Leibniz-Gemeinschaft

Der Senat

13. Juli 2016

Stellungnahme zum Kiepenheuer-Institut für Sonnenphysik, Freiburg (KIS)

Inhaltsverzeichnis

Anlage A: Darstellung

Anlage B: Bewertungsbericht

Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht

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 24. und 25. September 2015 das Kiepenheuer-Institut für Sonnenphysik Freiburg (KIS) in Freiburg. Ihr stand eine vom KIS 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 KIS nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 13. Juli 2016 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

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

Das Kiepenheuer-Institut für Sonnenphysik Freiburg (KIS) betreibt Grundlagenforschung in der Astronomie und Astrophysik mit besonderem Schwerpunkt in der Sonnenphysik. Dazu betreibt es bodenbasierte Beobachtungseinrichtungen für eigene und externe Forschungsarbeiten.

Das KIS hat sich seit der letzten Evaluierung sehr gut weiterentwickelt und bewältigte dabei ein bemerkenswertes, dynamisches Wachstum. Das Arbeitsprogramm wurde um innovative Fragestellungen erweitert, so dass das Institut heute mit großem Erfolg an der Schnittstelle von Sonnen- und Sternenphysik arbeitet. Dabei erzielte es in den vergangenen Jahren herausragende, international wahrgenommene **Arbeitsergebnisse**. Neben grundlagenorientierten Arbeiten sind insbesondere auch die Beiträge zur Entwicklung technischer Komponenten für Observatorien in der ganzen Welt ausgezeichnet. Die Leistungen aller drei Forschungsbereiche werden als „sehr gut bis exzellent“ eingeschätzt. Nach Abschluss wesentlicher Instrumentierungsmissionen, die sich in einer hohen Anzahl technischer Berichte niederschlugen, sollte die Anzahl von Aufsätzen in Zeitschriften mit Begutachtungssystemen künftig wieder steigen.

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

Das KIS verfügt über beeindruckende Infrastrukturen zur Beobachtung der Sonne, mit deren Betrieb es zentrale wissenschaftliche Dienstleistungen für die internationale Sonnenphysik erbringt. Mit dem **Sonnenteleskop GREGOR** steht dem Institut eine für seine weitere Entwicklung maßgebliche und europaweit einzigartige Messtechnik zur Verfügung. Die Planungen, ein „*GREGOR Science and Data Center*" aufzubauen, sind überzeugend. Der Senat empfiehlt, der Nutzung und Auswertung der mit GREGOR gewonnenen Daten höchste Priorität einzuräumen. Weitere strategische Planungen sind noch zu präzisieren, auch mit Blick auf den Ressourceneinsatz, und durch den Beirat näher einzuschätzen. Das gilt insbesondere mit Blick auf das inzwischen hoch priorisierte Vorhaben *European Solar Telescope* (EST), an dem teilzunehmen das KIS derzeit prüft. Voraussetzung hierfür wäre, dass das KIS dazu weitere Ressourcen akquiriert.

Das Institut wird sehr gut geleitet. Sowohl der Direktor als auch die stellvertretende Direktorin sind gemeinsam mit der Universität Freiburg berufen, mit der das Institut enge und ertragreiche **Kooperationen** pflegt. Die Mitarbeiterinnen und Mitarbeiter des KIS bringen sich engagiert in den Forschungsschwerpunkt „Atom, Molekül und Optische Physik" des Physikalischen Instituts der Universität ein. Ebenso trägt das KIS zur akademischen Lehre an ausländischen Universitäten (insbesondere in Strasbourg) bei. Die Zusammenarbeit mit außeruniversitären Partnern ist vielfältig und zeichnet sich durch erfolgreiche strategische Kooperationen mit Observatorien, wissenschaftlichen Einrichtungen und im Rahmen von Konsortien aus. Kooperationen mit Leibniz-Einrichtungen sollten zukünftig intensiviert werden.

Die Ausstattung des KIS mit **Mitteln** der institutionellen Förderung ist auskömmlich. Es ist sehr positiv, dass der Anteil der Drittmittel am Gesamtbudget deutlich gestiegen ist. Die Einwerbung von zwei ERC-Grants im Jahr 2012 war dabei ein beeindruckender Erfolg. Bei der Deutschen Forschungsgemeinschaft sollte das Institut allerdings regelmäßig Mittel mindestens in Höhe der DFG-Abgabe einwerben. Daher sind seine jüngsten Erfolge bei der Einwerbung solcher Mittel wichtig.

Die apparative **Ausstattung** ist exzellent. Mit Blick auf die unzureichende räumliche Ausstattung des KIS hatte der Senat bereits 2008 Handlungsbedarf gesehen. Bisher wurden allerdings nur Zwischenlösungen gefunden. Es bedarf dringend einer dauerhaften Lösung für die Unterbringung. Vom Sitzland Baden-Württemberg erwartet der Senat die Aufhebung der Verbindlichkeit des Stellenplans im tariflichen Bereich, um eine globale und flexible Steuerung der Personalmittel am KIS zu ermöglichen. Der Stiftungsrat des KIS wird gebeten, zur räumlichen Ausstattung und zur Verbindlichkeit des Stellenplans bis zum 30. Juni 2017 zu berichten.

Das KIS ist attraktiv für den **wissenschaftlichen Nachwuchs** und konnte die Anzahl der am Institut betreuten Promovierenden in der Vergangenheit deutlich steigern. Die Förderung von Postdoktorandinnen und -doktoranden wurde intensiviert und hatte einen sehr positiven Effekt auf die Institutsentwicklung. Um weitere Verbesserungen anzustoßen, sollte sich das KIS stärker an den Karriereleitlinien der Leibniz-Gemeinschaft orientieren.

Die Aktivitäten des Instituts zur Förderung der **Chancengleichheit** führten zu erfreulichen Fortschritten. Seit 2008 wird das KIS von einer stellvertretenden Direktorin geleitet. Es

sollte seine schon jetzt erheblichen Anstrengungen in diesem Bereich konsequent weiterverfolgen und dabei insbesondere die Anzahl der Doktorandinnen steigern.

Mit seinen innovativen Arbeiten trägt das KIS maßgeblich zur Erforschung der Sonne, deren magnetokonvektiven Prozessen und Strukturen sowie zu den Auswirkungen auf die Dynamik der Sonnenatmosphäre und das System Sonne-Erde bei. Die Arbeiten werden mit Hilfe einzigartiger Messtechniken und Observatorien ausgeführt. In dieser Form ist die Erfüllung der Aufgaben des KIS an einer Hochschule nicht möglich. Eine Eingliederung des KIS in eine Hochschule wird daher nicht empfohlen. Das KIS erfüllt die Anforderungen, die an eine Einrichtung von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischem Interesse zu stellen sind.

2. Zur Stellungnahme des KIS

Der Senat begrüßt, dass das KIS 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 KIS als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

27 August 2015

Annex A: Status report

Kiepenheuer Institute for Solar Physics, Freiburg (KIS)

Contents

1. Structure, Tasks and Institutional Environment

Development and funding

KIS was founded in 1943 with the name "Fraunhofer-Institut". It receives joint funding from the German states and the federal government (50 % each) since 1975. The institute was renamed Kiepenheuer Institute for Solar Physics (KIS) in 1978. KIS is a member of the Leibniz Association.

After successful evaluation in 2007/2008 and on the basis of the Senate's recommendations and a joint statement by the responsible departments at Federal and *Länder* level in September 2008, the Joint Science Conference determined that KIS still met the requirements for joint funding.

Responsible department at *Länder* level: Ministry of Science, Research and Arts of Baden-Württemberg, Stuttgart (MWK)

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

Legal form and organisation

Since 2002 KIS is a legally independent foundation of public law. Bodies of the foundation are the Board of Directors, the Scientific Advisory Committee and the Foundation Council (see also chapter 6).

KIS' supervisory committee is the Foundation Council ("*Stiftungsrat*"), which is composed of representatives of the funding agencies, the rector of the University of Freiburg, an elected representative of KIS, and the chairman of the Scientific Advisory Committee. It appoints and oversees the Board of Directors and decides on fundamental issues of scientific, financial or legal nature. It meets once a year.

The Board of Directors consists of the director and the deputy director. It is responsible for the execution of the daily business of the institute. Both directors represent the institute to the outside. Each director is appointed by the Foundation Council for a five year period; reappointments are possible.

The Scientific Advisory Committee is appointed by the Foundation Council and consists of six to eight scientists, serving a maximum of two four-year terms. It advises both the Board of Directors and the Foundation Council on questions of scientific strategy. It evaluates the work of the institute and advises the Foundation Council on appointments of the director and deputy director. It meets at least once a year.

Furthermore, KIS has several internal advisory and information committees. Following a recommendation of the last evaluation, KIS has established the Management Team ("*Leitungsrunde*") to improve internal communication: members are the board of directors and the board's office, lead scientists and the heads of administration, IT and technical services. The function is to disseminate information on the progress of work and on all other factors which have influence on the institute and to advise the board on pending decisions. The Strategic Committee ("*Strategiekommission*") consists of the board of directors and scientific staff members elected by the Scientific Staff Assembly (a commit-

tee composed of all scientific staff members), including postdocs and doctorate students. The committee assembles a few times a year and advises the board on matters of scientific strategy, in particular on the recruitment of scientific staff. The Budget Committee ("*Haushaltsausschuss*") advises the board on the execution of KIS' annual budget.

Mission and tasks

The mission of KIS is basic research in astrophysics, in particular solar physics. This includes observational and theoretical astrophysics and the development of state-of-the-art instruments and observing techniques for ground and space based observing facilities. Furthermore, KIS operates observing facilities, e. g. the German Solar observing facilities at the Teide Observatory on the island of Tenerife in the Canaries, for its own research as well as for other entities. The overarching goal of KIS is to explore unique opportunities through interdisciplinary connections of solar physics with other scientific areas and through international collaborations.

Research structure

Scientific staff at KIS is organised in two departments (Theoretical Solar Physics and Experimental Solar Physics; see appendix 1) which were formally established in 1999. Each department is led by a member of the Board of Directors and consists of work groups focusing on particular areas of research. In addition, there are support units which cover administration, technical service including mechanical and electronic workshops, and information technology.

Following the programme budget, KIS' activities are organised in two Program Areas. **Program Area 1** "Astrophysical Research and Training" comprises three research foci (cf. chapter 3):

- Research focus "Magnetized Solar Atmosphere"
- Research focus "Global Magnetic Activity"
- Research focus "High-Resolution Techniques"

Program Area 2 "Development and Operation of Observation Facilities" comprises the development and operation of the German facilities at the Teide Observatory, contributions to further ground-based observing facilities as well as contribution to space and balloon missions.

KIS' Services comprise workshops, scientific IT and administration.

National and international scientific environment

According to the institute, there are two national scientific institutions which have comparable research groups in similar fields as KIS: the Leibniz Institute for Astrophysics Potsdam (AIP) and the Max Planck Institute for Solar System Research (MPS) in Göttingen. Together with university groups in Kiel, Göttingen and Bochum this makes the German Solar physics community one of the largest in Europe with KIS considering itself as one of the leading solar science institutes in Germany and Europe.

In order to create synergies, the German solar physics community divides competences and resources: The operation of optical ground based observing facilities is the area of competence of KIS, with AIP and MPS as partners. The Max Planck Institute for Solar System Research is the leading institute in the development of space experiments for solar physics, with KIS participating as a partner. AIP's competences in optical polarimetry and solar radio astronomy complement those of KIS and MPS. Both MPS and AIP have groups which develop numerical magneto-hydrodynamic simulation codes for stellar atmosphere modelling to which KIS, as the institute points out, also makes significant contributions. Two helioseismology groups at MPS and KIS are of similar size and activities. KIS considers itself the leader in the polarised radiative transfer theory, molecular physics and their applications for a wide range of astrophysical problems, from the sun to stars and planets.

Important European research establishments whose solar groups are comparable to KIS in terms of scientific focus and responsibilities are the Instituto de Astrofisica de Canarias (IAC), Spain, the Observatoire de Paris – Meudon (OPM), France as well as the Institute for Solar Physics (ISP) in Stockholm, Sweden. There are also several research groups at European universities and institutes which, however, do not operate observing facilities for community use. International research establishments of importance with solar groups outside Europe which are comparable to KIS are e. g. the National Solar Observatory (NSO, Tucson, USA), the High Altitude Observatory (HAO, Boulder, USA), the Institute for Astrophysics (IIA, Bangalore, India) and the National Astronomical Observatories in Beijing (China).

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

According to KIS, solar physics is intimately related to the near-Earth space environment and space weather prediction. Therefore, solar physics has immediate relevance to life on Earth and the evolution of civilisation. The results of solar research form an important ingredient for modelling the Earth's climate.

The supra-regional significance of KIS, as the institute points out, rests upon its role as one of the largest solar physics establishments in Europe and its operation of Europe's largest ground-based solar telescope GREGOR at the Teide Observatory, which is considered to be one of the scientifically most productive facilities of its kind. As KIS argues, such a facility requires significant budget as well as personnel and technical resources and is best developed and operated by an institution with stable funding and federal support.

2. General concept and profile

Development of the institution since the last evaluation

Research activities of KIS, as the institute points out, have gained a new dimension after 2008 following changes in key scientific personnel. In September 2008, the deputy director took office bringing with her an interdisciplinary approach to research with expertise in solar, stellar and planetary atmospheres, polarised radiative transfer and physics of

molecules. Since then, she has steered the development of the strategic vision for the institute, initiating and implementing the Visiting Investigator Program (VIP) as well as organising regular internal discussions and reports for planning and stimulating research. Furthermore, her broad international collaborations have become the basis for establishing long-term collaboration contracts with leading astrophysics institutes providing KIS with new research facilities on the Canary Islands and in Hawaii.

Likewise, in 2009, a lead scientist returned to the institute after a three years absence, filling the position of a former lead scientist, who left KIS at the same time. Expertise in modelling the solar corona was hence replaced by helio- and asteroseismology. Both hirings, as the institute points out, have connected the solar research at KIS with general problems of stellar magnetism, structure and variability, thus expanding KIS expertise in solar magnetism towards a wider range of physical conditions in stars.

Results

In the years 2012 to 2014 KIS' staff published a total of 100, 107 and 97 publications, respectively, most of these publications being articles in peer-reviewed journals, contributions to proceedings, and technical reports (see appendix 2 for further details). As the institute further elucidates, it intensified efforts to publish its results in peer-reviewed journals following a recommendation of KIS' last external evaluation in 2008. While these efforts led to an increase in the subsequent years, numbers fell in the recent past given the institute's involvement in the SUNRISE flight and in activities connected with the commissioning of GREGOR. However, these activities produced a high number of technical reports, totalling in 144 papers in the years 2012 to 2014, which accounted for almost half of the publications of KIS in this period. Nevertheless, KIS expects the number of refereed publications to increase again from 2015 onwards as the ERC funded projects (HotMol, ORIGIN) achieve their maturity and first results of GREGOR will be published.

As part of the institute's scientific service and infrastructure tasks, KIS operates the German Solar Telescope at the Observatory del Teide (OT) on Tenerife. This is one of its core tasks listed in the statutes of the institute.

KIS provides knowledge and technology transfer in various ways, but foremost in connection with its activities in the development of instrumentation for which KIS connects with various industrial partners, e. g. for the fabrication of the optics for GREGOR and the Visible Tunable Filter (VTF) for the Daniel K. Inouye Solar Telescope, Hawaii. Instrumental developments at KIS also lead to spin-offs in the past. Occasionally, staff members apply for a patent for a technical invention, with financial support of the institute, but KIS itself did not have any revenue from intellectual property rights in the last three years.

Academic events and public relations

KIS scientists organised several academic meetings in Freiburg and all over the world. Smaller events were hosted at KIS, larger events found external venues. In addition, many KIS scientists were involved in the scientific organising committee of international

meetings. The largest events organised in Freiburg are The European Solar Physics Meeting (2008), the 1st CASSDA-Solarnet Workshop (2014)[1], and a joint HELAS/EAST conference (2015)[2]. KIS scientists also organised or co-organised a number of workshops, project and board meetings for a selected audience.

Together with partner institutes, KIS organises a yearly technical meeting (OTTM), intended for all technical assistants at the Teide observatory as well as interested observers. All aspects of the observatory operation are covered: technical and procedural problems, solutions, technical modifications and upgrades, new instrumentation, observing modalities.

KIS has current public relations instruments at its disposal: website, press communication, public talks, and interviews on TV and radio stations. KIS also participates in events organised by the (local) press or other institutions, e. g. "Science Days", "Girls Days" or events such as "Advanced Education for High School Teachers on Solar Physics and Astronomy". Furthermore, the solar observatory on the Schauinsland mountain near Freiburg is used for public outreach activities. In the last years, KIS was able to welcome approx. 1.100–1.600 visitors annually. KIS dedicates about 0.3 FTE to public outreach.

Strategic work planning for the next few years

KIS has developed a long-term Strategic Plan for the decade 2013–2022 and beyond which identifies prospective research directions, institute structure development and areas of expertise for new appointments. It outlines the KIS development towards an international centre for ground-based solar physics. Overall, as the institute points out, the KIS profile will be strengthened by imbedding solar studies into interdisciplinary research and by assuming new international responsibilities.

The KIS mid-term research plan 2013–2017 foots on KIS' strategic goals in the coming decade:

- Understand the structure of an active stellar atmosphere, such as of the Sun and cooler stars, in particular the processes structuring magnetic fields and heating the upper atmosphere (chromosphere and corona).
- Understand processes in the stellar interior contributing to the solar dynamo, in particular, and to stellar activity, in general.
- Understand the effect of stellar radiation on planetary atmospheres, especially in the domain of strongly irradiated exoplanets which may illuminate yet unknown effects of the solar radiation on the earth's atmosphere and climate.
- Maximise scientific impact of the GREGOR telescope as well as instrumentation built by KIS for other facilities.
- Expand collaborations with the DKIST partners and co-lead the European Solar Telescope (EST) with the *Instituto de Astrofísica de Canarias* (IAC, Tenerife).

[1] CASSDA: Center for Advanced Solar Spectro-Polarimtric Data Analysis
[2] HELAS: European Helio- and Asteroseismology Network; EAST: European Association for Solar Telescopes

- Establish a Science Data Center and a Center for Remote Operation in Freiburg at KIS headquarters to provide access to the German and European solar community to premier observing facilities on Tenerife (GREGOR and European Solar Telescope, EST) and on Hawaii (DKIST).
- Lead the initiative on the development of a 1 m class solar telescope network. Design and develop such a network for synoptic solar observations (Solar Physics Research Integrated Network Group, SPRING).
- Actively disseminate solar physics expertise to other areas of astrophysics, such as stellar activity and circumstellar and planetary environments through collaborations and new hirings. Attract and support new research groups in these areas.

Appropriateness of facilities, equipment and staffing

In 2014, the institutional funding by federal and *Länder* governments totalled approx. 5.5 M€ (see appendix 3); compared to the last evaluation in 2006, institutional funding was approx. 3.4 M€. As part of its funding, KIS currently receives two "temporary extraordinary items of expenditure" (*Sondertatbestände*):

- Building the Visible Tunable Filter instrument (VTF) for the Daniel K. Inouye Solar Telescope (DKIST, Hawaii), in collaboration with the National Solar Observatory – [2011–2018]
- Relocation of parts of the institute to a new accommodation [2015–2018].

KIS' third-party funding contributed approx. 2.1 M€ to its revenues in 2014; in the last three years (2012–2014) this amounted to an average of approx. 23 % of KIS's revenues (between 17 and 27 %). In the main, KIS raised funds at the EU, federal and *Länder* governments (German Aerospace Center, DLR), and in the competitive procedure of Leibniz Association. KIS hosts two ERC funded groups: HotMol ("Hot Molecules in Exoplanets and Inner Discs", Advanced Grant) and ORIGIN ("The Origin of Solar Activity", Starting Grant). Between 2012 and 2014, KIS also conducted three projects funded by the German Science Foundation (DFG), in 2013 and 2014, however, the institute's revenues from DFG were lower than the respective fee to be disbursed. According to KIS, efforts are made to sustain the current level of third-party funding during the next decades.

Currently, KIS is distributed across four buildings on the slopes of the Schlossberg close to downtown Freiburg (within a range of 500 m horizontally and 50 m vertically) – a situation which, according to KIS, continues to constrain the further evolution of the institute and already has been a concern during the previous evaluation in 2008. However, despite all efforts of the institute, local authorities, and funding bodies, a final and satisfying solution could not be established so far. In 2009 and again in 2015, KIS received extra funding to rent additional space (2009-2015: 200 m^2 of laboratory space), which has been replaced by a new building (2015: 650 m^2 office and laboratory space). In KIS' view, the accommodation of the workshops and laboratories in the old buildings is still unsatisfactory and needs to be improved. The State Ministry for Science, Research and Arts (MWK) has declared its continued determination to provide a satisfactory solution in the future.

In terms of IT and data processing facilities, KIS views itself as sufficiently equipped. A net of workstations provide the capacity to analyse observational data and to perform theoretical simulations. Computing facilities have also been acquired through third-party funding. They need to be maintained and carried forward once funding expires. External high-performance computing resources, e. g. at the computer centre of the University of Freiburg, are being used as needed.

Prospectively, KIS plans to provide for archiving and management of its data (GREGOR Science and Data centre) coming to the petabyte range. Discussions with the computer centre of the University of Freiburg are currently under way.

As of 31 December 2014, KIS employed 84 people in total (excluding four student and graduate assistants and five scholarship recipients), mounting up to 73.3 full time equivalents (FTE; see appendix 4). 34.0 FTEs had been assigned to academic staff (40 people including 12 doctoral candidates). Altogether 12 scientists were financed from institutional funding (Theoretical Solar Physics: four, Experimental Solar Physics: eight).

3. Subdivisions of KIS

Research at KIS is carried out in two departments: Theoretical Solar Physics and Experimental Solar Physics. Each department has three working groups specialising in particular areas of research (cf. Appendix 1). Activities at KIS, however, are classified into two Program Areas, of which Program Area 1 is subdivided into three research foci connecting the two departments.

Program Area 1: Astrophysical Research and Training

(30.4 FTEs, thereof 19.0 FTEs in research and scientific services, 2.3 FTEs Post-doctoral scholarship recipients, 9.0 FTEs doctoral candidates, and 0.1 FTEs service staff)

Research focus "Magnetized Solar Atmosphere"

Work programme development and results

This focus aims at understanding magnetic structure formation and magneto-convection processes in the photosphere as well as the structure and dynamics of the chromospheres and heating processes in the outer atmosphere. It concentrates on the following topics: Small-Scale Phenomena, with the emphasis on magnetic elements, faculae, and the turbulent magnetic field: Among other results, circular polarisation signals indicating photospheric velocities of more than 8 km/h were detected for the first time and interpreted as magnetic reconnection, high resolution images of the sun in the Mg II k line were investigated for the first time in solar physics, and the highest contrast features were detected in the solar photosphere in the near UV and successfully modelled with MHD simulation in CN and OH molecular bands.

– Fundamental processes on small scales, such as magneto-convection, MHD turbulence, magnetic field intensification and dissipation, and energy transport: Among other results, inward growing arches at granule boundaries could be identified in the solar photosphere as horizontal vortex tubes when compared with numerical simula-

tions, waves have been identified as a precursor of exploding granules, and global time-dependent relative temperature fluctuations as functions of the geometric height in the solar atmosphere were determined using photometric observations of the Sun as a star and by solving the inverse helioseismic problem under the adiabatic assumption.

- Sunspots, with the goal to understand their stability, structure, dynamics, energetics, formation, and decay: In this topic, new insights on how spots and in particular penumbrae form were gained. Moreover, observations with Hinode SP revealed some 50 % of the sunspot penumbra exhibits downflows, and 40 % of all downflows are associated with opposite magnetic fields. Furthermore, spectro-polarimetric observations of a forming sunspot were conducted.
- Chromospheric heating and dynamics, in particular the propagation, conversion, and dissipation of various magnetohydrodynamic waves in the solar atmosphere, and small-scale magnetic reconnection and associated formation of small-scale jet phenomena: Among other results, the energy flux into the chromosphere by acoustic waves was found to be a factor of two larger than previously found, and cut-off frequencies for torsional and transverse tube waves in atmospheres with non-vanishing temperature gradients have been analytically derived in view of obtaining constraints on the mechanical energy transport into the corona by magnetohydrodynamic waves.

Publications and third-party funding

Between 2012 and 2014 scientists assigned to this focus published 49 articles in peer-reviewed journals, ten articles in other journals, and one individual contribution to an edited volume. Five of these publications were co-authored with scientists from program area 2. At an average, members of this focus raised third-party funds in the amount of approx. 61 K€ annually; most of these funds were granted by the German Science Foundation (DFG).

Work planning

During the next decade, the research focus plans to advance knowledge on the sun and its variability, in particular by

- Developing realistic numerical models of solar magnetic activity, on both local and global scales
- Understanding the formation and decay of sunspots and other magnetic structures
- Obtaining robust information on subsurface structures and flows
- Understanding magnetic and non-magnetic coupling in the solar atmosphere and the interior
- Expanding knowledge on processes leading to energetic events in the solar atmosphere.

Research focus "Global Magnetic Activity"

Work programme development and results

This research focus deals with the origin, evolution, and energetics of magnetic fields in the sun and other stars, the global hydrodynamic structure of the solar and stellar interiors, and the influence of stellar radiation and activity of planets. It aims at understanding how global hydrodynamics of the stellar interior interacts with the magnetic dynamo and how this interaction results in global activity cycles and variability.

KIS research on the global stellar magnetic activity focuses on the following topics:

- Subsurface structures and flows, concentrating on the helioseismic signatures of subsurface structures and flows and on the retrieval of meaningful physical parameters for these structures and their connection to surface features: Among other results, a new global helioseismic analysis method was developed for detecting the meridional flow in the deep solar convection zone. Also, a method for time-distance helioseismology in spherical coordinates was developed and successfully tested. Furthermore, a method for employing the sun and stars as giant hydrodynamical detectors for the gravitational-wave background was developed.
- Stellar magnetic fields, developing reliable inversion methods for inferring spatially unresolved magnetic structures on stellar surfaces and with the depth in the atmosphere: Among other results, a novel method to recover the 3D structure of starspots from spectropolarimetry in atomic and molecular lines was developed, a theoretical study of molecular polarisation due to the Zeeman and Paschen-Back effect in red dwarfs due to magnetic spots was carried out (and recommendations for optimal observations were deduced), and small-scale magnetic fields and convection were simulated to study the dependence of their properties on stellar parameters.
- Solar and stellar activity cycles, analyzing long-term records of solar and stellar activity to investigate activity cycles and their relation to the underlying dynamo processes: In this topic the database of all sunspots scanned with TIP at the Vacuum Tower Telescope (VTT) between 1999 and 2011 was investigated regarding the cycle dependence of sunspot properties during the last cycle 23, and the present cycle 24. From this analysis it was found that the magnetic field strength of sunspots was decreasing during cycle 23, while the new cycle started again with spots of stronger magnetic field strengths. Furthermore, a new method was developed to recover 2D maps of active regions and differential rotation on stellar surfaces from continuous photometric series of high quality.
- Circumstellar environment and planetary atmospheres, modelling effects of the stellar radiation and activity on the circumstellar environment and planetary atmospheres and inferring spatially unresolved structures: By applying polarimetric radiative transfer methods to planetary atmospheres, a model was developed to determine parameters of the planet, including the orbital parameters and the radius of the planet. Furthermore, polarised reflected light of the exoplanet HD189733 was detected and characterised in three spectral bands. A multiple scattering model with polarised radiative transfer was developed to calculate limb polarization on the sun,

stars and planets. A comparison with available measurements on the sun in the continuum allowed for testing solar model atmospheres.

Publications and third-party funding

Between 2012 and 2014, scientists assigned to this focus published 24 articles in peer-reviewed journals, 15 articles in other journals, and officiated as editors of two edited volumes. There have been no co-authorships with scientists from program area 2. At an average, members of this focus raised third-party funds in the amount of approx. 630 K€ annually; most of these funds were granted by the EU and in the competitive procedure of the Leibniz Association.

Work planning

Plans for the research focus during the next decade include:

- to obtain 3D tomography of stellar magnetic fields across the HR-diagram,
- to expand and analyse long-term records of cyclic solar and stellar activity,
- to reveal relations between the interior structure, magnetic activity and element abundances,
- to explore the circumstellar environment and its influence on planet formation and evolution, and
- to understand planetary atmospheres weathered by stellar radiation and activity.

Research focus "High-Resolution Techniques"

Work programme development and results

This research focus aims at developing high-resolution and high-sensitivity techniques for imaging, spectroscopy and polarimetry of the sun and other stars.

KIS research in this area focuses on the following topics:

- Pipelines for data reduction and analysis tools, producing calibrated science-ready data: Among others, the CASSDA project (Center for Advanced Solar Spectro-Polarimetric Data Analysis) has developed a set of data reduction and analysis tools for spectroscopic and spectro-polarimetric data. Existing software calibration libraries were revised and unified, and a procedure is developed to automatically release standardised data to the Virtual Solar Observatory. Moreover, a data base system was developed and installed to host and access the large volumes of HMI data. Furthermore, a method was developed for the visualization of wave propagation on the background of a complex, dynamically evolving atmosphere.
- Solar high-resolution techniques, including wave front control, high-precision spectrographs, and image restoration techniques: Among others, the following results have been achieved: A series of reference articles provided technical details and performance of the mechanical design of the GREGOR telescope, its control system, optical design, adaptive optics system, and the broad-band imager. The GREGOR adaptive optics (AO) has been upgraded to a multi-conjugated adaptive optics (MCAO) system,

in order to increase the small corrected field-of-view of the conventional AO system to one arc minute. In addition, a new pointing system for solar telescopes was developed and it was found in a proof-of-concept campaign at the Vacuum Tower Telescope (VTT) that the new procedure may reduce telescope drifts by almost one order of magnitude with respect to conventional systems.

– High-precision polarimetry, including studies of new detectors, fast modulation and demodulation schemes, and new instruments using this technology: Among other results, the setup for the high sensitivity Zurich Imaging polarimeter (ZIMPOL) system was developed and deployed at the GREGOR telescope. Moreover, a new EMCCD-based dual-beam imaging polarimeter has been designed and installed at the 3.67 m Advanced Electro-Optical System (AEOS) telescope. The Hokupa'a-85 curvature adaptive optics system components have been adapted to create a new AO-corrected beam for this instrument. Furthermore, a new night-time imaging polarimeter based on EMCCD and fast ferro-electric liquid crystal (FLC) modulation was designed and built for using the GREGOR telescope at night. It was combined with the new night-time AO system. First tests of polarimetric observations of Uranus and Neptune were successful.

Publications and third-party funding

Between 2012 and 2014, scientists assigned to this focus published 7 articles in peer-reviewed journals as well as 9 articles in other journals. They produced one discussion paper and officiated as editors of one edited volume. One publication has been co-authored with scientists from program area 2. At an average members of this focus raised third-party funds in the amount of approx. 350 K€ annually; these funds were raised by the EU and in the competitive procedure of Leibniz Association.

Work planning

Plans for the research focus during the next decade include:

– to provide data management and analysis methods for the focal-plane instruments for major solar telescopes with KIS involvement (DKIST, EST),
– to contribute to instruments for solar space missions,
– to expand development and deployment of solar high-resolution techniques,
– to develop instrumentation for non-solar high-precision polarimetry, and
– to lead the international development of a new ground-based network of synoptic telescopes (SPRING).

Program Area 2: Observatory Operations and Instrument Development

(30.6 FTEs, thereof 7.0 FTEs in research and scientific services, and 23.6 FTEs service staff)

Work programme development and results

KIS leads the operation of the German solar telescopes GREGOR and Vacuum Tower Telescope (VTT) on Tenerife, and coordinates the cooperation with German partner institutes (AIP and MPS, cf. section 2). KIS implements the work required for the operation

and the development of the post-focus instrumentation in its workshops in Freiburg. Additional post-focus instruments are provided by the partner institutes.

Observing time is allocated between German partners (75 %, KIS, AIP, MPS), SOLARNET), Spain (20 %), and international partners (5 %). The operation of the observatory is a long-term commitment which defines the service function of KIS' activities. About one quarter of the base resources of KIS in terms of budget and manpower are allocated for the observatory operation, including administration, maintenance, and observing scientist support. The financial resources currently contributed by the partners, AIP and MPS, to the operations budget amount to about 200 K€ annually and are managed by KIS. The partners also contribute to technical services and to instrumentation at the observatory from their own funds.

The German observatory on Tenerife consists of three telescopes:

- GREGOR is the largest (1.5 m) solar telescope in Europe. Its commissioning started in summer 2011, and its official inauguration took place in spring 2012. It was followed by a science verification phase with all first-light instruments until the end of 2013. Since 2014, GREGOR is operated in an early science phase. Instruments that have been developed by KIS comprise the GREGOR Adaptive Optics System (GAOS), the GREGOR Broad Band Imager (BBI), the GREGOR Infrared Spectropolarimeter (GRIS), the GREGOR Fabry-Pérot Interferometer (GFPI), the Zurich Imaging Polarimeter (ZIMPOL), and the GREGOR@Night Spectrograph.
- The Vacuum Tower Telescope (VTT) has been the major observing facility at KIS until 2014. Instrumentation developed in this context include LARS, a laser frequency comb (LFC) for high-accuracy spectroscopy, and HELLRIDE, a Fabry-Pérot etalon-based imager which delivers high-cadence spatially resolved spectra.
- The Chromospheric Telescope (ChroTel) acquires semi-automatically full sun images in three spectral lines with high cadence. Data are archived and made available to the world-wide community through the Virtual Solar Observatory.

KIS participates with various international partners in the development of solar and night-time observing facilities, e. g. the European Solar Telescope (EST), and the Daniel K. Inouye Solar Telescope (DKIST, Hawaii), to which KIS has contributed the Visible Tunable Filtergraph (VTF), financed as an "extraordinary item of expenditure" (cf. chapter 2). KIS is also a member of networks, such as the ground-based network for synoptic observations of the sun (SPRING). Furthermore, KIS cooperates with various international partners in the development of new instrumentation. Altogether, as KIS points out, a major part of the institute's development work is carried out within these activities. KIS also contributes to missions on balloons and in space, such as Sunrise (Correlation Wave-front Sensor) and Solar Orbiter / Polarimetric and Helioseismic Imager (Image Stabilisation System).

Publications and third-party funding

Between 2012 and 2014, people assigned to Program Area 2 published 16 articles in peer-reviewed journals as well as 26 articles in other journals. They produced 143 tech-

nical reports. 41 publications have been co-authored with scientists from Program Area 1. At an average, members of program area 2 raised third-party funds in the amount of approx. 700 K€ annually. For the most part, these funds were raised by Federal and *Länder* governments as well as the EU.

Work planning

In KIS' view the scientific use of the current observing facilities will further increase. While GREGOR is in its initial years and will be a forefront research facility for the next decades, VTT is now in operation for more than 25 years. KIS expects that many observing programmes will prospectively use capabilities of GREGOR. This, however, will open opportunities to do research with VTT which complements GREGOR and for which VTT is better suited, e. g. the possibility to carry out focussed and long-term research programs. KIS fostered these developments by establishing unique instrumentation to open up research capabilities in the area of high precision spectroscopy and probing of the solar atmosphere.

As KIS argues, in the future, ground-based solar telescopes will increasingly be operated in a service mode, similar to large night-time facilities or space missions, where telescope use is optimised by queuing observations according, e. g., prevailing seeing conditions. The service mode can be enhanced by remote access to the telescope with the possibility to influence target selection and to modify or adapt other parameters in near real time. Against this background, KIS prepares to host the GREGOR Science and Data Center (GREGOR-SDC) to archive its data and provide access to both data and analysis tools for the German and international solar communities. In connection with this, KIS also plans to establish a Center for Remote Operations (CRO) based in Freiburg, which for the moment will support GREGOR operations and suitable programmes at VTT, but on the long run will also be used for access to the Daniel K. Inouye Solar Telescope (DKIST) and European Solar Telescope (EST). The CRO, as KIS argues, will provide scientists with technical support for the respective telescope and its instrumentation, suitable data reduction pipelines and initial analysis tools. According to the institute, first steps towards CRO are currently undertaken in the framework of the ongoing CASSDA programme.

KIS also schedules the implementation of several instrument upgrades and developments, e. g. in the area of Multi-Conjugated Adaptive Optics or the Visible Tunable Filtergraph (VTF).

4. Collaboration and networking

Collaboration with universities

The University of Freiburg is the most important academic partner of KIS. The current director, who assumed office in April 1997, is appointed to a full professor position at the university, with the dedication of astrophysics and solar physics in combination with a 50 % teaching load. The position of deputy director was established as joint appointment with a 25 % teaching load and filled through a regular university professor appointment procedure. The current deputy director assumed her position in September

2008. Both professors are integrated in the Physics Institute of the faculty within the research focus “Atomic, Molecular, and Optical Physics”. Two additional members of staff, of which one was appointed adjunct professor in 2008, have the *venia legendi* of the faculty of Mathematics and Physics.

KIS scientists contribute to academic teaching at Freiburg, some of them in collaboration with one of the established lecturers. Altogether, academic events of more than 70 credit hours were held by members of staff between 2012 and 2014. Many KIS scientists are also involved in advising and training of undergraduate and graduate students (cf. chapter 5). KIS also collaborates with the Freiburg Center for Data Analysis and Modelling (FDM) and, on a long standing basis, with the University computer center. Beyond that, KIS has entered into various other collaborations in international academia:

– Observatoire de Strasbourg at the Université de Strasbourg (education of physics master students in astrophysics)
– University of Turku and University of Hawaii (theoretical and instrumental collaboration in the framework of the project “International cooperation for Innovations in Sensitive Polarimetry”)
– New Jersey Institute of Technology (development of adaptive optics technologies for solar telescopes, in particular multi-conjugate solar adaptive optics).

Collaboration with other domestic and international institutions

KIS maintains a wide range of collaborations with partners in Germany and abroad. They primarily concern the operation of observing facilities, the development of astronomical instrumentation, and the development of data management and analysis methods for state-of-the-art solar and solar-stellar research.

The most important collaboration, as KIS points out, is the operation of the German Solar facilities in the Canary Islands, which involves contractual agreements with national and international partners. Other collaborations of importance involve the design and development of the next generation of ground-based solar telescopes of the 4m class, with European and US-American partners. KIS contributes to space experiments, also at an international level, by providing expertise in image stabilisation techniques. Another important international cooperation addresses high precision stellar polarimetry to study stellar environments and the magnetism of stars.

Main partner of KIS within the Leibniz Association is the Leibniz Institute for Astrophysics Potsdam (AIP), both in terms of AIP’s role as a partner in the consortium for the German solar facilities as well as a partner in developing instrumentation. KIS has also occasionally collaborated with the Leibniz Institute for Atmospheric Physics Kühlungsborn (IAP) in the past. Main partner at the Max Planck Society is the Max Planck Institute for Solar System Research (MPS) in Göttingen with which KIS joined forces in the development of instrumentation of balloon-borne solar telescopes (e. g. SUNRISE), space experiments (Photospheric and Helioseismic Imager, PHI) on board the ESA mission Solar Orbiter, to be launched in 2018, and the development of post-focus-instruments for the German solar telescopes on Tenerife. KIS also collaborates with local Fraunhofer insti-

tutes and with the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation, Karlsruhe-Ettlingen.

Within the European community, KIS is part of the European Association for Solar Telescopes (EAST) which has been founded in 2006 in Freiburg. Its foremost goal is to develop the European Solar Telescope (EST), a next-generation solar observing facility of the 4m class, to be built in the Canaries. KIS leads the European Helio- and Asteroseismology Network (HELAS) and has established links to the Institutio Richerche Solari Locarno (Switzerland) and the Stellar Astrophysics Center at Aarhus, Denmark. KIS coordinates and participates in numerous projects funded by the European Union, e. g. OPTICON, Solarnet, and SpaceInn (leading institute).

On an international level, KIS collaborates with the National Solar Observatory (USA), the High Altitude Observatory (HAO, Boulder, USA), NASA and the Predictive Sciences Institute (PSI, San Diego, USA).

In the reporting period (2012–2014), altogether 38 scientists came for a visit to KIS, nine of them for a period longer than 3 months. Longer visits have been facilitated by the installation of a Visitor Investigator Program (VIP), which was established in 2009. 22 KIS scientists have visited other institutes for shorter or longer research stays, three of them for more than three months.

Other collaborations and networks

KIS is involved in research governance at national and international level, e. g. at the Council of German Observatories, or, as member of Leibniz Association, in Section D or at some of the association's working groups. Members of KIS are also involved in various leading or steering functions of national and international projects.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

As of 31 December 2014, KIS employed 84 persons in total (excluding four student / graduate assistants and five scholarship recipients), mounting up to 73.3 full time equivalents (FTE). 34.0 FTEs had been assigned to academic staff (40 people including 12 doctoral candidates), 23.8 FTEs to technical support and service positions (27 people), and 10.5 FTEs to positions in administration (12 people). 42.5 % of KIS' academic staff were funded by third-party grants, 65 % of academic staff were employed under fixed-term contracts (see appendix 4).

Since the last evaluation, KIS filled vacancies of the Deputy Director (2008) and of a lead scientist (2009). One lead scientist left the institute for another position. Altogether, the number of employees at KIS rose by 43 % from 57 (2006) to 84 (2014). KIS offers 12 positions for scientists financed from institutional funds, four of which will become vacant due to retirements within the next five years, three in the experimental department and one in the theoretical department.

Promotion of gender equality

According to the institute, KIS conforms to the standards of Leibniz Association in the "Implementation Agreement on Equality". Since 2003, KIS also appoints an equal opportunity officer.

In order to increase the number of women in the academic staff, KIS encourages female students to pursue a career in astrophysics. The KIS Deputy Director serves as a role model for female scientists. In 2012, a female lead scientist won a Leibniz grant for "Women in academic leadership positions", enabling her to build a junior research group. As KIS points out, the measures introduced by the Deputy Director have lead to a significantly improved gender balance since the last evaluation. While in 2006 only one female scientist and another female doctoral candidate had been employed at KIS, numbers rose to six female scientists and one female doctoral student as of 31 December 2014. Hence, the fraction of women in the academic staff has increased from almost 8 % to 17.5 %. As KIS elucidates further, the institute still suffers from a severe underrepresentation of women in its scientific and technical staff, but the present number is close to their representation among physics students at the University of Freiburg.

KIS has taken several measures to achieve a better work-life balance of its employees: working hours are flexible. A system for lifetime work accounting was established for staff members who spend longer periods at the observatory. Several positions are established as part-time positions. Staff members may apply for tele-working for up to 12 hours per week. In addition, KIS contributes to the cost for child care. KIS also joined the regional "Dual Career" network and the Freiburg network "Family-friendly Companies". In 2014, KIS obtained the certificate "*berufundfamilie*" of the Hertie Foundation.

Promotion of junior researchers

As KIS points out, there are typically 10 undergraduate students as well as 10 graduate students pursuing a PhD at the institute at any point in time. Graduate thesis work is generally supported by part-time employment (first year: 50 %, second year and after: 67 %). Each PhD student has an assigned advisor with whom he or she collaborates on a daily basis. PhD students are encouraged to enrol in the graduate programme of the University of Freiburg.

Graduate theses take typically between 3 to 5 years; most of them are supported through third-party funding. Whenever necessary, funding gaps are bridged from KIS' institutional funding. Between 2012 and 2014 three doctoral degrees that had been supervised by members of KIS' staff have been successfully finished. If possible, PhD finalists receive a full post-doc position. Following recommendations of the last evaluation in 2008, two temporary positions have been allocated for post-doctoral scientists (KIS Research Fellows). KIS has started, in 2014, to organise seminars for career advancement of young scientists and intends to make this a regular event.

According to KIS, the number of young researchers at KIS has steadily grown from 2012, essentially due to external funding. To further increase incentives for the recruitment of excellent young scientists, management has initiated an internal regulation allowing for supplementing salaries of researchers and engineers from external funding if the scope

of their responsibilities exceeds the normal employment duties. The respective document will be fully implemented in 2015.

Vocational training for non-academic staff

KIS participates in vocational training and education programmes for non-academic staff. Several staff members in the technical department have the appropriate licenses to engage these programmes. The duration of those positions is three years.

There are currently five apprenticeship positions: two in the mechanics workshop, one in the electronics laboratory, one in the technical IT group, and one in the Data processing and IT group. The trainees obtain degrees as precision mechanics technician, electronics technician, and IT specialist. In the past three years, three trainees finished their apprenticeship. After successfully passing their final exams, trainees are often offered a term position for a year to facilitate their entry to the professional world.

KIS encourages the non-academic staff to participate in various training and education programmes related to their job or, to obtain an academic degree if they fulfil the requirements. KIS supports them by fully or partly financing the courses or by offering a flexible working time model.

6. Quality assurance

Internal quality management

KIS is committed to compliance with the rules of good scientific practice and has also nominated an ombudsperson to which staff can address in matters of (potential) scientific misconduct.

Scientific papers with a KIS member as lead author undergo a KIS-internal refereeing process before submission to a journal. Upon submission, all manuscripts are posted in the library for the information of and possible feedback from colleagues. KIS publishes its research results in international, high-impact journals with a peer-reviewing system.

The institute runs two colloquium series: the “institute colloquium” with invited experts from other institutions and the “house staff report series” in which KIS scientists present their current work and results. Each scientist is expected to report once per semester.

To improve the productivity of KIS scientists, the deputy director has introduced, in 2009, written internal quarterly reports where scientists indicate their plans and achievements in all aspects of expected performance results of which are annually reported to the Foundation Council and the Scientific Advisory Committee (SAC). She has also organised internal scientific workshops for discussing and defining strategies of the leadership and participation in large national and international projects. Internal achievement awards were attempted in 2009 but were not supported by the staff. KIS is planning to introduce yearly performance appraisals of staff members in late 2015.

Internal competitive funding of small projects from the KIS budget was introduced to stimulate initiatives of KIS researchers. The proposals are publicly presented and discussed at internal workshops, and available funding is allocated if practical.

Quality management by the Scientific Advisory Committee and Supervisory Board

The KIS Scientific Advisory Committee (SAC) consists of six to eight scientists, ideally with complementary expertise in order to cover the complete field of work at KIS, both in science and instrumental development. SAC meets regularly once each calendar year. Representatives of the state and federal funding ministries attend the meetings as observers. During those meetings, the KIS board presents a general overview of the state of the institute, the progress of larger (instrumentation) projects, and plans of major strategic or financial interest, which have to be agreed upon by the Foundation Council (cf. chapter1). KIS scientists have the opportunity to present their astrophysical work.

In 2012 the SAC performed a mid-term evaluation (audit) to assess the state of the institute and measure the progress made in implementing the recommendations following the evaluation in 2007.

Implementation of recommendations from the last external evaluation

The last evaluation resulted in a number of recommendations to be considered by KIS (see also Statement of the Senate of the Leibniz Association from 9 July 2008). They have resulted in actions as follows:

General concept and profile

(1) *"The institute's small size in future calls for clear priorities in the allocation of financial resources and staff assignment regarding its participation in international projects."*

According to the institute, KIS is strongly involved in key international projects. Recent successes with applications for EU/ERC funds have resulted in an increase of project funds and temporary personnel.

(2) *"In future, the theoretical studies conducted by KIS should predominantly deal with issues from the four existing key research areas of the institute; there should be no further expansion of research work to other thematic fields."*

As KIS points out, research foci have seen considerable changes since 2008, also due to changes in personnel since then.

(3) *"The institute will have to further develop its computer programmes with particular emphasis on parallelisation capacity."*

Since 2008 computer architecture and software used at KIS have seen significant changes. As the main users of the cluster computer have left the institute (resulting in a reorientation of the research foci) the cluster is no longer used. KIS now has a dark-fibre connection to the internet, and massively-parallel computers at high-performance computing centres are used as needed.

(4) *"KIS should begin to formulate strategies for an optimal utilisation of the data collected by the solar telescope GREGOR for the institute's adequate participation in the scientific findings. The available observation time should be allocated on a competitive basis, in particular with regard to international facilities. It was appreciated that KIS plans to set up a committee for the organisation of this task. The establishment of a time allocation committee should be initiated at an early stage."*

As KIS points out, a time allocation committee has been installed and international observing time is being allocated on a competitive basis; the remaining observing time is distributed among the partner institutes according to their respective shares. Moreover, strategies for a GREGOR data archive are being developed and will soon be implemented (cf. chapter 3, Program Area 2); once in place, it will be used to store and distribute data to interested parties. Access modalities will have to be agreed upon by the partner institutes.

(5) *"In the years to come, the institute needs to improve its acquisition of third-party funds with particular emphasis on the German Research Foundation (DFG)."*

According to the institute, KIS has significantly increased the acquisition of third-party funds, in particular from the EU/ERC. Funding from DFG has slowly decreased in recent years, however. KIS continues submitting DFG proposals and an upward trend of the total DFG funding is now recognisable for the coming years.

(6) *"Due to the inadequate room situation it is urgently recommended to rent additional locations on short notice. In the long run, a relocation of the whole institute seems necessary."*

KIS has rented additional office space for optical labs for project work as of 2009. KIS has also been actively looking for appropriate new housing in Freiburg. In 2012 a suitable location for a new institute building had been identified, but state and federal ministries could not agree on funding. As a temporary solution, additional office and laboratory space has been rented starting 2015 (cf. chapter 2).

(7) *"The public relations work and educational work with students at the Schauinsland observatory should be continued."*

Educational work with students as well as the public relations work at KIS has seen a boost, according to KIS. Furthermore, the instrumentation is being upgraded continuously, the practical courses for students have been improved and they are offered each year.

(8) *"Furthermore, KIS should intensify its efforts in raising national public awareness, which could be achieved taking part in the International Year of Astronomy 2009. For public relations work at KIS to become more professional, adequate funding is required for press and media work."*

Public relations work has been given more attention by the institute. Three scientists are now involved in public outreach, relations to public media, and to the organisation of public and educational events. Overall, roughly 0.3 FTE is allocated in the programme budget for these activities.

Collaboration and networking

(9) *"The divergent topical approaches of KIS, MPS and AIP as agreed upon on a national level should be maintained."*

The topical divergence in the German solar physics community has been maintained.

(10) *"A further intensification of the cooperation between the administrative departments of the university and KIS could lead to a reduction of the institute's administrative workload."*

Cooperation between the administrative departments of the university and the institute provides KIS with expertise not present at KIS, especially in the human resources department, as KIS argues. There is an intense and well working collaboration with the computer centre of the university, which connects the institute to the internet, supports licensing of commercial software packages and provides backup services. An expansion of this collaboration is under discussion.

(11) *"The option of entering into a contractual agreement with the Albert-Ludwigs-Universität Freiburg to grant all KIS scientists access to relevant electronic journals should be explored."*

Upon request and approval by the director, KIS scientists can obtain a computer account at the University of Freiburg and thereby gain access to its extensive collection of electronic journals.

(12) *"KIS should give particular attention to connect to large computer centres."*

According to the institute, KIS has established a faster internet connection; the data traffic with the Teide Observatory profits from this improvement as well.

(13) *"KIS is advised to establish a closer cooperation with work groups from other universities."*

As KIS points out, the institute is involved in cooperations world-wide, with research institutes, universities and industry (cf. chapter 4). Also, KIS scientists actively participate in the global network of astrophysicists.

Staff development and promotion of junior researchers

(14) *"KIS should become even more active in recruiting female scientists and doctoral candidates."*

The number of female scientists has increased significantly since last evaluation. In 2012 a female post-doc won a Leibniz grant for women in academic leadership positions; since then she has established a junior research group (cf. chapter 5).

(15) *"The proportion of temporary scientific positions with basic funding should be further increased. For the operation of the solar telescope GREGOR, qualified staff should be permanently available on Tenerife."*

Two scientist positions have been converted to term positions on institutional funding for post-docs (KIS Research fellows). The establishment of local observatory staff has been initiated with the hiring of two technicians who work at the observatory and live on the island.

(16) *"KIS should come up with more incentives for the recruitment of excellent young scientists."*

For incentives offered by KIS cf. chapter 5.

Quality assurance

(17) *"From the year 2008 onwards, the programme budget should be used for internal control purposes. The management's plans for a performance-based allocation of resources at the institute should be implemented."*

The program budget is routinely used as a planning instrument, as KIS points out. However, according to the institute there is little room for performance-based allocation of resources, since a significant part is tied to external (co-)funding. The only feasible performance-based benefits derive from the project overhead funds, which can in general be used within the generating project (cf. chapter 6, internal quality management).

Appendix 1

KIS Organizational Structure

Scientific Advisory Committee

Prof. Dr. Jürgen Schmitt (Chair)
Prof. Dr. Artie Hatzes (Vice-chair)

Board of Directors

Prof. Dr. Oskar von der Lühe
Prof. Dr. Svetlana Berdyugina

Board Office

Blank (Assistant)
Bruls (Scientific assistant)

Foundation Council

MDgt Michael Kleiner (Chair)
Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg

Dr. Renata Ch. Feldmann (Vice-chair)
Bundesministerium für Bildung und Forschung

PA1: Astrophysical Research and Teaching		**PA2: Observatory Operation and Instrument Development**	**Services**
Theoretical Solar Physics Berdyugina	**Experimental Solar Physics** von der Lühe	**Observatory Operation** Sigwarth / Schlichenmaier	**Workshops** (Sigwarth) Mechanics & Construction (Fischer) Electronics (Heidecke) Technical IT (Knobloch)
WG Atmospheres ATMOS, Berdyugina WG Helio- and Asteroseismology SEISMO, Roth WG Magnetism MHD, Steiner	WG Instrumentation INSTR, von der Lühe WG Observations OBS, Schmidt WG Data Processing DATA, Bello González	**Instrumentation Projects** DKIST / VTF (PI: von der Lühe / Sigwarth) Solar Orbiter (PI: Schmidt) HOTMOL Polarimetry (PI: Berdyugina) Gregor@Night (PI: Berdyugina) EST (von der Lühe) SPRING (Roth)	**Scientific IT** (Caligari) **Administration** (Hentschel)
Staff Representation - Employee Committee (Personalrat) - Scientific Staff Assembly (Konvent) - Equal Opportunity Officer (Gleichstellungsbeauftragte)		**Internal Advisory and Information Committees** - Management Team (Leitungsrunde) - Strategic Committee (Strategiekommission) - Budget Committee (Haushaltsausschuss)	

Appendix 2

Publications of KIS

	Period		
	2012	**2013**	**2014**
Total number of publications	**100**	**107**	**97**
Monographs	–	–	–
Individual contributions to edited volumes (invited reviews)	1	–	–
Articles in peer-reviewed journals	43	29	24
Articles in other journals, proceeding contributions	26	16	18
Working and discussion papers / Technical reports	28	61	55
Editorship of edited volumes	2	1	–

Appendix 3 Revenue and Expenditure

Revenue		2012			2013			2014 [1]		
		K€	% [2]	% [3]	K€	% [2]	% [3]	K€	% [2]	% [3]
Total revenue (sum of I., II. and III.; excluding DFG fees)		6393			7412			7828		
I.	**Revenue (sum of I.1., I.2. and I.3)**	6209	100 %		7230	100 %		7619	100 %	
1.	INSTITUTIONAL FUNDING (EXCLUDING CONSTRUCTION PROJECTS AND ACQUISITION OF PROPERTY)	5129	83 %		5364	74 %		5537	73 %	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	5129			5364			4900[4]		
	thereof items of extraordinary expenditure ("*Sondertatbestand*": DKIST/VTF)	994			924			885		
2.	REVENUE FROM PROJECT GRANTS	1.080	17	100 %	1.866	26	100 %	2.082	27	100 %
2.1	DFG	131		12 %	105		6 %	46		2 %
2.2	Leibniz Association (competitive procedure)	343		32 %	404		21 %	330		16 %
2.3	Federal, *Länder* governments	387		36 %	650		35 %	509		24 %
2.4	EU	216		20 %	707		38 %	1.197		58 %
2.5	Industry	0		0	0		0	0		0
2.6	Foundations	0		0	0		0	0		0
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		
II.	**Miscellaneous revenue** (e.g. membership fees, donations, rental income, funds drawn from reserves)	184			182			209		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* governments, EU structural funds, etc.)	0			0			0		

Expenditures		T€	T€	T€
Expenditures (excluding DFG fees)		6.609	7.094	6.909
1.	Personnel	2.785	2.927	4.454
2.	Material expenses	0	0	0
2.1	*Proportion of these expenditures used for registering industrial property rights (patents, utility models etc.)*	0	0	0
3.	Equipment investments	1.745	1.338	735
4.	Construction projects, acquisition of property	0	0	0
5.	Other operating expenses (if applicable, please be specific)	2.079	2.829	1.720
DFG fees (if paid for the institution – 2.5% of revenue from institutional funding)		126	132	137

[1] Preliminary data: no
[2] Figures I.1, I.2 and I.3 add up to 100 %. The information requested here is thus the percentage of "Institutional funding (excluding construction projects and acquisition of property)" in relation to "Revenue from project grants" and "Revenue from services".
[3] Figures I.2.1 to I.2.6 add up to 100 %. The information requested here is thus the percentage of the various sources of "Revenue from project grants".
[4] This number is lower than in I.1 because K€ 637 had to be transferred into 2015.

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31/12/2014)

Please select appropriate and modify as necessary	Full time equivalents		Employees		Female employees	
	Total	on third-party funding	Total	on temporary contracts	Total	on temporary contracts
	Number	Percent	Number	Percent	Number	Percent
Research and scientific services	**34,0**	**42,5**	**40**	**65,0**	**7**	**85,7**
Professors / Direct. (C4, W3 or equivalent)	1,7	29,4	2	0	1	0
Academic staff in executive positions (A15, A16, E15 or equivalent)	1,0	–	1	–	–	–
Junior research group leaders / junior professors/ post-doctoral fellows (C1, W1, A14, E14 or equivalent)	2,0	50,0	2	50,0	1	100,0
Scientists in non-executive positions (A13, A14, E13, E14 or equivalent)	21,3	44,8	23	56,5	4	100,0
Doctoral candidates (A13, E13, E13/2 or equivalent)	8,0	42,5	12	100,0	1	100,0
Service positions	**23,8**	**11,6**	**27**			
Technical Support (from E13, senior service)	2,0	–	2			
Technical Support (E9 to E12, upper-mid-level service)	16,4	16,8	18			
Technical Support (E5 to E8, mid-level service)	2,3	–	3			
Library (E9 to E12, upper-mid-level service)	0,1	–	1			
Information technology - IT (from E13, senior service)	1,0	–	1			
Information technology - IT (E9 to E12, upper-mid-level service)	2,0	–	2			
Administration	**10,5**	**10,5**	**12**			
Head of the administration	**1,0**	–	1			
Internal administration (financial administration, personell etc.) (E9 to E12, upper-mid-level service)	2,0	–	2			
Internal administration (financial administration, personell etc.) (E5 to E8, mid-level service)	4,8	22,9	6			
Building service (E5 to E8, mid-level service)	1,0	–	1			
Building service (E1 to E4)	1,7	–	2			
Student assistants/ graduate assistants	**0,9**	**27,8**	**4**			
Trainees	**5,0**	–	**5**			
Scholarship recipients at the institution	**3,3**	**100,0**	**5**		**2**	
Doctoral candidates	1,0	100,0	1		1	
Post-doctoral researchers	2,3	100,0	4		1	

22 February 2016

Annex B: Evaluation Report

Kiepenheuer Institute for Solar Physics, Freiburg (KIS)

Contents

1. Summary and main recommendations

The mission of the Kiepenheuer Institute for Solar Physics (KIS) is basic research in astrophysics, in particular solar physics. This includes observational and theoretical astrophysics as well as the development of instruments and observing techniques for ground-based observing facilities.

Since the last evaluation in 2008, the institute has developed successfully and has made considerable progress. It has not only achieved a substantial growth in scope, staff, instrumentation, infrastructure, and institutional as well as third-party funding, but also refined its work programme by strengthening the institute's expertise in solar-stellar physics.

Since 2008, members of staff have been producing outstanding, globally-noted scientific results and technological developments. Third-party fund raising has improved significantly; the acquisition of two ERC Grants in 2012 was an outstanding success. The institute has also managed to generate very high-quality publications. KIS collaborates intensively with a wide range of national and international partners and contributes to technical developments in observatories worldwide. Furthermore, the institute is very successful in attracting and educating young researchers. In summary, the three research foci are rated as "very good to excellent".

KIS maintains impressive infrastructures for observing the Sun. The solar telescope GREGOR on Tenerife, in particular, means the institute has measuring technology at its disposal which is both seminal for its continued development and quite unique in Europe. KIS uses it to provide highly-relevant services for the global solar community. Because the launch of the facilities was somewhat delayed due to technical start-up difficulties it is now important to give absolute priority to the use and evaluation of the data generated by GREGOR. The plan for creating a science and data centre to facilitate, amongst other things, appropriate archiving, management and access to GREGOR data is convincing.

Such extremely successful developments in the period since the last evaluation have led to the establishment of a wealth of innovative scientific and technological projects. Here KIS works with great efficiency at the interface of solar and stellar magnetism and contributes significantly to the research of the Sun and its inherent mechanisms. In the light of its goal of becoming a European centre of solar physics, however, KIS needs to prioritise its projects and align them with its long-term strategic planning.

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. Plans to further develop the "Center for Advanced Solar Spectro-Polarimetric Data Analysis" (CASSDA, founded in 2012) into a "GREGOR Science and Data Center" are endorsed. KIS rightly recognises such a centre as an important prerequisite for the comprehensive management, provision and exploitation of KIS' data. Proper implementation of this centre would, however, necessitate an increase in

the number of IT staff. KIS is thus encouraged to drive its plans to secure funding in order to bring the centre to life.

2. In order to maintain its status of a leading institution in the field, KIS needs to align its range of current scientific and technological projects with its long-term strategic planning. As already pointed out by the Scientific Advisory Committee, the latter is still too general. Hence, KIS should prioritise its projects in accordance with specific goals and milestones against the backdrop of the resources at its disposal. In this context, the institute should not lose sight of its main tasks in the field of solar physics.
3. KIS must drive its efforts to acquire DFG funding at least in the amount of its annual DFG fees.
4. Given that both the findings of the last evaluation (2008) and the audit conducted by the Scientific Advisory Committee (2012) drew attention to the space problems of accommodating KIS satisfactorily, a solution must now be found urgently. In order to be able to uphold its scientific performance and remain internationally competitive the institute requires, in particular, appropriate workshop facilities.

STAFF DEVELOPMENT AND PROMOTION OF JUNIOR RESEARCHERS

5. According to the 2016 programme budget, there is still a binding staffing appointment plan (*verbindlicher Stellenplan*) for 80 % of KIS' personnel. KIS' funding agency (State Ministry of Baden-Wuerttemberg for Sciences, Research and Arts), however, is expected to act in accordance with the Administrative Agreement between the Federal and *Länder* Governments with regard to the joint funding of member institutions of the Leibniz Association (AV-WGL) and to completely abolish this plan. It should be replaced by criteria which allow the workforce to be managed globally.
6. In order to further improve the promotion of junior researchers and to raise standards, KIS should follow the "Career guidelines of the Leibniz Association" more closely.

2. General concept and profile

The mission of the Kiepenheuer Institute for Solar Physics (KIS) is basic research in astrophysics, in particular solar physics. This includes observational and theoretical astrophysics as well as the development of instruments and observing techniques, especially for ground-based observing facilities.

With its innovative scientific approaches and the respective infrastructures KIS contributes significantly to the research of the Sun and its inherent mechanisms. This work is of fundamental scientific interest as the Sun serves as a defining example for other stars in the universe, as does the solar system for the analysis of exoplanets. KIS' work is of crucial importance as solar activity impacts on space weather and the near-earth environment as well as the earth's atmosphere, surface and climate. The Sun's activity affects

global communication and transportation systems at large. By influencing climate change, it has had an impact on the earth in the past and will continue to do so in the future. Hence, KIS' work is of major relevance to society.

Development of the institution since the last evaluation

Since the last evaluation in 2008, the institute has developed successfully and has made considerable progress. It has not only achieved a substantial growth in scope, staff, instrumentation, infrastructure, and institutional as well as third-party funding, but also refined its work programme by strengthening the institute's expertise in solar-stellar physics. The latter is the research focus of the Deputy Director who was appointed in 2008 and, together with the Director, has been responsible for remarkably dynamic developments since then. As a result, KIS now works at the interface of solar and stellar magnetism with great success.

The return of a leading scientist in 2009 also had a very positive influence on the development of the institute. Just like the Deputy Director he, too, acquired an ERC Grant in 2012. These two grants (one Starting Grant and one Advanced Grant) have enabled KIS to establish highly innovative themes, a notable achievement that provides clear evidence of the institute's scientific and technological excellence. KIS has consequently been able to continue honing its profile, and these two projects place it at the very forefront of research in the field (see Chapter 3). The positions for junior researchers which have been created by the projects have also had a very positive effect.

Since 2012/13, with the completion of the main construction work on the solar telescope GREGOR, the institute has had access to an infrastructure which is both seminal for its continued development and unique in Europe.

Publications

In the period since 2008, members of the institute have produced a significant number of original and high-quality publications, especially in helioseismology and the investigation of sunspots. Also, detailed observations of magnetohydrodynamic processes in the Sun, for example waves in the solar atmosphere, have resulted in impressive images which have been widely recognised. Furthermore, KIS has successfully disseminated the outcomes of its simulation activities on the basis of CO^{5}BOLD, for instance.

After the last evaluation, the number of peer-reviewed papers produced by KIS staff increased. Given the institute's involvement in various instrumentation missions, like GREGOR, which resulted in the publication of an array of technical reports, numbers dropped however. Since the solar telescope went into operation and thanks to additional scientific staff, the two ERC Grants are gradually bearing fruit, which is being reflected in a concomitant increase in the number of peer-reviewed publications. In order to promote this process, KIS should make greater use of the internal reporting system on quality assurance it has introduced (see Chapter 6).

Infrastructure and services

KIS has been majorly involved in setting-up scientific infrastructures as well as designing and constructing equipment components for various missions. By operating its observational instruments, KIS performs services which are of the greatest relevance to the international solar physics community.

With GREGOR, the institute runs the largest ground-based solar telescope in Europe (1.5 metres diameter) and the second largest in the world. As early as 2008, in the context of the institute's last evaluation, great expectations were attached to its operation. Due to technical challenges, however, GREGOR could only be launched in 2012/13. Since then, KIS has invested a lot of resources in the facility, especially into repairing technological deficits in the telescope's optical elements. As a result, GREGOR now delivers high-precision polarimetry data. Via time allocation schemes, GREGOR is accessible to the entire international community. Since 2014, three instruments have been in operation: a Broad Band Imager (BBI), the GREGOR Infrared Spectrograph (GRIS) and the GREGOR Fabry-Pérot Interferometer (GFPI) with two Etalons used as a narrow tunable wavelength filter. Plans to enhance the status of the current GREGOR adaptive optics system (AO) to a multi-conjugated adaptive optics system (MCAO) are persuasive and have already been partially implemented.

The Review Board welcomes the fact that human resources, particularly for technical maintenance, have been increased as recommended: currently, KIS employs two technicians for the onsite-maintenance of its observing facilities on Tenerife on a permanent basis. KIS should pursue its plans to acquire financing from partner institutions for additional local staff.

Before GREGOR was launched, the Vacuum Tower Telescope (VTT) was KIS' major observing facility in the Canary Islands. In accordance with a recommendation made at the last evaluation, KIS successfully developed an utilisation concept exploiting VTT's prospective technological and scientific potential. Part of this concept involved enhancing its instrumentation which has produced significant results in the context of projects such as LARS and HELLRIDE. VTT also facilitates the recording of comprehensive and robust statistical series of relevance to the solar community. Moreover, in the recent past, VTT has proven an ideal testing ground for the remote control of telescope operations, which will become a major issue in the coming years. Plans for the further use of VTT are welcomed.

With the development of the Visible Tunable Filter (VTF) on Hawai'i, KIS is making a major contribution to the Daniel K. Inouye Solar Telescope (DKIST), a four-metre ground-based solar telescope due to start operation in 2019. The involvement of KIS is highly welcomed and of paramount importance as it will guarantee the institute's observing time at DKIST in the future. It is pleasing that the design of VTF is being supported by a temporary extraordinary item of expenditure ("Sondertatbestand") amounting to almost four million euro over the period 2011 to 2018. Current activities to secure extra funding to cover additional financial requirements for the completion of the VTF are appreciated and should be given the highest priority by the directors.

In 2009, the first flight of the SUNRISE balloon mission was conducted and resulted in a series of important papers. In 2013, a second flight was undertaken which generated data that offered interesting insights into the magnetic activity of the Sun.

KIS is also part of the Solar Orbiter mission, contributing an image stabilisation system for the Photospheric and Helioseismic Imager (PHI) instrument. The institute brings its outstanding technical expertise to the project in an excellent manner and enjoys great recognition for its work amongst the partners.

Academic events and public relations

The institute is actively involved in the organisation of academic events. It uses the established public relations tools in the expected ways to disseminate information both to the specialist community and to the public at large. Moreover, the institute operates the "Schauinsland Observatory" and uses this infrastructure to the best effect to communicate its activities and engage the public in solar and astrophysical themes.

It is welcomed that KIS has devoted more human resources to public outreach in the last few years. With 0.3 FTEs, however, this area still tends to be under-resourced. Even though KIS is a relatively small institute, it should consider whether staffing numbers could be augmented in this field.

Knowledge and technology transfer

The institute has a very high international reputation in the field of developing technical instruments. As a result of its remarkable expertise and long-term experience it is a coveted partner, not least for the optical industry. Due to the technological demands of observational instruments and the development of individual components such as the mirrors for the GREGOR telescope and the Visible Tunable Filter (VTF), KIS has made valuable and innovative contributions to technology development.

Strategic work planning for the next few years

It is welcomed that KIS is now making increasing use of GREGOR and its data (see Chapter 3 for details). In the years to come, the telescope is scheduled to become the institute's scientific basis and will be of crucial importance. Hence, science involving GREGOR must have top priority. **Plans to further develop the "Center for Advanced Solar Spectro-Polarimetric Data Analysis" (CASSDA, founded in 2012) into a "GREGOR Science and Data Center" are endorsed. KIS rightly recognises such a centre as an important prerequisite for the comprehensive management, provision and exploitation of KIS' data. Proper implementation of this centre would, however, necessitate an increase in the number of IT staff. KIS is thus encouraged to drive its plans to secure funding in order to bring the centre to life**. Also, as mentioned above, the completion of the VTF should be given highest priority as it is of paramount importance of the inauguration of DKIST in 2019.

Such extremely successful developments in the period since the last evaluation have led to the establishment of a wealth of innovative scientific and technological projects. On this basis, the institute has become both a European and one of the world leaders in so-

lar and stellar physics. Moreover, KIS aspires to achieving leadership in the topical field of solar and stellar magnetism. The Review Board welcomes the fact that the institute has broadened its scope from the earlier focus on solar magnetism to embrace general problems of stellar magnetism, structure and variability. This is a logical development of KIS' programme of work which can easily be combined with new themes like exoplanetary atmospheres or physics of molecules.

In order to maintain its status of a leading institution in the field, however, **KIS needs to align its range of current scientific and technological projects with its long-term strategic planning. As already pointed out by the Scientific Advisory Committee, the latter is still too general. Hence, KIS should prioritise its projects in accordance with specific goals and milestones against the backdrop of the resources at its disposal. In this context, the institute should not lose sight of its main tasks in the field of solar physics.**

Appropriateness of facilities and equipment

KIS' financial provisions in terms of institutional funding are appropriate.

As advocated at the previous evaluation, KIS has increased its third-party funding, which accounted for 27 percent of its entire funding in 2014. In particular, by acquiring two ERC Grants in 2012, as well as four projects financed in the context of the Leibniz competitive scheme, KIS was able to boost its external funding substantially: on average, its third-party funding rose from € 470k p. a. in the reporting period 2004–2006 to approximately € 1.7 million p. a. between 2012 and 2014.

Currently, EU funding accounts for the major portion of the institute's portfolio, followed by funds from the Federation and the *Länder,* and those secured under the Leibniz competitive scheme. However, KIS was not so successful in its applications to the German Research Foundation (DFG). As already recommended in 2008, **KIS must drive its efforts to acquire DFG funding at least in the amount of its annual DFG fees.** It is welcomed that the institute has already made provisions for those working in the context of the ERC-funded projects to continue being employed when funding terminates in 2017.

In the light of substantial increases in third-party funding, KIS faces the problem of providing appropriate space for its scientists to work in. Until recently, KIS was housed in three buildings on the slopes of the Schlossberg close to the centre of Freiburg. Since 2015, extra funding (a temporary extraordinary item of expenditure) has been made available to rent additional space (650 m^2) in a nearby building. This is helping to alleviate the situation which had already been described as unsatisfactory in 2008. Although KIS is now able to meet its most urgent needs, the layout and capacity of the buildings are still unsatisfactory (see Chapter 3 for further details).

Given that both the findings of the last evaluation (2008) and the audit conducted by the Scientific Advisory Committee (2012) drew attention to the space problems of accommodating KIS satisfactorily, a solution must now be found urgently. In order to be able to uphold its scientific performance and remain internationally competitive the institute requires, in particular, appropriate workshop facilities. Moreover, accommodating all the research foci in a common building would reduce fric-

tion and significantly facilitate internal collaboration. It is welcomed that, in the medium term, the University of Freiburg is planning a new physics building in which KIS could also possibly be accommodated. The funders, the University of Freiburg and KIS should coordinate well in advance in order to find the optimum solution.

3. Subdivisions of KIS

KIS pursues its research and development activities in the framework of two programme areas:

- Programme Area 1: Astrophysical Research and Training (30.4 FTEs, thereof 19 in research and scientific services, 2.3 post-doctoral scholarship recipients, 9 doctoral candidates and 0.1 service staff)
- Programme Area 2: Observatory Operations and Instrument Development (30.6 FTEs, thereof 7 in research and scientific services, and 23.6 service staff).

In the following, two of the three research foci in Programme Area 1 will be assessed. The third research focus will be examined in conjunction with Programme Area 2.

Research focus "Magnetised Solar Atmosphere"

This research focus aims to understand magnetic structure formation and magnetoconvection in the photosphere as well as the structure and dynamics of the chromosphere and heating processes in the outer atmosphere of the Sun.

With the use of the GREGOR telescope as well as the data derived from the SUNRISE mission, the group has made considerable progress in the recent past. It has not only produced impressive images down to 50 km resolution, e.g. on sunspots, but has also developed further its highly sophisticated expertise in high resolution observation and theory. Now that GREGOR has entered its productive stage, remarkably detailed observational data are becoming available for future activities.

The group is characterised by a strong connection between observation and research. The observations of the evolution of sunspots, for instance, have led to a deeper understanding of their umbral and penumbral properties, their boundaries and the prevailing wave phenomena in sunspots. In this field, the group holds an excellent position. The investigations of the interaction of the solar plasma with the magnetic field at various spatial scales and in different atmospheric layers are conducted on an outstanding level. Furthermore, the work on the various magnetoconvective processes on the Sun's surface has generated interesting approaches to explaining the fundamental heating processes in the chromosphere and corona.

The group has been very successful in transferring its fundamental insights into other areas of solar physics. This has produced very good, internationally visible results in areas such as magnetic tornados in which the institute has described new phenomena, thus inspiring further research activities. In the fields of solar magnetism and magnetic shadows fruitful collaborations were generated with Research Focus 2. The transfer of findings to research on other stars, even though it is too far reaching in some respects, is

impressive and will facilitate links to the stellar community (see Chapter 2). This should not, however, deviate from concentrating on the Sun.

The group's work has resulted in very convincing publications that are well known in the community. In the reporting period overall, 60 papers were published, including 49 articles in peer-reviewed journals. Cooperation with the other research foci should be yet more clearly documented in joint publications.

In the field of the simulation of magnetoconvection in the solar atmosphere, the group ranks amongst the top groups worldwide. In particular, it is well known for its design and utilisation of CO^{5}BOLD, the Conservative Code for the Computation of Compressible Convection in a Box of L Dimensions (with L=2,3), which has proven highly relevant. Recent attempts to extend CO^{5}BOLD to other stars are fundamental, but should be more closely connected to observation. The overall aim of the group to develop a self-consistent magnetoconvective sunspot model on both local and global scales is demanding, but realistic as the group has a wide range of methodology, tools, observing expertise, and knowledge in spectropolarimetry as well as in solar and plasma physics at its disposal.

All in all, this research focus is rated as "very good to excellent".

Research focus "Global Magnetic Activity"

This research focus deals with the origin, evolution, and energetics of magnetic fields in the Sun and other stars, global hydrodynamic structures of the solar and stellar interior, and the influence of stellar radiation.

Members of this research focus have been very successful in acquiring third-party funding. Especially the two ERC Grants obtained in 2012 are a true sign of its innovativeness. Beyond that, the group has also secured funds under the Leibniz competitive procedure. In the years 2012 to 2014, 24 articles were published in peer-reviewed journals as well as 15 articles in other journals. Given the innovative activities of this focus, these figures should rise in the coming years. Now that the two ERC-funded projects are bearing fruit, the group has already proved its capability to increase its publication output in 2015.

An essential part of the group's work addresses the origin of solar activity using helioseismology methods. In the context of this ERC-funded activity (ORIGIN), the group has successfully conducted innovative research. A study of seismic waves on the Sun and its impact on the solar dynamo, for instance, has contributed significantly to a better understanding of the solar magnetic field and provided interesting information on the conditions in the outer layers of the Sun. Novel helioseismic techniques based on cross-spectral analysis allowed for a measure of meridional flow in the Sun's interior. These activities are considered to be one of the major contributions to solar physics in recent years and have had a great impact on the theory of self-excited dynamos that generate the solar magnetic field. This excellent work is original and highly relevant. By using gravitational wave detection, KIS has introduced a very innovative and outstanding approach.

In the framework of the second ERC-funded activity (HOT MOLECULES), the group studies gaseous environments of extra-solar planets in order to understand the formation of earth-like planets and habitable environments. This work is original, too, and brings together novel theoretical and observational approaches. It is an impressive example of the application of high precision polarimetry for which KIS has a worldwide reputation. The transfer of knowledge about planetary and stellar conditions to solar conditions and vice versa is convincing. By connecting solar, stellar, and molecular physics, KIS has produced many excellent outcomes, e.g. polarisation models and molecular probes of magnetic fields in starspots. On the basis of previous work, there is prolific potential for further investigations, also of the solar atmosphere.

The study of joint magnetospheres of close binary stars is an interesting side project also bearing on other activities within the group. In order to fully exploit the topic's potential KIS should try to find its niche amongst the many other groups working in this field worldwide. In this respect, it might be worth considering strengthening the group's expertise on stars, which would also benefit other topics dealt with in this research focus.

The application of KIS' results to other stars and planets is truly remarkable. Some projects, however, though very interesting, are marginal to the topic, such as the strong focus on exoplanets, and KIS is not actually well positioned for their observation. In the light of the institute's limited resources, KIS should critically examine how relevant they are for the overall scientific strategy of the institute and set priorities (see Chapter 2).

The group has considerable expert knowledge in detecting and measuring polarised light, which is considered a core expertise of KIS (see subsequent chapter). It is at the forefront of research in high sensitivity polarimetry and, not least with respect to its instrument know-how, a leader in the field. Its work has had an impressive impact and inspired debates on a very high scientific level.

All in all, this research focus is rated as "very good to excellent".

Research focus "High-Resolution Techniques" and Programme Area 2: Observatory Operations and Instrument Development

The research focus "High-Resolution Techniques", together with members of Programme Area 2, demonstrate striking expertise in the deployment and application of high-sensitivity instruments for imaging, spectroscopy and polarimetry. Just as in the past, it is one of the engines driving the institute's excellence. The groups are very strong and active and perform on an outstanding level at the international cutting edge of science and technology.

Amongst a whole array of projects already conducted, the activities surrounding GREGOR, the creation of a multi-conjugate adaptive optics system (MCAO) and the development of the Visible Tunable Filter (VTF) for the Daniel K. Inouye Solar Telescope (DKIST) are particularly outstanding. The impressive approaches used demonstrate the group's high degree of engineering expertise in the field of high-precision polarimetry. The result of this is outstanding, world-class instrumentation, albeit at the expense of peer-reviewed publications of which there are fewer in comparison with other groups.

With KISIP in the field of data processing, the group has one of the leading codes at its disposal.

In the reporting period, the research focus "High Resolution Techniques" and Programme Area 2 "Observatory Operations and Instrument Development" were very prolific and produced an impressive number of publications. Above all, these were technical reports which had been prepared on the basis of the manifold activities relating in particular to GREGOR. Altogether, from 2012 to 2014, 23 articles were published in peer-reviewed journals (essentially "Astronomische Nachrichten") and 35 in other journals. It is expected that these figures will eventually rise with GREGOR entering into its productive stage. A remarkably large number of publications were co-authored with scientists from other subdivisions. This is a clear sign of very good internal collaboration.

Between 2012 and 2014, considerable third-party funding was raised: in addition to the Leibniz Association, particularly from the European Union. Programme Area 2 also acquired substantial funding from the Federal and *Land* Governments. On average, both groups attracted funding in the amount of € 350k and € 700k *p. a.* respectively. This is a very convincing level, which the groups should be able to continue raising in the coming years.

The research focus "High-Resolution Techniques" as well as Programme Area 2 foster productive contacts to a wide range of external partners. During interviews on site, KIS' collaborative partners acknowledged the exceptionally high quality of KIS' work and also mentioned that many of their own projects would not have been accomplished without KIS' expertise.

In 2012, KIS was successful in acquiring Leibniz Competition funding for a "Center for Advanced Solar Spectro-Polarimetric Data Analysis" (CASSDA). This centre is of strategic importance and has produced very promising results so far, such as numerous remarkable tools to advance data reduction and analysis techniques in solar and astrophysics. Furthermore, the group has developed great expertise in inversion techniques. The centre is well organised and manages the storage, calibration, analysis as well as the provision of its data to the solar physics community at a high standard. With CASSDA, the institute has implemented a recommendation made at the last evaluation very successfully.

Overall, these activities are rated as "very good to excellent".

As already described in Chapter 2, the space allocated to the workshops developing instruments is a critical issue. They are housed in the basement of old city mansions, which are too small and inappropriately shaped. Installing urgently required equipment is disproportionately expensive. By renting additional space in a fourth building it has been possible to deal with the most urgent, short-term problems but an appropriate, long-term solution to meet the need, particularly for suitable workshops, has not yet been found. In order to enable KIS to fully exploit its potential in this specialised field of expertise the workshop conditions must equate to requirements.

4. Collaboration and networking

Collaboration with universities

KIS collaborates intensively with the University of Freiburg where it contributes to academic teaching, curriculum development, and the supervision of doctoral students. Both the Director and the Deputy Director of KIS hold joint appointments with the university. With its solar- and astrophysical expertise, KIS enriches the Institute of Physics as well as the university's research focus "Atomic, Molecular, and Optical Physics". Both KIS and the University of Freiburg should consider establishing joint junior professorships.

Abroad, KIS fosters prolific collaborations in academic teaching as well as in scientific and technological cooperation with the Université de Strasbourg, the University of Turku (Finland), and the University of Hawai'i at Mānoa as well as with the New Jersey Institute of Technology, Newark, New Jersey.

Collaboration with other domestic and international institutions, and networks

KIS' collaborations with non-university partners are impressively diverse – including collaborations with observatories, research institutions, and consortia.

KIS collaborates highly successfully with the Max Planck Institute for Solar System Research (MPS) and the Leibniz Institute for Astrophysics Potsdam (AIP), both on the basis of contractual agreements in the framework of GREGOR and other bilateral projects, such as SUNRISE and SOLAR Orbiter (MPS) as well as GREGOR@night (AIP), a high-resolution double spectrograph for night-time observation that started in 2006. In addition, there are close links to individual groups working on simulation and stellar activity. Finally, the partners cooperate closely on the exchange of data. KIS should examine whether increasing its efforts to collaborate with other Leibniz institutes (in the domain of optics, for instance) might prove interesting.

In the framework of the German solar facilities in the Canary Islands, collaboration with the *Instituto de Astrofísica de Canarias* (IAC) as the host institution operating the observatories is of great importance. Collaboration has been fruitful for decades with the implementation of GREGOR being a milestone.

Furthermore, together with 21 European and US-American partners, KIS is making significant contributions to the design and development of the next generation ground-based solar telescope DKIST on Hawai'i. Its engagement and expertise will guarantee the institute access to observation times once the telescope becomes operational in 2019.

In addition, EU consortia, such as OPTICON, Solarnet, and HELAS as well as its successor SpaceInn are of fundamental importance for KIS' networking and have generated prolific collaborations. KIS is very active in the European solar community and often takes on the leadership. It represents the interests of the German solar community on a long-standing basis and plays a major role in international networks. These activities are greatly appreciated, but KIS should ensure that the responsibility for scientific and infrastructural consortia is evenly distributed amongst the stakeholders.

In order to further promote collaborations on a personal as well as an institutional level, KIS introduced a Visitor Investigator Programme in 2009. Under this programme, exter-

nal scientists are invited to stay at KIS for up to twelve months. The programme has great potential to strengthen collaborations yet further, but has not so far led to a significant increase in the numbers of visiting scientists in Freiburg. It is therefore recommended to exploit the programme more strategically and to further improve its promotion.

5. Staff development and promotion of junior researchers

Staff development and personnel structure

As of 31 December 2014, a total of 84 people were employed at KIS (excluding assistants and scholarship recipients). Compared to the figures at the last evaluation in 2008 (57 staff as of 31 December 2006) and mainly due to a significant increase in third-party funding, this signifies considerable growth. Correspondingly, the number of scientific staff has also increased from 26 (2006, including six doctoral students) to 40 in 2014 (including 12 doctoral students).

The proportion of scientists on fixed-term contracts has increased considerably since then, partly thanks to the re-dedication of two core budget-funded scientific positions as temporary fellowships. In view of the growing volume of regular tasks, the number of permanent positions, especially for technicians, is now comparatively low. In this situation there is a danger of losing highly qualified staff and it should be tackled appropriately.

The decision to create the position of a Deputy Director is greatly welcomed. This measure has proved its worth. The Director and Deputy Director jointly manage the institute very efficiently. In general, KIS has a convincing personnel structure and a good tenure track policy. All the demands associated with tenured positions, however, as well as the appointment criteria should be clearly communicated to all those employed at KIS. It is a great achievement that the institute has been able to diversify staffing even further by considerably increasing the number of researchers from abroad.

In the coming years, four senior scientists will retire. It is welcomed that KIS has developed a clear vision of how to fill these positions in future, especially in view of the upcoming challenges relating to the storage, calibration, analysis, and provision of GREGOR data as well as KIS' positioning at the interface of solar and stellar magnetism. These ideas should be implemented as planned.

In justifying additional positions, the institute should elaborate its needs according to strategic considerations and also take account of requirements in the IT sector, especially as personnel development in this sector has not kept pace with the constantly growing importance of IT for the institute as a whole (see Chapters 2 and 3). Against the backdrop of the institute's plans to build a "GREGOR Science and Data Center" and a "Center for Remote Operations" (see Chapter 3), which are of major importance to the sustainable and efficient use of the telescope, this is particularly vital. The successful implementation of these centres with the existing IT personnel capacity, which is already tight, is cause for skepticism.

According to the 2016 programme budget, there is still a binding staffing appointment plan (*verbindlicher Stellenplan*) for 80 % of KIS' personnel. KIS' funding agency (State Ministry of Baden-Wuerttemberg for Sciences, Research and Arts), however, is expected to act in accordance with the Administrative Agreement between the Federal and *Länder* Governments with regard to the joint funding of member institutions of the Leibniz Association (AV-WGL) and to completely abolish this plan. It should be replaced by criteria which allow the workforce to be managed globally.

Promotion of gender equality

At the end of 2014, seven female scientists were employed at KIS (2004: two scientists and one doctoral candidate), including the Deputy Director (as of 2008), a leading junior researcher, and a female doctoral candidate. At 17.5 percent in the "research and scientific services" sector, the proportion of women at KIS is average for the academic field of relevance to the institute, physics[1]. In terms of senior scientific staff on the other hand, at 40 percent (two of five individuals), the proportion of women is pleasingly high. In comparison with the situation seven years ago, KIS has made good progress. It should, nevertheless, drive its efforts to increase the proportion of female doctoral students as the figure was definitely too low at the end of 2014.

KIS is called upon to keep pursuing its endeavours to further promote gender equality. The measures already in place at the institute, particularly those to encourage the career development of women junior researchers, should make it possible to achieve the quotas in the binding cascade model.

KIS offers a number of incentives to maintain and facilitate a good work–life balance and has thus managed extremely well to create a family-friendly atmosphere. As a result, KIS was awarded the certificate "berufundfamilie" in 2014. In order to attract talented personnel, KIS should continue its successful efforts.

Promotion of junior researchers

KIS is very successful in attracting young researchers and the relevant numbers have risen in recent years. It is welcomed that KIS has earmarked two temporary positions for postdoctoral scientists, each allocated to one of the institute's two departments. As the measure has already proven its worth, KIS could even consider expanding the so-called KIS Research Fellowship Programme. Within the scope provided by the "Wissenschaftszeitvertragsgesetz" (legislation on fixed-term contracts in science), the institute should synchronise the duration of employment contracts with the duration of projects.

At the end of 2014, a total of twelve doctoral students were employed at KIS, almost half of them on third-party funding. Between 2012 and 2014, however, only three doctoral degrees were successfully completed. KIS is aware that this figure is too low and should increase in the coming years. It is welcomed that, according to the institute, five dissertations will have been finished by autumn 2015.

[1] By comparison: percentage of women in physics according to the DFG's equal opportunities monitoring 2013: 16.8 % of scientists, 9.4 % of professors.

KIS does not offer a structured PhD programme, although it advises its PhD candidates to enrol in the graduate programme offered by the University of Freiburg. In addition, the institute runs soft skills courses and organises in-house workshops as well as practical training for its doctoral students. Each candidate has an assigned advisor at the institute. Altogether, KIS provides a stimulating and scientifically creative atmosphere for its doctoral students. Nevertheless, **in order to further improve the promotion of junior researchers and to raise standards, KIS should follow the "Career guidelines of the Leibniz Association" more closely.** This should help to strengthen links with the university. Furthermore, the institute should pursue the idea of increasingly involving alumni and their professional experiences in its existing seminars on career advancement.

Vocational training for non-academic staff

KIS' long-time commitment to vocational training for non-academic staff is commendable. The five apprenticeship positions are very attractive and have generated a large number of qualified staff.

6. Quality assurance

Internal quality management

KIS has a broad range of internal committees and measures to ensure the quality of its work, amongst other things a convincing procedure for reviewing its publications. Furthermore, up to € 300k are allocated to projects designed to improve instrumentation in an internal competitive procedure. KIS also routinely monitors quality management within instrumentation development and use very efficiently. All in all, internal quality management is very good. As quarterly progress reports have proven effective in steering publication outcomes, they should become a standard tool.

KIS is modestly sized and has flat hierarchies. It should therefore be able to further improve transparency and internal communication. With its wealth of internal committees, the directors have the means to steer communication within the institute even better. In order to advance career development, it should be considered whether the idea of regular employee appraisals should be introduced.

The person elected as Equal Opportunity Advisor should not only become a member of the Strategy Committee, but also be fully involved in all kinds of staff employment procedures, especially if permanent positions are at stake.

Quality management by the Scientific Advisory Committee and Supervisory Board

The Scientific Advisory Committee (SAC) provides very good input for the institute's work. It was especially instrumental in improving the institute's strategic planning. Overall, it does an excellent job. KIS should implement the recommendations even more conscientiously (see Chapter 2).

The Supervisory Board supports the institute in accordance with its mandate. It has been very committed to trying to solve the space problems at KIT, a situation which was

declared to be unsatisfactory at the last evaluation. However, both KIS and its Supervisory Board should improve their communication, especially as far as the institute's strategic planning and priority setting is concerned.

Implementation of recommendations from the last external evaluation

Most of the recommendations from the last evaluation (see Statement of the Senate of the Leibniz Association of 9 July 2008) have been convincingly put into practice (see also Status Report, pp. A-19). The following points, however, were not or not fully implemented:

1) the further expansion of KIS' research work to other thematic fields, which the Review Board advised against in 2008 (see Chapter 2). Indeed, especially with the arrival of the deputy director, KIS somewhat enlarged its thematic spectrum, but this decision was appropriate and has led to interesting results.
2) the acquisition of DFG funding (see Chapter 3),
3) KIS' space problems, in particular with regard to its technical workshops (see Chapter 3).

Appendix

1. Review Board

Chair (Member of the Leibniz Senate Evaluation Committee)

Roland **Sauerbrey**	Helmholtz-Zentrum Dresden-Rossendorf

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Jürgen **Troe**	Institute of Physical Chemistry, the University of Göttingen

Reviewers

Bernhard **Brandl**	Leiden Observatory, Leiden University, Netherlands
Lyndsay **Fletcher**	School of Physics and Astronomy, University of Glasgow, UK
Ralph **Neuhäuser**	Astrophysical Institute and University Observatory of Friedrich Schiller University Jena
Merav **Opher**	Astronomy Department, Boston University, USA
Michael **Perryman**	School of Physics, University College Dublin, Ireland
Werner **Schmutz**	Physikalisch-Meteorologisches Observatorium Davos (CH) / World Radiation Center
Lidia **van Driel-Gesztelyi**	Mullard Space Science Laboratory, University College London, UK

Representative of the Federal Government

Friederike **Trimborn-Witthaut**	Federal Ministry of Education and Research, Bonn

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

Sigrid **Hemming**	Ministry of Social Affairs, Health, Science and Equality of Land Schleswig-Holstein, Kiel

2. Guests

Representative of the relevant Federal government department

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

Representative of the relevant Land *government department*

Tania **Bolius**	Ministry of Sciences, Research and Arts of Baden-Württemberg, Stuttgart

Representative of the Scientific Advisory Committee

Jürgen **Schmitt**	Hamburg Observatory, University of Hamburg

Representative of the Leibniz Association

Martin **Möller**	DWI – Leibniz Institute for Interactive Materials, Aachen

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

Hans-Jochen **Schiewer**	University of Freiburg, Rector
Sami K. **Solanki**	Max Planck Institute for Solar System Research, Göttingen
Rafael **Rebolo**	Instituto de Astrofísica de Canarias, Tenerife, Spain
Valentin **Martinez Pillet**	National Solar Observatory, Boulder, USA

17 March 2016

Annex C: Statement of the Institution on the Evaluation Report

Kiepenheuer Institute for Solar Physics, Freiburg (KIS)

It is with great satisfaction that Kiepenheuer Institute (KIS) takes note of the evaluation report provided by the review board in February 2016. We would like to thank all the members and guests of the review board as well as the evaluation unit of Leibniz Association for the excellent support, organisation and implementation of the evaluation. Our Institute sees itself confirmed on the course it adopted after the preceding evaluation and will do everything in its power to continue operating as successfully in the future.

Please find below our detailed statement on the main recommendations made in the report:

1. *Plans to further develop the „Center for Advanced Solar Spectro-Polarimetric Data Analysis" (CASSDA, founded in 2012) into a „GREGOR Science and Data Center" are endorsed. KIS rightly recognises such a centre as an important prerequisite for the comprehensive management, provision and exploitation of KIS' data. Proper implementation of this centre would, however, necessitate an increase in the number of IT staff. KIS is thus encouraged to drive its plans to secure funding in order to bring the centre to life.*

We are very happy about this recommendation since it endorses an essential element of the institute's strategic planning that includes transferring the current head of the CASSDA project to a tenured position after expiry of the project in 2017. This position will be in charge of establishing the recommended "Science and Data Center" in the long term. In addition and for the same purpose, the interdisciplinary group for scientific data processing will be strengthened by an additional IT specialist. Other measures will follow.

2. *In order to maintain its status of a leading institution in the field, KIS needs to align its range of current scientific and technological projects with its long term strategic planning. As already pointed out by the Scientific Advisory Committee, the latter is still too general. Hence, KIS should prioritise its projects in accordance with its specific goals and milestones against the backdrop of resources at its disposal. In this context, the institute should not lose sight of its main tasks in the field of solar physics.*

Kiepenheuer Institute opened up to adjacent fields of astrophysics such as stellar physics and extrasolar planets, because it is in a position to contribute specific knowledge in these areas. Moreover, these contacts broaden the horizon of our scientific staff and create new career opportunities for young scientists. Kiepenheuer Institute will make sure that its main field of activity continues to be solar physics. The strategic goals of the institute will continue to be aimed at this core mission. Examples for this are GREGOR and our participation in projects such as DKIST and EST. In cooperation with its Scientific Board, the Institute will formulate and communicate these strategic goals more clearly in the future.

3. *KIS must drive its efforts to acquire DFG funding at least in the amount of its annual fees.*

The Institute is aware that it must acquire more DFG funds. In recent years, only on one occasion the third-party funds acquired from DFG did not exceed the Institute's contribution to DFG. We are making progress. In the time since the evaluation visit, DFG projects in the amount of €600,000 have been granted for the next three years.

4. *Given that both the findings of the last evaluation (2008) and the audit conducted by the Scientific Advisory Committee (2012) drew attention to the space problems of accommodating KIS satisfactorily, a solution must now be found urgently. In order to be able to uphold its scientific performance and remain internationally competitive, the institute requires, in particular, appropriate workshop facilities.*

In the past eight years the institute has made every effort to improve its accommodation situation. So far, with support of the funding agencies, only the most urgent needs have been covered. Especially the accommodation of the institute's workshops still needs to be improved. The institute will continue to work together with its funding agencies towards a consolidated housing solution for the entire institute.

5. *According to the 2016 programme budget, there is still a binding staff appointment plan (verbindlicher Stellenplan) for 80% of KIS' personnel. KIS' funding agency […], however, is expected to act in accordance with the Administrative Agreement between the Federal and State Governments with regard to the joint funding of member institutions of the Leibniz Association (AV-WGL) and to completely abolish this plan. It should be replaced by criteria which allow the workforce to be managed globally.*

The institute will resolve this issue together with the Baden-Württemberg Ministry of Science, Research and Arts.

6. *In order to further improve the promotion of junior researchers and to raise standards, KIS should follow the „Career guidelines of the Leibniz Association" more closely.*

KIS will implement this recommendation. We assume that this will be necessary anyway under the revised version of the law on fixed-term contracts for scientists (Wissenschafts-Zeitvertragsgesetz).