

# Bochum

## Ruhr-Universität Bochum, Theoretische Physik, Weltraum- und Astrophysik, Lehrstuhl IV

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### 1 Personal und Ausstattung

#### 1.1 Personalstand

##### *Direktoren und Professoren:*

Prof. Dr. Reinhard Schlickeiser [-22032],  
*am Institut tätig:* Prof. Dr. em. Karl Schindler [-24728].

##### *Wissenschaftliche Mitarbeiter:*

Dipl.-Phys. Carsten Arbeiter [-26862](DESY-Verbundforschung); Dr. Udo Arendt [-26709]; Dipl.-Phys. Michael Beiermann [-23458](SFB 591 TP A1)(ab 04/2004); Dipl.-Phys. Hanno von Bodecker [-28878](VW-Stiftung)(bis 02/2004); Dipl.-Phys. Thorsten Borrmann [-23779]; Dr. Ingo Büsching [-26011](DLR-Verbundforschung)(bis 07/2004); Dr. Bengt Eliasson [-23729](SFB 591 TP B3); Priv.-Doz. Dr. Horst Fichtner [-23786]; Dr. Gunnar Hornig [-23799](VW-Stiftung)(bis 02/2004); Dipl.-Phys. Ralf Kissmann [-22051](SFB 591 TP A6); Dipl.-Phys. Jens Kleimann [-23771](Stipendiat, Allg.Prom.Koll. RUB); Dr. Andreas Kopp [-23786](SFB 591 TP A6) (ab 10/2004); Dr. Ioannis Kourakis [-26011](SFB 591 TP B3); Dr. Ulrich Langner [-23779](DFG SCHL 201/14-3) (ab 26.10.2004); Dr. Christoph Mayer [-28878](VW-Stiftung)(bis 02/2004); Prof. Dr. Martin Pohl [-27796](bis 12/2004, jetzt: Iowa State University); Dr. Anita Reimer [-23676](DESY-HESS)(bis 08/2004, jetzt Lise-Meitner Habilitations-Stipendiatin); Dr. Olaf Reimer [-22051](DLR-GLAST); Dr. Claudia Schuster [-23771](DESY-HESS); Dr. Andreas Shalchi Toussi (geb. Teufel) [-26011](ab 11/2004); Prof. Dr. Dr. h.c. Padma Kant Shukla [-23759]; Dr. Mark Siewert [-23676](DESY-HESS); Dipl.-Phys. Felix Spanier [-23457](SFB 591, TP A5); Dr. Emanuele Tassi [-23458](EU PLATON)(bis 07/2004); Dr. Viatcheslav Slava Titov [-23458](VW-Stiftung)(bis 02/2004).

##### *Doktoranden:*

Dipl.-Phys. Carsten Arbeiter [-26862](DESY-Verbundforschung); Dipl.-Phys. Michael Beiermann [-23358](SFB 591 TP A1); Dipl.-Phys. Thorsten Borrmann [-23779](DFG SCHL 201/14-1); Dipl.-Phys. Ingo Büsching [-26011](DLR-Verbundforschung)(bis 07/2004); Dipl.-Phys. Atanur Dogan (extern: Lufthansa Systems Group GmbH, Corporate Communications, Am Weiher 24, 65451 Kelsterbach, Germany, Tel. +49(0)69-696 90776); Dipl.-Phys.

Ralf Kissmann [-22051](SFB 591 TP A6); Dipl.-Phys. Jens Kleimann [-23771](Stipendiat, Allg. Prom. Koll. der Ruhr-Universität Bochum); Dipl.-Phys. Claudia Schuster [-23771](DE-SY-HESS)(bis 12/2004); Dipl.-Phys. Mark Siewert [-23676](DESY-HESS); Dipl.-Phys. Felix Spanier [-23457](SFB 591, TP A5); Dipl.-Phys. Emanuele Tassi [-23458](EU PLATON)(bis 07/2004); Dipl.-Phys. Ralf Weyer [-26862](externer Doktorand).

*Diplomanden:*

cand.-phys. Dennie Lange; cand.-phys. Olaf Koch (bis 03/2004); cand.-phys. Corinna Kriegeskorte; cand.-phys. Jens Ruppel; cand.-phys. Urs Schaefer-Rolffs; cand.-phys. Ralf Schröder; cand.-phys. Oliver Sternal; cand.-phys. Robert Tautz.

*Sekretariat und Verwaltung:*

Gisela Buhr, [-23314] (SFB 591); Angelika Schmitz, [-26710].

*Technisches Personal:*

Bernd Neubacher, DV-Systemtechniker [-23798]; Timo Altenfeld, AZUBI [-28878]; Robin Schröder, AZUBI [-28878].

*Studentische Mitarbeiter:*

cand.-phys. Florian Bendl (bis 09/2004); cand.-phys. Dennie Lange (bis 09/2004); cand.-phys. Olaf Koch (bis 03/2004); cand.-phys. Corinna Kriegeskorte; cand.-phys. Christian Röken; cand.-phys. Jens Ruppel; cand.-phys. Urs Schaefer-Rolffs; cand.-phys. Ralf Schröder; cand.-phys. Oliver Sternal; cand.-phys. Robert Tautz cand.-ing. Tobias Welz.

## 1.2 Personelle Veränderungen

*Ausgeschieden:*

*Diplomanden:*

cand.-phys. Florian Bendl (10/2004); Dipl.-Phys. Hanno von Bodecker (02/2004); Dipl.-Phys. Olaf Koch (04/2004).

*Wissenschaftliche Mitarbeiter:*

Dipl.-Phys. Ingo Büsching [-26011](DLR-Verbundforschung)(bis 07/2004); Dr. Gunnar Hornig [-23799] (VW-Stiftung)(03/2004); Dr. Christoph Mayer [-28878](VW-Stiftung)(03/2004); Prof. Dr. Martin Pohl [-27796](12/2004); Dipl.-Phys. Emanuele Tassi [-23458](EU PLATON)(08/2004); Dr. Viatcheslav Slava Titov [-23458](VW-Stiftung)(03/2004).

*Neueinstellungen und Änderungen des Anstellungsverhältnisses:*

*Diplomanden:*

cand.-phys. Corinna Kriegeskorte; cand.-phys. Urs Schaefer-Rolffs; cand.-phys. Oliver Sternal; cand.-phys. Robert Tautz.

*Doktoranden:*

Dipl.-Phys. Michael Beiermann [-23458](SFB 591 TP A1)(ab 04/2004).

*Wissenschaftliche Mitarbeiter:*

Dipl.-Phys. Michael Beiermann [-23458](SFB 591 TP A1)(ab 04/2004); Dr. Andreas Kopp [-23786](SFB 591 TP A6) (ab 10/2004); Dr. Ulrich Langner [-23779](DFG SCHL 201/14-3) (ab 26.10.2004).

**2 Gäste**

Dr. Mark Eric Dieckman, Department of Science and Technology (ITN), Linköping University, Norrköping, Schweden, EU-Stipendiat Turbulent Boundary Layers, 02.01.–31.03.2004 und 01.07.2004–31.03.2005

Prof. Dr. Sybille Günter, Max-Planck-Institut für Plasmaphysik, Tokamakphysik, Garching, SFB 591, TP A5, 11.–12.05.2004

Dr. Jan-Ove Hall, Department of Astronomy and Space Physics, Uppsala University, Uppsala, Schweden, EU-Stipendiat Turbulent Boundary Layers, 14.06.2004–13.03.2005

Prof. Dr. Akira Hasegawa, Soliton Communication, Kyoto, Japan, SFB 591, TP B3, 17.–23.07.2004

Dipl.-Phys. Verena Heidrich-Meisner, Institut für Theoretische Physik und Astrophysik, Universität Kiel, SFB 591, TP A5, 05.11.2004

Dr Gerald Jacobs, Sterrenkundig Observatorium, Vaksgroep Wiskundige Natuurkunde en Sterrenkunde, Universiteit Gent, Gent, Belgien, EU-Stipendiat COMPLEX PLASMAS, bis 04/2004;

Prof. Dr. Dusan Jovanovic, Institute of Physics, University of Belgrade, Serbia and Montenegro, YU-11001 Belgrade, Yugoslavia, SFB 591, TP B3, 01.–30.04.2004

Prof. Dr. Phillip Kronberg, University of Toronto, Department of Astronomy, Toronto, ON Canada M5S 3J3, SFB 591, TP A5, 13.–14.10.2004

Prof. Dr. Alexander Lazarian, University of Wisconsin-Madison, Department of Astronomy, Madison, WI, USA, SFB 591, TP A5, 04.02.2004 / 15.–16.07.2004 / 08.10.2004

Prof. Dr. Ian Lerche, Institut für Geophysik und Geologie, Universität Leipzig, SFB 591, TP B3, 30.11.–01.12.2004

Alejandro Luque Estepa, Theoretische Physik IV, Universität Bayreuth, EU-Stipendiat Turbulent Boundary Layers, 01.11.2004–31.03.2005

Prof. Dr. A.A. Mamun, Jahangirnagar University Dhaka, Bangladesh, SFB 591, TP B3, 10.–25.06.2004

Prof. Dr. Michal Ostrowski, Obserwatorium Astronomiczne, Uniwersytet Jagiellonski, Krakau, Polen, SFB 591, TP A5, 18.04.–15.05.2004

Madelene Parviainen, Department of Science and Technology (ITN), Linköping University, Norrköping, Schweden, EU-Stipendiat Turbulent Boundary Layers, 01.11.2004–31.03.2005

Prof. Dr. Martin Pohl, Department of Physics, Iowa State University, Ames, IA, USA, 15.–18.07.2004

Prof. Dr. Oleg Pokhotelov Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, SFB 591, TP B3, 07.–09.07.2004

Prof. Dr. Jun-ichi Sakai, Laboratory for Plasma Astrophysics, Toyama University, Toyama - Japan 14.–26.07.2004

Prof. Dr. Stewart C. Prager, Department of Physics, University of Wisconsin, Madison, USA, SFB 591, TP A5, 17.05.2004

Prof. Dr. Bo Thide, Swedish Institute of Space Physics, Uppsala University, Uppsala, Schweden, SFB 591, TP B3, 09.09.2004

Prof. Dr. Davy D. Tskhakaya, Department of Theoretical Physics, University of Innsbruck, Innsbruck, Österreich, 14.04.2004 / 05.-11.12.2004.

### 3 Lehrtätigkeit, Prüfungen und Gremientätigkeit

#### 3.1 Lehrtätigkeiten

Folgende Lehrveranstaltungen wurden an der Universität Bochum durchgeführt:

U. Arendt *Tutorium für Studienanfänger*, SS 04

U. Arendt *Vorlesung: Grundlagen der Quantenmechanik und Statistik*, (4 + 2 h), WS 04/05

H. Fichtner *Vorlesung: Einführung in die Theoretische Physik I (analytisch und numerisch)*, (2 + 4 h), WS 03/04

H. Fichtner *Vorlesung: Einführung in die theoretische Physik II (analytisch und numerisch)*, (2 + 4 h), SS 04

H. Fichtner *Tutorium für Studienanfänger*, SS 04

H. Fichtner *Seminar: Einführung in die Weltraumphysik*, (2 h), WS 04/05

H. Fichtner *Vorlesung: Grundlagen der Quantenmechanik und Statistik*, (4 + 2 h), WS 04/05

R. Kissmann *FH Praktikum: Physik I (Optik) für Vermessungsingenieure und Geoinformatiker*, (3 h), WS 03/04

R. Kissmann *FH Vorlesung: Physik I (Optik) für Vermessungsingenieure und Geoinformatiker*, (1 + 1 + 2 h), WS 04/05

A. Reimer *Vorlesung: Einführung in die theoretische Astrophysik* (2 h), SS 04

R. Schlickeiser *Vorlesung: Astrophysik kosmischer Strahlung*, (2 h), SS 04

R. Schlickeiser *Vorlesung: Theoretische Physik III (Quantenmechanik I)*, (4 + 2 h), WS 04/05

R. Schlickeiser *Seminar: Theoretische Astrophysik*, (2 h), WS 04/05

F. Spanier *FH Vorlesung: Physik I (Optik) für Vermessungsingenieure und Geoinformatiker*, (1 + 1 + 2 h), WS 03/04

F. Spanier *FH Praktikum: Physik I (Optik) für Vermessungsingenieure und Geoinformatiker*, (3 h), WS 04/05

#### 3.2 Prüfungen

Von Herrn Prof. Schlickeiser wurden 8 Vordiplom-, 23 Diplom- und 8 Promotionsprüfungen abgenommen.

Von Herrn Priv.-Doz. Dr. Horst Fichtner wurden 2 Diplom- und 7 Promotionsprüfungen abgenommen.

#### 3.3 Gremientätigkeit

Fichtner, H.: Wahl zum Vorsitzenden der Arbeitsgemeinschaft Extraterrestrische Forschung (AEF) = Vorsitzender des DPG Fachverbands Extraterrestrische Physik (EP); Mitglied der Arbeitsgruppe Perspektivenpapier *Sonne und Heliosphäre*; Deputy Convener des Symposiums *To the Edge of the Solar system and Beyond*, 2. World Space Congress Houston, USA; Editor für *Advances in Space Research*, Symposium *The Heliosphere at Solar Maximum*, 2. World Space Congress Houston, USA; Bibliotheksbeauftragter der Fakultät für Physik und Astronomie; Mitglied der Berufungskommission der C3-Professur *Theoretische Physik*, Nachfolge Prof. Dr. W. Glöckle.

Reimer, A.: Mitglied der Berufungskommission der C3-Professur *Theoretische Physik*, Nachfolge Prof. Dr. W. Glöckle; Gleichstellungskommission der Fakultät für Physik und Astronomie; Berufungskommission zur gemeinsamen Berufung von Dr. Ritman an das Forschungszentrum Jülich und an die Ruhr-Universität Bochum.

Reimer, O.: Mitglied der GLAST Users Group (NASA) für das Satellitenexperiment GLAST.

Schlickeiser, R.: Chairman *Working Group on Particle Astrophysics* Division IX, International Astronomical Union; Vorsitzender *Fachkollegium 311 - Astrophysik und Astronomie*, DFG; Advisory Board Member *Astrophysics and Space Science Transactions (ASTRA)*; Mitglied der Berufungskommission der W3-Professur *Experimentalphysik, insbesondere Hadronenphysik* (Nachfolge: Prof. Dr. H. Koch); Sprecher des Sonderforschungsbereichs SFB 591 *Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung*, Ruhr-Universität Bochum.

Shukla, PK: Elected Member IUPAP, C16 Commission; Elected Fellow, Institute of Physics, UK; Elected Fellow, AIP, USA; Associate Member, Centre for Interdisciplinary Plasma Science, Max-Planck-Institute fuer Plasmaphysik und Extraterrestrische Physik, Garching; Chairman of the International Advisory Committee of the International Conference on the Physics of Dusty Plasma; Member of the International Advisory Committee of the International Congress on Plasma Physics (ICPP); Member of the International Program Committee of the ICPP; Member of the International Advisory Committee of the World Space Environment Forum; Co-Director/Convener of the International Conference on the Frontiers of Plasma Physics and Technology; Chairman of the International Topical Conference on Plasma Physics; Mitglied des Editorial Board *Plasma Physics and Controlled Fusion*; Associate Editor *Journal of Plasma Physics*; *IEEE Trans Plasma Science*; *J. Fusion Energy*; Co-Editor Topical Issue of *Physica Scripta*, Royal Swedish Academy of Sciences; Co-Director International Workshop on Theoretical Plasma Physics, 5-16 July 2004, Abdus Salam ICTP, Trieste, Italien; Editorial Board Member, *New J Physics*, Institute of Physics, Bristol, UK; Invited Full Professor, Institut Superior Technica, Universitat Technica de Lisboa, Portugal; Visiting Fellow, Centre for Fundamental Physics, Rutherford Appleton Laboratory, Chilton, Didcot, UK; International Advisory Committee Member of 2004 International Congress on Plasma Physics, Nice (Frankreich), 25-29 October 2004.

#### 4 Wissenschaftliche Arbeiten

Der am Institut für Theoretische Physik angesiedelte Lehrstuhl IV: Weltraum und Astrophysik übt eine Brückenfunktion aus zwischen den Theoretischen Lehrstühlen und den Lehrstühlen für Astronomie und Astrophysik an der Ruhr-Universität Bochum. Schwerpunkte des Lehr- und Forschungsprogramms des Lehrstuhls sind theoretische Fragestellungen aus der Weltraumphysik, der Astrophysik und der Physik kosmischer Plasmen mit Verzweigungen in die Gebiete der beobachtenden Astronomie, der Kosmologie, der Labor-Plasmaphysik, der Hochenergiephysik und der Teilchen-Astrophysik.

Im Bereich der Plasmaphysik beteiligt sich der Lehrstuhl am Graduiertenkolleg *Hochtemperaturplasmaphysik* und am Sonderforschungsbereich (SFB) 591 *Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung* mit zwei Teilprojekten über *Selbstgenerierte elektromagnetische Felder: Instabilitäten und energiereiche Teilchenstrahlen* und *Dynamik nicht-sphärischer Staubteilchen in magnetisierten Plasmen: Theorie*. Europaweit kooperiert der Lehrstuhl im Rahmen des EU Research Training Network *Complex plasmas: The science of laboratory colloidal and mesospheric charged aerosols* mit den Universitäten Chilton, Lissabon, Neapel, Oxford, Tromsø und dem MPI für Extraterrestrische Physik (Garching).

In der von der Volkswagenstiftung geförderten Nachwuchswissenschaftlergruppe *Topologische Fluidynamik* (Leitung Dr. G. Hornig) werden Arbeiten zur *Topologischen Struktur elektromagnetischer Felder in Plasmen* durchgeführt.

Im Bereich der Astronomie und Astrophysik beteiligt sich der Lehrstuhl am Graduiertenkolleg *Galaxiengruppen als Laboratorien für baryonische und dunkle Materie* und an der bodengebundenen Gammaastronomie im Rahmen des H.E.S.S.-Projekts in Zusammenarbeit mit dem Max-Planck-Institut für Kernphysik in Heidelberg. Der Lehrstuhl ist Mitglied von VIHROS, dem Virtuellen Institut für Hochenergiestrahlungen aus dem Kosmos. Dr. M. Pohl ist Interdisciplinary Scientist für das Gamma-Ray Large Area Space Telescope (GLAST) der NASA. Europaweit kooperiert der Lehrstuhl im Rahmen des EU Research Training Network *Plasma Astrophysics: Theory, Observations, Numerics (PLATON)* mit den Universitäten St. Andrews, Heraklion, Leuven, Nieuwegein, Potsdam, Strasbourg und Tenerife.

#### 4.1 Weltraumphysik

Modellierung der Zeitabhängigkeit des Transports von energetischen Elektronen in der Heliosphäre, insbesondere Einfluss korotierender Wechselwirkungsregionen (Ferreira, Fichtner, Heber, Kissmann, Potgieter)

Weiterführung der Modellierung der dreidimensionalen Heliosphäre: Einfluss eines variablen Interstellaren Mediums und Effekt der kosmischen Strahlung (Borrmann, Ferreira, Fichtner, Kopp, Schlickeiser)

Fortführung der Untersuchung der dreidimensionalen Plasmastruktur der inneren Heliosphäre (Fichtner, Grauer, Kleimann, Kopp)

Studie zur selbstkonsistenten Plasmawellenheizung des Sonnenwindplasmas (Fichtner, Laitinen, Vainio)

Studie des Zusammenhanges der mittelfristigen Sonnenaktivität (Maunder Minimum), der Modulation kosmischer Strahlung und Produktion kosmogener Elemente (Fichtner, Scherer)

Fortsetzung der Untersuchung der Sonnenwindexpansion mit Hilfe von Symmetriegruppen (Fichtner, Kalisch, Neusch, Shevalier, Sreenivasan)

Untersuchung zum Pick-up Ionen Transport in der Heliosphäre (Fahr, Fichtner, Kissmann)

Bestimmung der Elemente des räumlichen Diffusionstensors zum Transport heliosphärischer kosmischer Strahlung (Shalchi, Schlickeiser).

#### 4.2 Astrophysik

Quasilineare Theorie des Transports und der Beschleunigung kosmischer Strahlung in anisotroper magnetohydrodynamischer Turbulenz; Alfvén-Wellen-Transmission und Teilchenbeschleunigung an parallelen, relativistischen Stoßwellen; Stoßfreie Heizung des interstellaren Mediums durch Landau-Dämpfung; Interstellare Dichtefluktuationen bei anisotroper Turbulenz (Dogan, Lazar, Lerche, Schlickeiser, Shalchi, Spanier, Stawicki, Vainio, Virtanen, Weyer).

Nichtthermische Strahlungsprozesse in den Jets aktiver galaktischer Kerne und Gamma-ray bursts; Teilchenbeschleunigung in Supernova-Überresten; Heizung und Kühlung des Jetplasmas; Analytische Modellierung relativistischer Jets (Arbeiter, Böttcher, Koch, Lerche, Pohl, A. Reimer, Schlickeiser, Schröder, Schuster, Siewert).

Gamma-Astrophysik mit dem H.E.S.S.-Observatorium (A. Reimer, O. Reimer, Schlickeiser, Schuster, Siewert) Kollektive Instabilitäten in relativistischen Feuerbällen (Lerche, Pohl, Schlickeiser).

Semianalytische Behandlung der Propagation kosmischer Strahlung mit stochastischer Nachbeschleunigung und realistischer Gasverteilungen (Pohl, Schlickeiser, Weyer).

Zeitabhängige Modellierung der Propagation kosmischer Strahlung in Sonnennähe (Büsching, Grenier, Perrot, Pohl, Schlickeiser).

Hochenergieemission von Galaxienhaufen (Pohl, A. Reimer, O. Reimer, Sreekumar, Mattox).

Multibandanalyse der Emission von Supernova-Resten (A. Reimer, Pohl).

Analytische Rechnungen zur dreidimensionalen Propagation kosmischer Strahlung (Büsching, Pohl, Schlickeiser).

Erzeugung kosmologischer Magnetfelder durch die Weibel-Instabilität (Sakai, Schaefer-Rolffs, Schlickeiser, Shukla, Tautz).

### 4.3 Plasmaphysik

Selbstgenerierte elektromagnetische Felder: Instabilitäten und energiereiche Teilchenstrahlung (Kissmann, Schlickeiser, Schröder, Spanier).

Stochastische Magnetfelder mit Struktur – Universelles Verhalten beim chaotischen Transport: Berechnung der Anwachsraten und Zyklotrondämpfungsraten von Plasmawellen mithilfe der speziell-relativistischen korrekten Formulierung der Dispersionstheorie; Berechnung von Gleichgewichtsspektraldichten interstellarer Plasmawellen; selbstkonsistente Bestimmung der Heizraten des interstellaren Mediums durch Turbulenzdissipation und Berücksichtigung hoher Metallizitäten durch große Staumdichten; Selbstkonsistente Bestimmung der Energiespektren Kosmischer Strahlung durch stochastische Beschleunigung an Plasmaturbulenz (Abdullaev, Kissmann, Schlickeiser, Shalchi, Spanier, Spatschek, Stawicki, Weyer).

Kovariante Dispersionstheorie linearer Wellen für anisotrope Plasmaverteilungsfunktionen (Lazar, Schaefer-Rolffs, Schlickeiser, Tautz). Kollektive Prozesse in teilweise ionisierten staubigen Magnetoplasmen zur Aufklärung von Phasenübergängen und Staumdübelbildungsprozessen; Teilchen-Beschleunigung in Astrophysikalische Plasmen; Nichtlinear Prozesse in Weltraum Plasmen; Kollektive Prozesse in Neutrino-Plasmen (Dieckmann, Eliasson, Jacobs, Kourakis, Mamun, Marklund, Shukla).

### 4.4 Topologische Fluidynamik

Analytische Arbeiten zur magnetischen Helizität und ihrem Verhalten unter Rekonnexion. Untersuchungen zu Formen höherer topologischer Invarianten elektromagnetischer Felder (Hornig, Mayer, v. Bodecker).

Untersuchungen zur Struktur und Auftreten magnetischen Rekonnexion an Nullstellen magnetischer Felder (Hornig, Titov, Tassi).

Geometrie und Verhalten magnetischer Flußröhren die in der Photosphäre der Sonne verankert sind, insbesondere in Anwendung auf sog. *Two-ribbon flares* (Titov).

## 5 Diplomarbeiten, Dissertationen, Habilitationen

### 5.1 Diplomarbeiten

*Abgeschlossen:*

Dipl.-Phys. Olaf Koch: *Spektrale Analyse der Hochenergieemissionen extragalaktischer Quellen.*

*Laufend:*

cand.-phys. Dennie Lange: *Simulation der Modulation kosmischer Strahlung über einen solaren Zyklus,*

cand.-phys. Corinna Kriegeskorte: *Zur kosmologischen Interpretation der Quasar-Rotverschiebung,*

cand.-phys. Urs Schaefer-Rolffs: *Kovariante Theorie der kinetischen Weibel-Instabilität,*

cand.-phys. Ralf Schröder: *Plasmastrahlung von Aktiven Galaxien: Emission von Paarplasmajets in den Radio Lobes*,

cand.-phys. Oliver Sternal: *Berechnung von Flüssen energetischer Neutralatome aus der heliosphärischen Grenzschicht*,

cand.-phys. Robert Tautz: *Magnetfelderzeugung in kosmologischen Plasmen*.

## 5.2 Dissertationen

*Abgeschlossen:*

Dr. Ingo Büsching: *Zeitabhängige Propagationsrechnung kosmischer Strahlung in Sonnennähe*,

Dr. Claudia Schuster: *Erzeugung magnetohydrodynamischer Turbulenz und Teilchen-Welle-Wechselwirkung in relativistischen Ausflüssen*,

Dr. Mark Siewert: *Nichtthermische Heizung und Temperaturbillanz in Jets aktiver galaktischer Kerne* (Promotion: Januar 2005),

Dr. Emanuele Tassi: *Three-dimensional magnetic reconnection at null points*.

*Laufend:*

Dipl.-Phys. Carsten Arbeiter: *Hochenergie-Emission relativistischer Stoßwellen*,

Dipl.-Phys. Michael Beiermann: *Berechnung von Transportparametern der kosmischen Strahlung unter Berücksichtigung von steilen Turbulenzspektren*,

Dipl.-Phys. Thorsten Borrmann: *Ein hydrodynamisches 3-D Mehrkomponentenmodell der Heliosphäre und ihrer Wechselwirkung mit kosmischer Strahlung*,

Dipl.-Phys. Atanur Dogan: *Polarisation magnetohydrodynamischer Wellen*,

Dipl.-Phys. Ralf Kissmann: *Transportprozesse im Wellenzahlraum*,

Dipl.-Phys. Jens Kleimann: *Teilchentransport in stellaren Winden*,

Dipl.-Phys. Felix Spanier: *Plasmawellendämpfung und ihre Interaktion mit dem Transport kosmischer Strahlung*,

Dipl.-Phys. Ralf Weyer: *Untersuchungen zur stochastischen Beschleunigung galaktischer kosmischer Strahlung*.

## 5.3 Habilitationen

*Laufend:*

Dr. Anita Reimer: *Hochenergiestrahlungsprozesse in Jets von aktiven galaktischen Kernen*.

## 6 Tagungen, Projekte am Institut und Beobachtungszeiten

### 6.1 Tagungen und Veranstaltungen

3. Symposium des Sonderforschungsbereichs SFB 591 *Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung*, Physikzentrum Bad Honnef, 15.–16.04.2004

SFB 591 - Doktoranden-Kolloquium, Internationales Begegnungszentrum (IBZ) der Ruhr-Universität Bochum, 29.–30.07.2004

Fichtner, H.: Second International UCRJET Workshop, Bochum, 23.–27.03.2003

4. Symposium des Sonderforschungsbereichs SFB 591 *Universelles Verhalten gleichgewichtsferner Plasmen: Heizung, Transport und Strukturbildung*, Physikzentrum Bad Honnef, 02.–03.12.2004



## 6.2 Projekte und Kooperationen mit anderen Instituten

Dr. G. Hornig und seine Arbeitsgruppe sind Mitglied des EU Research Training Networks PLATON (Plasma Astrophysics: Theory, Observations and Numerics of Heating, Flares and Winds).

Dr. O. Reimer ist Mitglied des Large Area Telescope (LAT)-Instrumentteams des Gamma-Ray Large Area Space Telescope (GLAST).

Prof. Dr. R. Schlickeiser, Drs. A. und O. Reimer, Dr. M. Pohl, C. Schuster und M. Siewert sind Mitglieder der High Energy Stereoscopic System (H.E.S.S.) Kollaboration.

Prof. Dr. Dr. h.c. P.K. Shukla ist Mitglied des CIPS, Max-Planck Institut fuer Extraterrestrische Physik und Plasmaphysik, Garching

## 7 Auswärtige Tätigkeiten

### 7.1 Nationale und internationale Tagungen

#### a) Tagungsleitung

Kissmann, R.: 1. Doktoranden-Kolloquium des Sonderforschungsbereiches 591, Bochum Internationales Begegnungszentrum (IBZ) der Ruhr-Universität Bochum, 29.–30.07.2004 (Organisator)

Shukla, P.K.: Alfven 2004 Workshop on *Space Environment Turbulence*, Beaulieu (France), 19-23 April 2004, Session Chairman

Shukla, P.K.: Third Workshop on *Dusty Plasmas*, Capri (Italy), 1-5 June 2004, Session Chairman

Shukla, P.K.: International Workshop on *Theoretical Physics*, Abdus Salam ICTP, Trieste (Italy), 5-16 July 2004, Session Chairman

Shukla, P.K.: 12th International Congress on *Plasma Physics*, Nice (France), 25-29 October 2004, Session Chairman

Spanier, F.: 1. Doktoranden-Kolloquium des Sonderforschungsbereiches 591, Bochum Internationales Begegnungszentrum (IBZ) der Ruhr-Universität Bochum, 29.–30.07.2004 (Organisator)

#### b) Eingeladene Vorträge

Eliasson, B.: The dynamics of ion and electron holes in an electron-ion plasma, *International Workshop on Theoretical Plasma Physics*, Trieste, 05.-16.07.2004

Kourakis, I.: Electrostatic wave propagation in dusty plasmas (Invited Talk), *3rd Hellenic School on Fusion Physics and Technology*, University of Thessaly, Volos, Greece, 29 March - 2 April 2004

Kourakis, I.: Theory of nonlinear excitations in dusty plasma crystals (Invited Talk), Contributed Research Talk, *International Conference and Summer School: Complexity in Science and Society*, Patras and Ancient Olympia, Greece, 14 - 26 July 2004

Kourakis, I.: Nonlinear Modulated Envelope Electrostatic Wavepacket Propagation in Plasmas (Invited Talk), *22nd Summer School and International Symposium on the Physics of Ionized Gases (SPIG 2004)*, National Park Tara, Serbia and Montenegro, 23 - 27 August 2004 (Invited Talk)

Kourakis, I.: Dusty Plasmas: a new paradigm in Nonlinear Science & Focus issue: Localized excitations in dust crystals (Invited Talk), MPIPKS - Max Planck Institut for the Physics of Complex Systems, Dresden (Germany), 24 Nov. 2004

Schlickeiser, R.: On quasilinear perpendicular diffusion of cosmic rays in weak turbulence (invited talk), *3rd Annual IGPP Conference. Physics of the outer Heliosphere*, Riverside, CA, USA, 11.02.2004

Schlickeiser, R.: Gamma Ray Astrophysics, *Internatl. WE-Heraeus Summer School "Physics with Cosmic Accelerators"*, 3 Lectures, Bad Honnef, 06.-07.04.2004

Schlickeiser, R.: Turbulence and quasilinear diffusion theories for the heliosphere, *COSPAR*, Paris, 21.07.2004

Schlickeiser, R.: Coronal mass ejection acceleration: Theoretical overview, *COSPAR*, Paris, 24.07.2004

Schlickeiser, R.: Acceleration mechanisms in jets of active galactic nuclei, 2 invited lectures, *Highlights in Elementary Particle and Astroparticle Physics*, Meeting Graduiertenkolleg "The standard Model of Particle Physics: Structure, precision tests and extensions", 05.10.2004

Schlickeiser, R.: On the origin of cosmological magnetic fields by plasma instabilities, *Internatl. Conference on Plasma Physics*, Nizza, Frankreich, 25.-29.10.2004

Shukla, P.K.: Nonlinear Waves and Structures in Complex Plasmas, *COSPAR Colloquium on Dynamical Processes in Critical Regions of the Heliosphere*, Dead Sea, Israel, 3-10 March, 2004 (Review Talk)

Shukla, P.K.: Collective Processes in Dusty Plasmas, *31st Annual Plasma Physics Conference of the IoP*, York University, UK, 5-9 April 2004 (Review Talk)

Shukla, P.K.: Nonlinear Phenomena Caused by Shear Alfvén waves in Space and Laboratory Plasmas, *Alfvén 2004 Workshop on Space Environment Turbulence*, Beaulieu (France), 19-23 April 2004 (Review Talk)

Shukla, P.K.: Complete Theory of Langmuir Envelope Solitons in Dusty Plasmas, *Third Capri Workshop on Dusty Plasmas*, Capri (Italy), 1-5 June 2004 (Review Talk)

Shukla, P.K.: Nonlinear Effects Associated with Dispersive Alfvén Waves in Plasmas, *30th EPS Conference on Plasma Physics and Controlled Fusion*, London, UK, 27 June-2 July 2004 (Topical Lecture)

Shukla, P.K.: **1.** Linear and Nonlinear Dispersive Alfvén Waves in Plasmas, **2.** Collective Processes in Dusty Plasmas. Scuola Nazionale Fisica della Materia Torino, Italy, 6-17 September 2004 (Two Review Talks)

Shukla, P.K.: Dusty Plasmas in Cosmic and Laboratory Environments, *Dusty and Space Plasma Physics Workshop*, University of Ghent, Belgium, 22-24 September 2004 (Plenary Talk)

Shukla, P.K.: Nonlinear Waves and Structures in Dusty Plasmas, *12th International Congress on Plasma Physics*, Nice, France, 25-29 October 2004 (Topical Lecture)

Shukla, P.K.: Survey of Dispersive Alfvén Waves and Associated Nonlinear Effects, *46th Annual Meeting of the DPP/APS*, Savannah, USA, 15-19 November 2004 (solicited Talk)

Shukla, P.K.: Fundamental Physics of Bose-Einstein Condensates, *Symposium on Cold Atom/Matter Wave Experiments in Space*, CfFP/Rutherford Appleton Laboratory, Chilton, Didcot (UK), 1-3 December 2004, (Tutorial Talk)

c) Beiträge zu Kongressen, Tagungen u.ä.

Dieckmann, M. E.: Connecting shock velocities to electron injection mechanisms, *The European Physical Society Plasma Physics and Controlled Fusion Conference*, London, 28.06-02.07.2004

Dieckmann, M. E.: Connecting shock velocities to electron injection mechanisms, *International Workshop on Theoretical Plasma Physics*, Trieste, 05.-16.07.2004

Dieckmann, M. E.: Streaming instabilities driven by mildly relativistic proton beams in plasmas, *The European Physical Society Plasma Physics and Controlled Fusion Conference*, London, 28.06-02.07.2004

- Dieckmann, M. E.: Streaming instabilities driven by mildly relativistic proton beams in plasmas, *International Workshop on Theoretical Plasma Physics*, Trieste, 05.-16.07.2004
- Eliasson, B.: Nonlinear whistlerons, *12th International Congress on Plasma Physics*, 25-29 October 2004, Nice (France). Poster contribution P2-019.
- Eliasson, B.: Theoretical and numerical investigation of the shock formation of dust ion acoustic waves, *12th International Congress on Plasma Physics*, 25-29 October 2004, Nice (France). Poster contribution P1-049.
- Kourakis, I.: Theory of nonlinear excitations in dusty plasma crystals (contributed talk), *31st EPS Conference on Plasma Physics*, London, UK, Oct. 2004
- Kourakis, I.: Localized modulated electrostatic wavepackets in space and dusty plasmas (oral talk), *Dusty and Space Plasma Physics Workshop (FSAW 2004)*, Het Pand, Gent (Belgium), 22 - 24.09.2004
- Kourakis, I.: Discrete breather modes in complex plasma crystals (poster), *31st EPS Conference on Plasma Physics*, London, UK, 28.06-02.07.2004
- Kourakis, I.: Modulational instability and envelope excitations of dust-acoustic waves in a non-thermal background (poster), *31st EPS Conference on Plasma Physics*, London, UK, 28.06-02.07.2004
- Kourakis, I.: Envelope localized modes in electrostatic plasma waves (poster), *31st EPS Conference on Plasma Physics*, London, UK, 28.06-02.07.2004
- Kourakis, I.: Lagrangian formulation of electrostatic plasma waves: Application to dust-acoustic waves (poster), *31st EPS Conference on Plasma Physics*, London, UK, 28.06-02.07.2004
- Kourakis, I.: Localized nonlinear excitations in dusty plasma crystals (poster), *ITCPP 2004: Workshop on Theoretical Physics*, ICTP - Trieste, Italy, 5-16.07.2004;
- Kourakis, I.: Envelope localized electrostatic wavepackets in space and laboratory plasmas (poster), *ITCPP 2004: Workshop on Theoretical Physics*, ICTP - Trieste, Italy, 5-16.07.2004;
- Kourakis, I.: Nonlinear theory of dust lattice mode coupling in dust crystals (poster), *12th International Congress on Plasma Physics*, Nice, France, Oct. 2004
- Kourakis, I.: Intrinsic localized modes in dust lattices (poster), *12th International Congress on Plasma Physics*, Nice, France, Oct. 2004
- Kourakis, I.: Modulated envelope localized wavepackets associated with electrostatic plasma waves (poster), *12th International Congress on Plasma Physics*, Nice, France, Oct. 2004
- Kourakis, I.: Lagrangean formulation of ion- and dust-ion-acoustic waves (poster), *12th International Congress on Plasma Physics*, Nice, France, Oct. 2004
- Kourakis, I.: Theory of solitary waves in complex plasma lattices (poster), *12th International Congress on Plasma Physics*, Nice, France, Oct. 2004
- Spanier, F.: Interstellar and heliospheric plasma wave damping processes, *3rd IGPP Meeting*, Riverside CA, USA, 09.-13.02.2004
- Spanier, F.: Are Kolmogorov-type spectra reasonable in the Interstellar medium, *IPP-Seminar*, Ringberg, 09.-10.11.2004
- Spanier, F.: Interstellar plasma wave damping, Fast magnetosonic waves, *AEF-Frühjahrstagung*, Kiel, 09.-11.11.2004
- Spanier, F.: Three wave interaction in the shock downstream region, *4. Symposium des SFB 591*, Bad Honnef, 02.-03.12.2004

## 7.2 Vorträge und Gastaufenthalte

Reimer, A.: Forschungsaufenthalt und Kolloquium, University of Adelaide, Australien, 01.11.–10.12.2004

Schlickeiser, R.: Astrophysical bean-plasma instabilities, IPP-Kolloquium, Garching, 30.01.2004

Schlickeiser, R.: On quasilinear perpendicular diffusion of cosmic rays in weak turbulence (invited talk), Department of Physics, University of California, Riverside CA, USA, 08-14.02.2004

Schlickeiser, R.: Astrophysical bean-plasma instabilities, Physics Colloquium, Department of Physics and Astronomy, University of Ohio, Athens OH, USA, 16.–17.02.2004

Schlickeiser, R.: Department of Astronomy and Astrophysics, University of Chicago, Chicago IL, USA, 18.–20.02.2004

Schlickeiser, R.: Gamma Ray Astrophysics: Exploring extreme astrphysical objects and cosmic boundaries, Physics Colloquium, Department of Physics, University of Iowa, Ames IA, USA, 21.–24.02.2004

Schlickeiser, R.: Gamma Ray Astrophysics: Exploring extreme astrphysical objects and cosmic boundaries, Physics Colloquium, Department of Astronomy, University of Minnesota, Minneapolis MN, USA, 25.–27.02.2004

Schlickeiser, R.: Astrophysical bean-plasma instabilities, Physics Colloquium, Department of Physics and Astronomy, University of Wisconsin, Madison WI, USA, 28.02.–02.03.2004

Schlickeiser, R.: Astrophysical bean-plasma instabilities, Physics Colloquium, Department of Physics, University of Helsinki, und Observatorium Turku, Finnland, 22.–26.03.2004

Schlickeiser, R.: Astrophysical bean-plasma instabilities, Physics Colloquium, Tuorla Observatory, University of Turku, Finnland, 26.04.2004

Schlickeiser, R.: Cosmic Rays and Gamma Astronomy, Treffen Graduiertenkolleg *Galaxy Groups as Laboratories for Baryonic and Dark Matter*, Bad Honnef, 03.-04.06.2004

Schlickeiser, R.: Acceleration mechanisms in jets of active galactic nuclei, 2 invited lectures, *Highlights in Elementary Particle and Astroparticle Physics*, Meeting Graduiertenkolleg "The standard Model of Particle Physics: Structure, precision tests and extensions", 05.10.2004

Schlickeiser, R.: On the origin of cosmological magnetic fields by plasma instabilities, *IPP Theory Week Workshop*, Schloss Ringberg, Wildbad-Kreuth, 08.-12.11.2004

Schlickeiser, R.: On the origin of cosmological magnetic fields by plasma instabilities, Max-Planck-Institut für Kernphysik, Heidelberg, 02.12.2004

Spanier, F.: Department of Physics and Astronomy, University of Ohio, Athens OH, USA, 16.–17.02.2004

Spanier, F.: Department of Astronomy and Astrophysics, University of Chicago, Chicago IL, USA, 18.–20.02.2004

Spanier, F.: Department of Physics, University of Iowa, Ames IA, USA, 21.–24.02.2004

Spanier, F.: Department of Astronomy, University of Minnesota, Minneapolis MN, USA, 25.–27.02.2004

Spanier, F.: Department of Physics and Astronomy, University of Wisconsin, Madison WI, USA, 28.02.–02.03.2004

Spanier, F.: Department of Physics, University of Helsinki, Finnland, 27.09.–01.10.2004

### 7.3 Beobachtungsaufenthalte, Meßkampagnen

Reimer, A.: H.E.S.S.–Beobachtungsbetrieb, Windhoek, Namibia, Südwestafrika, 30.08.–17.09.2004

Reimer, O.: H.E.S.S.–Beobachtungsbetrieb, Windhoek, Namibia, Südwestafrika, 09.04.–03.05.2004

### 7.4 Kooperationen

AUTh. Aristotle University of Thessaloniki, Physics Department (Theoretical Mechanics), Greece

Australia Telescope National Facility, CSIRO, Epping, Australia

Bartol Research Institute, University of Delaware, Newark, DE, USA

CEA Saclay, Frankreich

Center for Nonlinear Phenomena and Complex Systems, Université Libre de Bruxelles, Belgien

Centro de Electrodinamica, Instituto Superior Tecnico, Lissabon, Portugal

Departmento di Scienze Fisiche, Università di Napoli, Italien

Department of Applied Mathematics, University of St. Andrews, Scotland

Department of Astronomy and Astrophysics, UC Santa Cruz, CA, USA

Department of Physics, Physical Research Laboratory, Ahmedabad, Indien

Department of Physics and Astronomy, University of Calgary, Canada

Department of Science and Technology, Linköping University, Norrköping, Schweden

EO Hulbert Center for Space Research, Naval Research Laboratory, Washington DC, USA

Fachbereich Physik, Universität Osnabrück, Osnabrück

INAOE, Tonantzintla, Puebla, Mexico

Institut für Astrophysik und Extraterrestrische Forschung, Universität Bonn, Bonn

Institut für Kernphysik (IK), FZ-Karlsruhe, Karlsruhe

Institut für Plasmaphysik (IPP), FZ-Jülich, Jülich

Institute of Earth Physics, Russian Academy of Sciences, Moskau, Rußland

Institute of Geophysics and Planetary Physics (IGPP), University of California, Riverside (UCR), Riverside, CA, USA

Institute of Nuclear Physics, Moscow State University, Moskau, Rußland

Iowa State University, Department of Physics and Astronomy, Des Moines, IA, USA, Los

Alamos National Laboratory, Los Alamos, NM, USA

MPI, Garching, Heidelberg, Katlenburg-Lindau

NASA Goddard Space Flight Center, Greenbelt, MD, USA

School of Physics and Astronomy, University of Birmingham, Birmingham, UK

Space Physics and Astronomy Department, Rice University, Houston, TX, USA

Space Research Centre Warschau, Polen

Space Research Laboratory, Department of Physics, Turku University, Turku, Finnland

Space Research Unit, Department of Physics, Potchefstroom University, Südafrika

Space Science Department, Rutherford Appleton Laboratory, Chilton, Didcot, UK

Stanford Linear Accelerator Center, Stanford, CA, USA

Umea University, Department of Plasma Physics, Umea, Schweden

Université de Montréal, Département de Physique, Montréal, QC, Canada

University of Adelaide, Department of Physics and Mathematical Physics, Adelaide, Australia

WW Hansen, Experimental Physics Laboratory, Stanford University, Stanford, CA, USA

### 7.5 Sonstige Reisen

Reimer, A.: *H.E.S.S. collaboration meeting*, Durham, UK, 04.–08.04.2004

Reimer, O.: *H.E.S.S. collaboration meeting*, Durham, UK, 04.–08.04.2004

## 8 Veröffentlichungen

### 8.1 In Zeitschriften und Büchern

#### *Erschienen:*

- Abbasi, H., Hakimi Pajouh, H., Shukla, P.K.: Modulation of electromagnetic electron cyclotron waves in the presence of nonisothermal electrons in plasmas. *Phys. Plasmas*, **11**, 4346-4352 (2004).
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- Aharonian, A., Akhperjanian, A.G., Aye, K.-M., ..., Schlickeiser, R., ...: Calibration of cameras of the H. E. S. S. detector, *Astroparticle Phys.* **22**, 109 (2004)
- Bharuthram, R., Shukla, P.K.: A tripolar vortex associated with nonlinearly interacting Shukla modes in a sheared magnetic field. *Physica Scripta* **T113**, 116-117 (2004).
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- Bingham, R., Shapiro, V.D., Shukla, P.K., Trines, R.: *Lower-hybrid wave activity and reconnection at the magnetopause*. *Physica Scripta* **T113**, 144-148 (2004).
- Bingham, R., Shukla, P.K., D. S. Spicer: *Coronal heating by dissipative current sheets*. *Physica Scripta* **T107**, 247-249 (2004).
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- Dieckmann, M.E., Eliasson, B., Stathopoulos, A., Ynnerman, A.: *Connecting shock velocities to electron injection mechanisms*, *Phys. Rev. Lett.*, **92**, 065006, 2004
- Dieckmann, M.E., Eliasson, B., Stathopoulos, A., Ynnerman, A.: *Kinetic simulation of electron injection by electrostatic waves*, *Baltic Astronomy*, **13**, 284-288, 2004
- Dieckmann, M. E., Rowlands, G., Eliasson, B., Shukla, P.K.: *Particle-in-cell simulations of electron acceleration by a simple capacitive antenna in collisionless plasma*. *J. Geophys. Res.* **109**, A12304, 10.1029/2004JA010436 (2004).
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