007/2008), AIP was already credited with excellent results. Since then, the institute has continued to develop very well.

The basic organisational structure comprising the research branches "Cosmic Magnetic Fields" and "Extragalactic Astrophysics", each consisting of three scientific sections, as well as the field of "Development of Research Technology and Infrastructure", consisting of four research and development (R&D) sections, has proven very successful (see Chapter 3 for the individual subdivisions). Meaningful strategic adjustments have been made since the last evaluation. Within the sections there is an appropriate mixture of experimental and observation-based and/or theoretical and simulation-based units. Links with the developmental units are close and productive. In "Cosmic Magnetic Field", however, a certain potential for increased cross-sectional cooperation was noted, for example with regard to the strategic theme "The Solar-Stellar Connection". Furthermore, it should be examined whether connections across research branches could be productively established, not least in order to boost the critical mass for certain themes (for example in the strategic theme "The Milky Way-Galaxy Connection").

In the last few years, AIP has been very successful at participating in, and even leading, challenging instrumentation projects for medium-size and large telescopes (see below: Strategic work planning). High resolution spectrographs are one of its major areas of activity in this field. AIP has now become one of the world's leading centres for 3D optical spectroscopy in astronomy.

Results

AIP's overall publication performance is already very good. Once some important instrumentation has gone into operation and additional observation times have been acquired, a significant further increase can be expected in the next few years.

AIP provides valuable infrastructure services. It is, for example, involved in operating research infrastructures that are in great demand internationally (including the Large Binocular Telescope [LBT] in Tucson, Arizona, and the robotic telescope STELLA on Tenerife). It also furnishes the community with databases for astronomical research (see Chapter 3.10) and develops software platforms and frameworks that are available to the scientific public (see Chapter 3.1).

AIP's work in the field of knowledge and technology transfer (KTT) is satisfactory. It is welcomed that the acquisition of "innoFSPEC" (see Section 3.11) has been used to establish a KTT Office. Two patents were registered during the reporting period. **Due to the development of the institute's technology and infrastructure sector in the last few years, the potential for KTT outcomes has grown but is not yet being fully exploited. The Review Board assumes that further interesting transfers will be forthcoming in the future.**

Staff at AIP are actively involved in scientific self-governance. Having succeeded to the chairmanship of the Council of German Observatories, the Chairman of the AIP Board

has taken on an important, prestigious role. He was also recently elected President of the German Astronomical Society.

AIP enjoys a media presence with coverage of astronomical topics. It is pleasing that, since 2007, the Staff Unit has included a full-time Scientific Coordinator who is also responsible for the institute's public outreach activities. This has facilitated a large number of showcasing events such as exhibitions, lectures, tours etc.

Strategic work planning for the next few years

By consistently and sustainably intensifying its activities in instrumentation development, AIP has noticeably honed its expertise and profile in this field and established itself as an internationally-recognised brand. This positioning was demonstrated most clearly by its successful bid for the leadership of the 4MOST Consortium (4-metre multi-object spectroscopic telescope). Thus, for the first time, AIP has assumed responsibility for managing the construction of instrumentation for the European Southern Observatory (ESO). On the basis of these complex tasks, the institute has laid excellent scientific and technical foundations for its work in the coming years which will essentially be determined by the scientific exploitation of these facilities. Furthermore, thanks to these substantial contributions to instrumentation, AIP scientists gain access to valuable observation times at the world's best telescopes, which will then unlock major potential for further research in the future.

The technical personnel available to implement these large-scale projects is both highly competent and motivated. However, the composition of the workforce in this section is not commensurate with the growth in demand. **Due to the central importance of the Technical Section for AIP's strategic development and competitiveness, the plans to strengthen it and to ensure permanent employment for the highly-qualified personnel are logical. AIP has developed a coherent mid-term development plan for the enlargement of the Technical Section. From 2017, for implementation it envisages additional funding of up to approximately €950k per year (extraordinary item of expenditure, see Status Report, p. A-10), staggered over a three- to four-year period. This is well justified. The implementation of these plans is explicitly supported.**

AIP is encouraged to continue focusing on projects that reflect the institute's particular strengths and promote its scientific work. By boosting the Technical Section, the best possible preconditions for this mission will be created.

Another of AIP's important objectives is to promote university astrophysics in the Berlin-Brandenburg research area, not least in order to lay the necessary foundations for acquiring third-party funding in the context of large coordinated programmes. To achieve this goal, the institute cooperates particularly closely with the University of Potsdam and pursues a conscious policy of increasing the number of jointly appointed professors (see Chapter 4).

Appropriateness of facilities, equipment, and staffing

AIP's financial provisions in terms of institutional funding are appropriate.

The institute is very successful at raising third-party funding. In 2013, it accounted for a third of its entire funding. This distribution is commensurate with the institute's mission. Within the third-party funding portfolio, grants from the Federal Government have the greatest weight, but AIP is also successful in its applications to the German Research Foundation (DFG). The institute is recommended to examine whether a growth in the volume of EU funding could be of benefit, not least with regard to networking in the European area.

AIP's laboratories and workshops are very well equipped and provide the best conditions for developing and constructing state-of-the-art astrophysical devices and infrastructures. Since the last evaluation, the construction of the *Leibnizhaus* (opened in 2010), which houses, amongst others, the large integration hall and temperature-controlled computer rooms, has upgraded the building facilities on the technological and instrumentation side. **AIP's office capacity, however, has long lagged behind actual needs** (see Status Report, p. A-9). **Moreover, thanks to the institute's success in acquiring third-party funding, the workforce has grown significantly since the last evaluation** (see Chapter 5)**; additional office space is urgently required. Consequently, the ongoing plans to construct a new, bilaterally-financed building are strongly supported.** The Review Board assumes that any follow-up costs will be included in budgeting in good time.

3. Subdivisions of AIP

Research branch "Cosmic Magnetic Fields":

(1) Work in the **Scientific Section "Magnetohydrodynamics and Turbulence"** (9 FTE) focusses on numerical simulations to explain the processes of star formation, development and rotation in interplay with magnetic effects. For this purpose, impressive theoretical simulations are productively combined with experimental results. Fruitful cooperation also takes place with supercomputing facilities in Germany. Given existing supercomputing potential, the plans of this internationally-recognised group to concentrate more on the global simulation of stars or star formation are extremely promising.

Against the backdrop of the time-intensive, sophisticated numerical simulations, the publication record of this group, which largely has a theoretical focus, is quantitatively satisfactory and qualitatively very good. The group's own software code (MHD Code) NIRVANA, which it continues to develop, is an essential tool that is used by groups outside of AIP. The closer connection with the stellar physics team, which complements the group, is greatly welcomed. Looking to the future, it is recommended to engage in collaboration outside of astrophysics (e.g. in plasma physics). The group is one of the European leaders in its field. In summary, this section is rated as "very good".

(2) In the **Scientific Section "Physics of the Sun"** (14 FTE) the combination of observation and theory plays a major role. In the last few years, the group has successfully in-

vested in improving its observation base. It is involved in developing the optical solar telescope GREGOR and the European radio telescope LOFAR (Low Frequency Array). Moreover, the group developed parts of the X-ray imager for the spectrometer telescope STIX on board the European Space Agency's Solar Orbiter.

The group can thus boast a very good record in developing instrumentation. It must now direct greater attention to communicating its outcomes as well as to high-visibility publishing. LOFAR went into operation in 2013 and has already generated initial results. Not so GREGOR, which was launched in 2012. In the coming years, the Review Board expects the group to significantly increase its publication output, which is already on a positive upward curve. Plans to intensify work on solar-stellar connections in the next few years are greatly welcomed. Close connections exist to the stellar physics team which should be intensified. In summary, this section is rated as "good to very good".

(3) Solar-type stars and their magnetic fields are the focus of the **Scientific Section "Stellar Physics and Stellar Activity"** (10 FTE). The group conducts very successful observations using the telescope STELLA, which was built at AIP. By introducing studies involving magnetic fields, major progress has been made in investigating the surface structures of stars and their formation. In this area the group has a worldwide reputation.

After the last evaluation and the retirement of the former group leader in 2008, research on planetary nebulae and their X-ray emissions was reduced in line with recommendations. The work on massive stars introduced under the new leadership is highly visible. The plans for continuation are promising and correspond well with the group's potential.

The group cooperates successfully with the magneto-hydrodynamics group, complementing each other. Beyond this, there is potential for additional collaboration within the research branch "Cosmic Magnetic Fields" which should be exploited to a greater extent. The group leader will retire in 2018. Plans to amalgamate the group leadership with a joint professorship at the University of Potsdam are welcomed. In summary, this group is rated as "very good to excellent".

Research branch "Extragalactic Astrophysics":

(4) The **Scientific Section "Milky Way and the Local Volume"** (19 FTE) was established in 2010 by amalgamating the previous section "Star Formation" and the research group "Galactic Archaeology" (previously in the section "Galaxies and Quasars"). This was an appropriate response by the institute to personnel changes and points ensuing from the last evaluation. Since then, the group has developed extremely well; it is relatively large and very prolific. The group combines observation with theoretical modelling to brilliant effect. It led RAVE (Radial Velocity Experiment) and distinguished itself in the Gaia Mission's *Data Processing and Analysis Consortium* (DPAC). It has now been tasked with developing 4MOST (the 4-metre multi-object spectroscopic telescope) by the European Southern Observatory (ESO), which can be considered a great achievement.

The group's internal and external networking is very good. It is particularly successful at engaging in collaborations to acquire expertise that is not available at the institute itself. It is welcomed that the group is due to be extended by a DFG-funded Emmy Noether junior research group. The group as a whole is one of the best in its field in the world. It is rated as "excellent".

(5) Following the last evaluation, the **Scientific Section "Galaxies and Quasars"** (14 FTE) was refocussed in line with recommendations. Some projects were phased out following changes in personnel, others (RAVE, Gaia) transferred to the redesigned section "Milky Way and the Local Volume" (see above). The group pursues an observational approach, generating important synergies between research and instrumentation. The focus is set on all-sky surveys using innovative observation methods such as integral field spectroscopy and the analysis (or reduction) of the complex 3-dimensional data generated (MUSE, CALIFA).

Altogether, the team is strong and international and successfully exploits its achievements in instrumentation for scientific purposes. A small, very active sub-unit that conducts research on X-ray astronomy is attached to the group. It is well known for its research on white dwarfs and makes a considerable contribution to the very good publication record of the overall group. This sub-group is heavily involved in the approaching launch of the eROSITA satellite mission which is expected to generate promising survey data. However, future planning should take account of the X-ray group's staffing level when it comes to major all-sky surveys. In summary, the section is rated as "very good".

(6) The **Scientific Section "Cosmology and Large-scale Structure"** (14 FTE) is a theory group with a focus on complex numerical simulations. The group has a very good record of acquiring computing time on supercomputers. Special mention should be made of the successful collaboration with the Supercomputing and E-Science unit at AIP.

Thanks to AIP's excellent computing infrastructures, the group produces impressive scientific results. One big success was the establishment of MultiDark, a new international research network on dark matter and dark energy research, which draws on the expertise of the group working on computational cosmology. The large simulation database developed in this context is state of the art and constitutes an important service for the entire astrophysical community. It is welcomed that the group fosters productive exchange with working groups dealing with observation and the collection and analysis of measuring data. This will continue to be of great importance for its further development.

Due to the retirement of senior scientists, the group is currently in a transition phase. For the continuous capitalisation of knowledge, the continuation of knowhow is essential. Competence in simulation, in particular, must not be lost. Plans to cooperate with the University of Potsdam in order to jointly recruit a professor for the group leadership are welcomed. In summary, this group is rated as "very good to excellent".

Development of Research Technology and Infrastructure:

(7) The **R&D Section "Telescope Control and Robotics"** (5 FTE) is successful in developing innovative software solutions for operating autonomous telescopes. These include, amongst others, the robotic operation of the STELLA telescope on Tenerife and the remote observing mode for the LBT in Arizona, which allows observer input. The section develops modern hardware for telescope control schemes, offering reliable remote operation, which is of key importance for AIP's science programmes on these telescopes. The section is rated as "very good".

(8) The **R&D Section "High-Resolution Spectroscopy and Polarimetry"** (5 FTE) develops high-solution spectrographs and polarimeters for solar and stellar physics in close cooperation with the Robotics Section. The development of the spectrograph PEPSI can be considered a great achievement. The STELLA Echelle Spectrograph (SES) is another complex, promising project. The group is currently working on a highly-promising design for a spectropolarimeter for the European Extremely Large Telescope (E-ELT). As polarimetry is often a neglected observing mode in modern large telescopes, AIP may play a key role here. The section is rated as "very good to excellent".

(9) The **R&D Section "3D and Multi-Object Spectroscopy"** (7 FTE) develops and builds optical field and multi-object spectographs for terrestrial telescopes that comply with the highest standards. At the same time, the group is extremely successful at developing software for reducing, analysing and visualising 3-D data. As a result, AIP has become known worldwide as a centre for 3D optical spectroscopy. Of its many important projects, special mention should be made of its involvement in the 2nd generation VLT instrument MUSE. The fact that MUSE delivered high quality data from day one is to a large degree based on the software contributions from this section which is rated as "excellent".

(10) The **R&D Section "E-Science and Supercomputing"** (8 FTE) is a data management facility that provides important services both for AIP internally as well as for the scientific community as a whole, for example in the data archiving of the MUSE instrument (in future also in the context of Gaia and 4MOST) or the production of simulation data regarding RAVE. The implementation of pipelines and archives for both observational and theory data is state of the art. A user-friendly interface allows for easy accessibility. The group can boast outstanding achievements in hardware development. It also has impressive storage capacities and elaborate storage strategies. Outcomes in this section are of major strategic importance to AIP's continued development and are rated as "very good to excellent". As noted at the last evaluation, they must be continued on a sustainable basis.

It is welcomed that AIP and the Institute for Physical Chemistry at the University of Potsdam have acquired a joint project in the context of the BMBF programme "Centres for Innovation Competence", allowing them to pursue promising approaches, particularly in the field of fibre-based spectroscopy. It should be investigated, though, whether collaborative opportunities exist with other institutes involved in optics and photonics both

within and outside of the Leibniz Association. The third-party funded project is based at AIP as R&D Section **(11) "innoFSPEC"** (15 FTE). At the end of the first funding period (starting in 2009), the 2014 evaluation was positive and funding for a further five years is secure. It is efficient that the section also coordinates knowledge and technology transfer at AIP (see Chapter 2).

4. Collaboration and networking

Collaboration with universities

AIP collaborates intensively and successfully with the University of Potsdam; both of the institute's directors and two other professors hold joint appointments. The establishment of a "structured research and training doctoral programme in astronomy and astrophysics" (also see Chapter 5) is welcomed, as is the joint "innoFSPEC" project (see Section 3.11). The common efforts of AIP and the University of Potsdam to drive astrophysical expertise in the region in the context of the Potsdam Research Initiative for Astrophysics (PRIA) are remarkable: three further joint appointments are planned, as well as a Master's programme in astrophysics (starting in the winter semester 2016).

Furthermore, staff at AIP are involved in teaching at TU Berlin and HU Berlin. Fruitful collaborative relations are also fostered with other universities in Germany and abroad in areas such as joint doctoral supervision and visiting professorships.

Collaboration with other institutions in Germany and abroad

AIP's collaborative relations with non-university partners like observatories, research centres, research consortia and research programmes are diverse and productive. The institute is contractually involved in a number of major national and international collaborative projects, for example, to develop technology for and operate and scientifically exploit terrestrial and space observatories. These include, in particular, the Large Binocular Telescope (LBT) in Tucson, Arizona, the International LOFAR Telescope (ILT), the solar telescope GREGOR on Tenerife, and the 4MOST project of the European Southern Observatory (ESO).

The Potsdam Research Initiative for Astrophysics (PRIA, see above) also involves closer links between AIP and the Zeuthen site of the Deutsches Elektronen-Synchroton DESY and the Max Planck Institute for Gravitational Physics (Albert Einstein Institute, AEI).

Within the Leibniz Association the Kiepenheuer Institute for Solar Physics in Freiburg is an important partner. AIP's involvement in the collaborative research alliance "Medical Technology: Diagnosis, Monitoring and Therapy" as well as in the Leibniz Network "Mathematical Modelling and Simulation" is greatly welcomed. The institute should intensify its contacts to Leibniz institutions with special expertise in laser technology and optical spectroscopy and investigate the potential for joint projects.

AIP is a partner in various EU projects and networks but is not currently responsible for coordinating a consortium. Somewhat greater involvement at EU level would allow the institute to increase its present volume of EU funding which is modest by comparison with its other sources of third-party funding (see Chapter 2, third-party funding).

The large number of visiting scientists regularly present at AIP, in some cases on extended visits, is just as pleasing as the large number of AIP employees visiting other institutes.

Despite its pronounced emphasis on basic research, thanks in particular to its infrastructure and technology development which have continued gaining in importance in the last few years, AIP also conducts application-related research. In the light of this, the institute's engagement in knowledge and technology transfer (see Chapter 2, results) and in relevant networks involving commercial partners (see Status Report A-16) is greatly welcomed.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

In comparison with the last evaluation, the number of full-time equivalents amongst scientific staff alone has risen by some 30% from 81 to 105. This is a result of successful acquisition of third-party funding: approximately half the positions are now funded in this way. As, in addition, AIP regularly hosts numerous scientific visitors (see Chapter 4), the need for additional space (see Chapter 2, equipment) is justified.

AIP's personnel structure is basically appropriate for its mission. In the Technical Section, however, additional support is necessary (see Chapter 2). Now that the binding staffing plan has been discontinued, AIP has greater flexibility in personnel management. This is important because it allows the institute to make appropriate strategic decisions with regard to achieving its scientific goals.

Promotion of gender equality

It is pleasing that AIP practises family-friendly personnel policies (see Status Report, p. A-17f), which have been attested by the *berufundfamilie* (career and family) certificate since 2013.

The proportion of women researchers at various levels of qualification at AIP is higher (a total of 22% of women in research and scientific services) than the low German average for women in physics[1]. At 29% at doctoral candidate level the proportion is even comparatively high. **Nevertheless, women are clearly underrepresented in AIP's scientific sector, particularly in leadership positions. AIP is called upon to achieve the binding quotas determined for this institute in the cascade model.**

Promotion of junior researchers

Junior researchers are very well trained and supervised at AIP. Through the Leibniz Competition, the institute, together with the University of Potsdam, acquired the Leibniz Graduate School for Quantitative Spectroscopy (2013 to 2016; cf. Status Report p. A-18), which is an important part of structured doctoral training in astrophysics at the university. It is welcomed that all AIP's doctoral candidates are integrated in this programme.

[1] 16.8 % of scientists and 9.4 % of professors (DFG, Monitoring Equal Opportunity 2013)

They are thus also part of Potsdam Graduate School, and AIP's doctoral students are able to benefit from a diverse and interesting portfolio. They should be encouraged to make greater use of these opportunities although the institute's poor public transport connections are a hindrance. AIP should continue its efforts to improve this situation.

Postdocs also receive very good scientific support at AIP. It is welcomed that they participate in teaching at the University of Potsdam and are thus able to acquire important expertise for their academic careers. The Karl Schwarzschild Fellowship Programme is an appropriate tool for attracting gifted junior researchers to the institute.

Vocational training for non-academic staff

It is welcomed that non-scientific staff regularly participate in dedicated training activities. The institute should examine to what extent offers in general key competencies could be extended.

It is also welcomed that the number of places for trainees was increased from three to four in 2015. This positive development should be pursued further in order to fulfill the expectations of the Federal and *Länder* Governments vis-à-vis the Leibniz Association.

6. Quality assurance

Internal quality management

AIP's cost-performance accounting has been established as an internal control element. Economic planning is based on the programme budget and ensures dovetailing of scientific planning and resource management. All in all, the institute has implemented sound quality management tools for its technical and scientific processes (see Status Report p. A-19).

In general, AIP is very well managed. The Scientific Chairman has clear perspectives for the institute's future development. The administration is very well organised; it functions effectively with good service awareness.

Quality management by the Scientific Advisory Board and Supervisory Board

The Scientific Advisory Board (SAB) provides excellent mentoring and critical support for the institute. It is very well informed and its constructive recommendations are valuable for AIP's development.

According to the statutes, the SAB chair is a voting member of the Board of Trustees, AIP's supervisory committee. In order to make a clear distinction between the functions of supervision and scientific advice, this regulation must be changed. As is usually the case at Leibniz institutions, the SAB chair should be a non-voting member of the Board of Trustees in a purely advisory capacity.

According to the AV-WGL[2], decisions made by the institutions' supervisory bodies on important research and science-policy matters, having significant financial implications,

[2] Administrative Agreement between the Federal and *Länder*-Governments with regard to the joint funding of member institutions of the Leibniz-Association.

or referring to the institutions' managerial staff require the agreement of the representatives of the Federal Government and the *Land*. Basically, AIP's statutes are in accordance with these requirements. Nevertheless, the wording should be brought into line with the relevant formulations in the AV-WGL.

Implementation of recommendations from the last external evaluation

AIP has extensively and successfully implemented the recommendations from the last evaluation (see AIP Status Report, pp. A-20ff.).

With regard to the long-term plan for AIP's IT structure (No. 10, pp. A-21f), it should be emphasised that the "very good to excellent" evaluation of the R&D Section "E-Science and Supercomputing" (see Chapter 3.10) indicates the central strategic importance of ensuring the long-term availability of the services provided here for AIP as a whole; as recommended at the last evaluation, this should be secured on a sustainable basis.

Appendix

List of Participants

1 Review Board

Chair (Member of the Leibniz Senate Evaluation Committee)

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

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Evamarie **Hey-Hawkins**	Institute of Inorganic Chemistry, Leipzig University, Germany

Reviewers[3]

Bernhard **Brandl**	Leiden Observatory, Leiden University, Netherlands
Boris **Dintrans**	Research Institute in Astrophysics and Planetology, CNRS and University Paul Sabatier Toulouse, France
Yvonne **Elsworth**	School of Physics and Astronomy, University of Birmingham, UK
Piero **Madau**	Department of Astronomy & Astrophysics, University of California, Santa Cruz, USA
Michael **Perryman**	School of Physics, University College Dublin, Ireland
Sabine **Schindler**	Institute for Astrophysics, University of Innsbruck, Austria
Charles C. **Steidel**	Cahill Center for Astrophysics, California Institute of Technology, Pasadena, USA
Jürgen **Stutzki**	I. Physical Institute, University of Cologne, Germany
Klaus **Werner**	Institute of Astronomy and Astrophysics, University of Tübingen, Germany

Representative of the Federal Government

Anke **Aretz**	Federal Ministry of Education and Research, Bonn, Germany

Representative of the Länder *Governments (Member of the Leibniz Senate Evaluation Committee)*

absent with apologies

[3] Guiseppina Fabbiano (Harvard-Smithsonian Center for Astrophysics) had to call off at short notice. She contributed a short written statement.

2. Guests

Representative of the relevant Federal government department

Renata **Feldmann**	Federal Ministry of Education and Research, Bonn, Germany

Representative of the relevant Land *government department*

Claudia **Herok**	Brandenburg Ministry of Science, Research and Culture, Potsdam, Germany

Representative of the Scientific Advisory Board

Peter **Schneider**	Department of Physics and Astronomy at the University of Bonn, Germany

Representative of the Leibniz Association

Franz-Josef **Lübken**	Leibniz Institute of Atmospheric Physics at University of Rostock (IAP), Germany

Representative of the Joint Science Conference Office (GWK-Büro), Bonn

Sara **Kammler**

3. Representatives of partner institutions (for talks of approx. one hour with review board and guests)

Robert **Seckler**	University of Potsdam, Germany
Tim **de Zeeuw**	European Southern Observatory, Garching, Germany
Adriano **Fontana**	INAF Astronomical Observatory of Rome, Italy
Frank **Lerch**	Optec-Berlin-Brandenburg (OpTecBB) e.V., Berlin, Germany

31 August 2015

Annex C: Statement of the Institution on the Evaluation Report

Leibniz Institute for Astrophysics Potsdam (AIP)

The Leibniz Institute for Astrophysics Potsdam (AIP) would like to thank the review board for its thorough and fair report and for its thoughtful recommendations. It is pleased to see that the board has valued AIP's research and development programme as very good to excellent, recognising the institute's supranational importance and its standing as an internationally competitive research institution.

The institute is very encouraged by the strong endorsement of the overall institute strategy (recommendation nr. 1). With the new observational facilities such as the GREGOR solar telescope (which was inaugurated in 2012 and started its science operations in late 2014), the integral field spectrograph MUSE (science operation since late 2014) and the high-resolution spectrograph PEPSI (science operations expected in 2016) the institute sees itself well positioned to further strengthen its scientific profile and impact (recommendation nr. 4).

The institute shares the board's recommendation nr. 2 that there is further potential in the area of knowledge and technology transfer (KTT). At the same time the institute would like to emphasize the core mission of the AIP as a knowledge-oriented institute to conduct fundamental research in the area of astrophysics as mandated by the institute's statutes. The institute has already initiated hoisting KTT by establishing strong collaborations with more application-oriented institutes within the Leibniz Association and within the Fraunhofer Society. With the continuation of the innoFSPEC excellence centre and AIP's participation in 3Dsensation programme, first steps in that direction have already been taken.

The institute feels reassured by the review board's strong endorsement of the mid-term development plan for AIP's technical section (recommendation nr. 3), in particular considering its strategic importance (recommendation nr. 4). The institute will implement this plan as a top priority, and has already initiated the discussions with the Brandenburg Ministry of Science, Research and Cultural Affairs (MWFK) and the Federal Ministry for Education and Research (BMBF). In the institute's view, and supported by the review boards recommendation, such an initiative has to be based on an accompanying extraordinary item of expenditure. This is needed in order to provide reliable planning and legal certainty, and in order to not to endanger the broad research portfolio of the institute, which the review board has identified as its major strength (recommendation nr. 1). A cornerstone of this plan is to reduce the large fraction of technical employees on third-party funded, time-limited work contracts, and to increase the fraction of permanent employees. Such a measure is also mandated by the currently planned labour law revisions applicable to Universities and publicly funded research institutions.

The institute is delighted to see the strong endorsement for a bi-laterally funded building (recommendation nr. 5). The institute has already initiated the discussions with the Brandenburg Ministry of Science, Research and Cultural Affairs (MWFK) and the Federal Ministry for Education and Research (BMBF) towards an implementation.

The AIP is pleased to see that the review board recognised the institute's efforts to increase the fraction of women in the scientific sector, and that the institute has already achieved fractions well above the national level in physics (page B-11). The institute will

strive to increase these numbers in the years to come (recommendation nr. 6). A particular challenge will be to increase the fraction of woman in scientific leadership positions, given only a very few vacancies in the years to come. The institute is prepared to face this challenge and will proactively try to recruit women for these positions.

Finally, we are thankful to AIP's Science Advisory Board and the Board of Trustees that has given the institute excellent advice over the past seven years. Together we will implement the recommendations of the review board in the years to come. We also are very grateful to the state and federal funding agencies for their continued strong support of the institute.