INTAS 93-2618-Ext: Periodic Progress Report No. 1

for the period of May 1, 1997, till April 30, 1998

Initial remark:

This report covers essentially the first year of the whole project. However, it is submitted late (March 1999) and therefore will cover also some of the later activities.

It should be mentioned that the project is co-sponsored by other sources as well, namely by

1. *Sonderforschungsbereich 343 "Diskrete Strukturen in der Mathematik"* at the University of Bielefeld (Short and long term visits of foreign Scientists)

2. *Humboldt Stiftung Bonn* (Individual grants)

3. *TMR-Network ERB FMRX CT-97-0107 "Algebraic K-Theory, Linear Algebraic Groups and Related Structures"* (Short and long term visits of foreign Scientists)

1. Title, Reference Number

Title:	Linear Algebraic Groups, Algebraic K-Theory, and related Structures in Algebra and Topology
Ref.-Nr.:	INTAS-93-2618-Ext
Project Co-ordinator:	Ulf Rehmann
Period time:	May 1, 1997, till April 30, 1998

2. Research

2.1 Scientific Objectives:

The research of this project is concentrated on: Investigation of the rationality linear algebraic groups, the splitting behavior of linear algebraic groups and their projective homogeneous varieties, the study of anisotropic groups, further investigation of splitting properties of quadratic forms, study of algebras with involution, investigation of central simple algebras with involution, descent and decomposability questions on such algebras, investigation of Lie algebras and their cohomology groups and their non-split and central extensions, in particular the computation of those groups, investigation of central simple algebras with involution Properties of the Brauer group for certain function field extension, K-theory of varieties, K-theory of normed algebras, Mac-Lane cohomology.
The scientific objectives of this project is to perform research in areas related to these fields.

2.2 Research Activities

The main activities of the project were done by individual research in the above mentioned fields. Interim results have been reported on the occasion of one international conference mentioned below, also some individual visits of the NIS participants at various western universities. All fields mentioned in section 2.1 (Objectives) have been investigated intensively. This is documented in the Annex of this report (page 6 ff.)
The work was in accordance with the work programme, and it is expected that this will be the case in the future.

2.3 Scientific Results

The results of the project are or will be documented by at least 42 publications (see Annex). Out of these publications, 33 have already been published or are accepted for publication in refereed international journals.
This shows the significance of the research results achieved by this project.
9 publications are mentioned (in the Annex) as being in preparation, their topics will be investigated during the last months of the project, and at least this will be the expected further achievement of the project.
Detailed discussions of the research topics is given in the Annex (page 6 ff).

Summarization of the scientific output:

Scientific Output	published	in press/accepted	submitted	in preparation
Paper in an International Journal	20	13	3	6
Paper in a National Journal				
Paper in proceedings of a conference		2		
Paper in Book, Monograph	1			
Internal Report	6			
Thesis (Msc Phd etc.)	3			
Oral Presentation, Public Lecture	5			

It should be mentioned here that the “Internal reports” are just preprints, most of which will be submitted for publication in a refereed journal also later, perhaps after slight revision.

3. Management

3.1 Meetings and visits

Participants met on the occasion of some international conferences, the visits of which were partially financed by this project. Several participating individuals reported their results. These conferences were:
[C1] Summer School on “K-Theory and algebraic groups”, June 28 – July 3, 1998 (Levico Terme Italy, organized by C. Pedrini with a scientific committee from two other participants. This had a particular training effect, since high level curses for researchers on the

postdoc level have been given. There have been two sessions: a morning session where the following 4 series of lecture have been given: 1) An introduction to K-Theory and its recent developments. 2) K-Theory and Algebraic Groups. 3) K-Theory of algebraic integers. 4) K-theory and quadratic forms over fields. Written notes of these curses were distributed to all participants. In the afternoon sessions there have been 11 research talks given by young researchers on topics concerning K-theory, algebraic groups, number theory, algebraic geometry, quadratic forms, Brauer groups etc.

[C2] Conference on "Linear Algebraic Groups and Related Structures", August 9 – 15, 1998 (University of Bielefeld, Germany), organized by I. Kersten and U. Rehmann. 32 Talks were given (45-60 min each), 67 participants from 17 countries attended the conference. This conference was funded by SFB 343 "Diskrete Strukturen in der Mathematik" at the University of Bielefeld, by this TMR project, and by INTAS project INTAS-93-2618-EXT. See `http://www.mathematik.uni-bielefeld.de/lag/`

[C3] International Congress of Mathematicians 1998, August 18 – 27, 1998 (Berlin). See `http://elib.zib.de/ICM98/`

Besides these conferences there are various research activities of the single labs, partially in interaction with each other, which are described separately for each participant of the project in the Appendix.
The conference C2 has been used as a co-ordination meeting. In the Appendix, the program of this conference together with its participants is given, and the contributions given by scientists from institutes supported by this project are marked by a *.
There were several exchanges or mutual visits of scientists between the partners.

Summarization of meetings and visits:

Visits	Number of Scientists	Number of person days
West $\Longrightarrow$ East	0	0
East $\Longrightarrow$ West	8	140
West $\Longrightarrow$ West	6	37
East $\Longrightarrow$ East	1	21

There was and there will be more exchange than indicated here, sponsored by the Sonderforschungsbereich 343 "Diskrete Strukturen in der Mathematik", by the Humboldt Foundation, and by the TMR-Network ERB FMRX CT-97-0107. Several scientists from the Eastern partner institutes spent some months at Bielefeld and at Besançon on the basis of these and other programs, besides from the figures mentioned in the table above. Also there were visits from the Western sites at Western and Eastern partners, but supported by different grants.

In particular, the conferences mentioned in section 3.5 will be used for further co-ordination of this project.

3.2 Collaboration

Intensity of Collaboration	high	rather high	rather low	low
West $\Longleftrightarrow$ East	*			
West $\Longleftrightarrow$ West	*			
East $\Longleftrightarrow$ East	*			

3.3 Time Schedule

The time schedule is mainly in accordance with the Work Programme. Reporting was delayed because of the fact that the Project Coordinator was engaged in many activities during 1998, including the organization of conference C2.

3.4 Problems encountered

No serious problems were encountered, neither in cooperation of team members nor in transfer of funds nor in telecommunications.

Problems encountered	major	minor	none	not applicable
Cooperation of team members			*	
Transfer of funds			*	
Telecommunication			*	
Transfer of goods				*
Other				*

3.5 Actions required

It is suggested that the duration of the project is extended till the end of 1999, without additional funding.
The reason is: In 1999 there are three important international conferences and one workshop concerning the topics of the project:

1. Conference on “Quadratic and Hermitean Forms” at Oberwolfach (Germany) 16.05. - 22.05.1999 (Organizers: Albrecht Pfister, Mainz, Winfried Scharlau, Münster, Jean-Pierre Tignol, Louvain-la-Neuve).

2. Conference on “Quadratic Forms and their Applications” in Dublin, July 4-10, 1999, organized by E. Bayer, Besançon, D. Lewis (Dublin) and A. Ranicki (Edinburgh).

3. Workshop on “Quadratic Forms and Related Topics”, May 25 – May 28, 1999, in Besancon, France, organized by E. Bayer and D. Hoffmann, Besançon.

4. Conference on “Algebraic K-Theory” at Oberwolfach (Germany) Sept 6. - Oct 2, 1999 (Organizers: Daniel R. Grayson, Urbana, Uwe Jannsen, Köln, Bruno Kahn, Paris.)

4. Finances

Payments:

Date:	Participant:	Purpose:	ECU:
14.09.97	Minsk(4)	50 % of grants(Iantchevski)	1200.00
06.11.97	Minsk(4)	50 % of grants(Tchernoussov)	1731.00
09.11.97	Tbilisi(6)	50 % of grants(all)	4600.00
18.12.97	St. Petersburg(3)	50 % of grants(all)	4980.00
07.08.98	Alma-Ata(5)	90 % of grants(all)	2380.50
07.08.98	Alma-Ata(5)	90 % of overhead	270.00
07.08.98	Alma-Ata(5)	Travel, Subsistence	650.00
07.08.98	St. Petersburg(3)	Travel, Subsistence	3164.86
16.10.98	Minsk(4)	Travel, Subsistence	388.39

Participant		**Cost Category**						TOTAL
#	Name of Part.	Individ. Grants Labour Costs	Overheads	Travel and Subsistence	Equipment	Consumables	Other Costs	(ECU)
1	Bielefeld							
2	Besançon							
3	St. Petersburg	4980.00		3164.86				8144.86
4	Minsk	2931.00		388.39				3319.39
5	Alma-Ata	2380.50	270.00	650.00				3300.50
6	Tbilisi	4600.00						4600.00

The spending by the Eastern partners was essentially been in accordance with the planning. Almost half of the total amount is spent for all partners. The money for the Western partners was withhold so far in order to have some flexibility at the end of the project if some of the Eastern partners would need additional financing. (The Western partners were able to finance their activities from other sources so far.)
For Alma-Ata, the grant was already paid up to 90 %, however, not so much travel and subsistence was paid here yet. It is expected that this will be balanced during this year.

5. Annexes

The annex consists of three parts:
1. Scientific reports by the single participants of the project (pp 6–14).
2. Program and List of Participants of the Conference C2 on "Linear Algebraic Groups and Related Structures" at Bielefeld. Talks by speakers from this project and participants from institutes sponsored by this project are marked by a * (pp 15, 16).
3. Reprints of some relevant publications.

Participant 1 – Bielefeld:

Activities: Organization of conference [C2]; Research in linear algebraic groups and related structures, in collaboration with I. Panin (St. Petersburg), V. Yanchevski, who both visited Bielefeld a few times.
I. Kersten and U. Rehmann participated in the conferences C1, C3.
Publications:
[HR-I] J. Hurrelbrink and U. Rehmann, Splitting patterns of trace forms, Canad. Math. Bull 41 (1998), no. 1, 71-78.
Abstract: The splitting pattern of a quadratic form q over a field k consists of all distinct Witt indices that occur for q over extension fields of k. In small dimensions, the complete list of splitting patterns of quadratic forms is known. It is shown that *all* splitting patterns of quadratic forms of dimension at most nine can be realized by trace forms.
[HR-II] J. Hurrelbrink and U. Rehmann, Splitting patterns and linear combinations of two Pfister forms, J. Reine Angew. Math. 495, (1998), 163–174.
Abstract: A criterion for anisotropy of forms of arbitrary degree over polynomial rings or polynomial fields is given. Also, quadratic forms which are linear combinations of two Pfister forms are characterized, and the dependency of classical invariants and splitting patterns of quadratic forms is studied.
[KR] I. Kersten and U. Rehmann, Excellence properties of semi-simple algebraic groups, J. Algebra 200 (1998), no. 1, 334–346.
Abstract: A semi-simple algebraic group over a field k is called excellent, when for every field extension K of k, the anisotropic kernel of G_K is defined over k. This parallels the definition of excellent quadratic forms as given by Knebusch, however, it is not true that a quadratic form is excellent if and only if its orthogonal group is excellent. The excellence of a form implies the excellence of its orthogonal group, but the converse is false. The excellent groups of inner type A_n are determined, in parallel an excellence condition for Azumaya algebras is formulated, and it is proved that exactly those Azumaya algebras are excellent which have square-free index.
[MRY] G. Margolin, U. Rehmann, V. Yanchevskii, Quaternion generation of the 2-torsion part of the Brauer group of a local quintic, to appear in: H. Bass, A.O.Kuku, and C. Pedrini. (Ed). Algebraic K-theory and its Applications. Proceedings of the Workshop and Symposium,(1997), ICTP, Trieste, Italy. WORLD SCIENTIFIC, Singapore, New Jersey, London, Hongkong (1999)
Abstract: The splitting behavior of the Brauer group for the field extension given by the function field K of a quintic over some local field k is determined by giving the elements of the kernel of the natural map of Brauer groups $\mathrm{Br}(k) \to \mathrm{Br}(K)$.

[KnR] Manfred Knebusch and Ulf Rehmann: Higher Anisotropic Kernels of Quadratic Forms, in preparation.
Abstract: It is shown that the higher anisotropic kernels of a regular quadratic form over any field are already defined over purely transcendental extensions of the ground field. A new theory of specializations concerning this fact is developed.

Participant 2 – Besançon:

Quadratic forms and invariants of fields Let k be a field of characteristic $\neq 2$. The *u–invariant* of k, denoted by $u(k)$, is the maximal dimension of anisotropic quadratic forms over k. The *Pythagoras number* $p(k)$ is the least integer p such that every sum of squares in k is a sum of p squares. A basic problem in quadratic form theory is to determine these invariants. One of our research objectives is to make a progress on this question.

Galois cohomology of linear algebraic groups Let G be a smooth linear algebraic group defined over k. The first Galois cohomology set $H^1(k, G)$ has important signification in many classification problems. Serre conjectured in 1962 that if the cohomological dimension of k is at most 2 and if G is semi–simple and simply connected, then $H^1(k, G) = 0$. More recently, Colliot–Thélène made a conjecture concerning the Hasse principle over fields of virtual cohomological dimension at most two. We propose to prove these conjectures.

Trace forms of Galois algebras

Let L/k be a finite Galois extension (or more generally, Galois algebra). We propose to determine the structure of the trace form of this extension as equivariant form.

Symmetric and skew–symmetric matrices with given eigenvalues

The eigenvalues of a symmetric matrix are totally real, those of a skew–symmetric matrix are totally imaginary. We would like to find the minimal dimension of a symmetric (respectively skew–symmetric) matrix with given eigenvalues.

2.2. Research activities.

Intensive research activities were carried out in all the above topics. The most important results of this research are listed below.

2.3. Scientific results

Detlev Hoffmann (jointly with Jan van Geel) have proved that the u–invariant of $\mathbf{Q}_p$ is *finite*, and less than 20. On the other hand, Hoffmann proved that any positive integer can be realized as the Pythagoras number of a formally real field. Both questions have been open for several years. These results have considerable importance in the theory of quadratic forms.

Eva Bayer–Fluckiger (jointly with R. Parimala) proved Serre's conjecture and Colliot–Thélène's conjecture for the classical groups.

Eva Bayer–Fluckiger and Marina Monsurro gave a criterion for the orthogonal sum of two copies of trace forms to be isomorphic over a field of virtual cohomological dimension at most 2.

Grégory Berhuy characterized the rational quadratic forms which arise as hermitian trace forms.

Pascale Koulmann gave upper bounds for the dimensions of skew–symmetric matrices with given minimal polynomial.

Publications

E. Bayer–Fluckiger, Local–global principles and linear algebraic groups, in *Number Theory*, Walter de Gruyter (1998), 45–53.

E. Bayer–Fluckiger, R. Parimala, Classical groups ad the Hasse Principle, *Ann. of Math.*, 150 (1998), 651–693.

G. Berhuy, Characterization of hermitian trace forms, J. Algebra, to appear.

D. Hoffmann, On the dimensions of anisotropic quadratic forms in I^4, *Invent. Math.* **131** (1998), 185–198.

D. Hoffmann, On Elman and Lam's filtration of the u–invariant, *J. reine angew. Math.* **495** (1998), 175–186.

P. Koulmann, Dimensions minimales de matrices antisymériques de polynôme minimal donné, *Comm. in Alg.*, to appear.

Presentations E. Bayer–Fluckiger : Oberwolfach, June 1997 (Galois groups and fundamental groups); European Research Conference, San Feliu de Xuichols, October 1997; Oberwolfach, April 1998 (Linear algebraic groups).
G. Berhuy : seminar talk, Lausanne, December 1997
D. Hoffmann : seminar talks, Bordeaux, December 1997; Paris 13, March 1998.
P. Koulmann : seminar talks, Bordeaux, November 1997, Caen, St. Etienne, April 1998.
M. Monsurro : seminar talk, Rome, january 1998.

PhD thesis Pascale Koulmann, Dimensions minimales de matrices symétriques et antisymétriques, November 1997 (advisors : Eva Bayer–Fluckiger, Jean–Pierre Tignol).

Diplom thesis Gregory Berhuy, Le u–invariant d'un corps, June 1997 (advisor : Eva Bayer–Fluckiger).

Visit of I. Panin in Besançon, 2 weeks in November, one month in May.
Visit of J–P. Tignol in Besançon,1 week in December.
Visit of V. Chernousov in Besançon,3 months (March, April and May).

Participant 3 – St. Petersburg:

N. Gordeev, O. Izhboldin, A. Merkurjev, I. Panin, A. Suslin, and S.Yagunov from St. Petersburg contributed by writing several research papers (see below).
O. Izhboldin, I. Panin take part in the conference [C2] contributing by giving talks there.

i) Alexander Merkurjev

a) The K-theory of algebraic tori and toric varieties were computed. In particular it was shown that $K_0(T)$ for a tori T is a finitely generated Abelian group. b) Explicit and uncomplicated index reduction formulas for inner forms of twisted flag varieties were obtained. c) A spectral sequence comparing G-equivariant and non-equivariant K-theory of a variety was constructed. A corollary of this is the surjectivity of the canonical map $R(H) \to K_0(G/H)$ for any simply connected semi-simple group G.
Publications:
[A] A.S. Merkurjev and I.A. Panin, *K-theory of algebraic tori and toric varieties* K-theory, 12, (1997), 101–143.
[B] A.S. Merkurjev, I.A. Panin, *Index reduction formulas, I* K-theory, 10, (1996), Issue 6, 517–586.
[C] *Comparison of equivariant and ordinary K-theory of algebraic varieties* Algebra i Analiz 9 (1997), no. 4, 175–214. (in Russian)

ii) Ivan Panin.
a) The K-theory of simply connected algebraic group and the K-theory of principal homogeneous spaces over such a group were calculated. Among the corollaries of these results are the injectivity of the Brauer groups map $Br(F) \to Br(F(X))$ and the vanishing of the codimension 2 cycle group $CH^2(X)$.
b) A well-known problem on purity for quadratic spaces over a local regular ring was positively solved for local regular rings containing a field. This is one result of a joint work with M. Ojanguren.
Publications:
[A] A.S. Merkurjev and I.A. Panin, *K-theory of algebraic tori and toric varieties* K-theory, 12, (1997), 101–143.
[B] I.A. Panin, *A splitting principle and K-theory of simply connected semi-simple algebraic groups.* St.Petersburg Mathematical Journal, 10, (1998) Issue 1, 88–131.
[C] M. Ojanguren and I. Panin, *A purity theorem for the Witt group* Preprint Bielefeld University, 97-117. (1997)
[D] I.A. Panin and A.A. Suslin, *On a Grothendieck for Azumaya algebras* St.Petersburg Mathematical Journal, 9 (1997) Issue 4, 306–316.
[E] A.S. Merkurjev, I.A. Panin, *Index reduction formulas, I* K-theory, 10, (1996), Issue 6, 517–586.

iii) Andrei Suslin
A variant of Gersten's Conjecture was proved for the K-theory of Azumaya algebras over a smooth local ring of geometry type. The corollary of this is the positive solution of Grothendieck's Conjecture on principal homogeneous spaces for the special linear group $SL_{1,D}$.
Publications:
[A]I.A. Panin and A.A. Suslin, *On a Grothendieck for Azumaya algebras* St.Petersburg Mathematical Journal, 9 (1997) Issue 4, 306–316.

iv) Oleg Izhboldin (Ijboldine)
a) Let $F(\psi, D)$ be the function field of the product $X_\psi \times X_D$, where X_ψ is the projective quadric determined by ψ and X_D is the Severi-Brauer variety determined by algebra D of exponent 2. In [A] the relative Galois cohomology group $H^3(F(\psi, D)/F, \mathbf{Z}/2\mathbf{Z})$ was

computed. In the second part of [A], the problem of isotropy of 8-dimensional quadratic forms was studied.
b) In [B], pairs ϕ, ψ of quadratic forms satisfying the condition $i_W(\phi_{F(\psi)}) \geq 2$ were studied. We completely describe such pairs in the case $\dim \phi \leq 7$ and present a partial description when $\dim \phi = 8$. We also describe all forms ϕ of dimension ≤ 9 such that projective quadric corresponding to the form $(\phi_{F(\phi)})_{an}$ is defined over F.
c) Excellence property for a generic splitting field of a central simple F-algebra is studied. In particular, we show that it is universally excellent if and only if the Schur index of the algebra is not divisible by 4.

Publications:
[A]Izhboldin, O. T. and Karpenko, N. A. *On the group* $H^3(F(\psi, D)/F)$. Doc. Math. J. DMV **2**, (1997), 297–311.
[B]Izhboldin O. T., *On the isotropy of quadratic forms over the function field of a quadric.* Algebra i Analiz, vol. **10**, no. 1, (1998) 32–57. (Russian). English transl.: to appear in St. Petersburg Math J. Vol. **10** (1999), No. 1.
[C]Izhboldin O. T., *On the nonexcellence of the function fields of Severi-Brauer varieties.* Max-Planck-Institut für Mathematik in Bonn, Preprint MPI **96-159**, (1996), 1–28. To appear in *Algebras and Representation Theory* as the second part of the paper: Izhboldin, O. T. and Karpenko, N. A. "*Generic splitting fields of central simple algebras: Galois cohomology and non-excellence*".

v) Sergei Yagunov (Iagounov)
Under the assumption of invertibility of $n!$ we generalized a definition of the pre-Bloch group to arbitrary dimension and study the relationship of the obtained group $\wp^n$ to the homology of GL_n. In particular, we constructed a spectral sequence, which converges to the homology of GL_n modulo the monomial group GM_n and has the generalized pre-Bloch Group $\wp^n$ as the first non-zero entry in $E^2_{0,*}$. Using this spectral sequence we could conclude that at least in low dimensions ($n < 5$) the constructed group $\wp^n$ splits as the direct sum of indecomposable parts in the first non-trivial homology groups of the triple $(GL_n, \{GM_n, GL_{n-1}\})$.

Publications:
[A]*Geometrically originated complexes and the homology of the Pair* (GL_n, GM_n)., Ph.D, Thesis, Northwestern University Evanston, Illinois, December 1997. [B]*One spectral sequence converging to homology* GL_n *modulo* GM_n. Preprint POMI 08–1998. (in Russian) [C]*Higher pre-Bloch groups and their application to study homology groups of* GL_n. Preprint POMI 10–1998. (in Russian)
[D] Homology of bi-Grassmannian complexes K-theory, Vol.12 (1997) No.3, 277–292.

vi) Nikolai Gordeev.
For almost regular representation of a cyclic group it has been proved the following assertion: if the numerator of the corresponding Hilbert- Poincare Series is a product of cyclotomic polynomials then the corresponding factor-variety is a complete intersection. It gives the answer in the particular case for one problem of R.Stanley (Adv.Math.28(1978), 57-83).

Publications: AN.L. Gordeev, *The Hilbert-Poincare Series for Some Algebras of Invariants of Cyclic Groups* Preprint Universität Bielefeld,98-008 (1998).

Visits: O. Izhboldin, I. Panin and K. Zanoullline attended the conference C2 at Bielefeld. V. I. Gultetskii (Minsk) visited St. Petersburg for 3 weeks.

Participant 4 – Minsk:

A. Chernousov and V. Yanchevskii from Minsk participate in this project. Chernousov is visiting Bielefeld right now supported by the Sonderforschungsbereich 343 "Diskrete Strukturen in der Mathematik".

Research activities and scientific results of V. Yanchevskii:

1. The complete description of 2-torsion of the Brauer group of local non-dyadic hyperelliptic curve in terms of corresponding generating equation is given. The quaternion generation of 2-torsion part of Brauer groups of local sextics of the following types is obtained (by sextic we mean a smooth projective model of the curve defined by an equation $y^2 = f(x)$, where $f(x)$ is a polynomial over local non-dyadic ground field k of degree 6):
(i) $f(x)$ is irreducible over k;
(ii) $f(x) = (x^2 - \pi)g(x)$, where π is a uniformizer of k and $g(x)$ is irreducible over k;
(iii) $f(x)$ is a product of three quadratic polynomials with common splitting field $k(\sqrt{\pi})$.

2. The complete description of p-primary torsion part of Brauer groups of local elliptic curves with split multiplicative reduction is found in case where p is relatively prime to the characteristic of the residue field of k.
3. For hyperelliptic curves with defining equation $y^2 = f(x)$, where $f(x)$ is a polynomial over ground field k with splitting field of 2-primary degree over k an explicit formula for computation of their indexes is obtained.
Publications:
(i) Yu.V.Procopchuk, V.I.Yanchevskii, 2-torsion of Brauer groups of local hyperelliptic curves. In: Papers dedicated to Sprindzhuk's 60th birthday. Minsk, (1997) 81 -84(in Russian).
(ii) A.A.Lipnitsky, V.I.Yanchevskii, Generators of 2-torsion part of Brauer groups of some local sextics (in preparation).
(iii) V.V.Goglev, V.I.Yanchevskii , Unramified Brauer groups of function fields of local elliptic curves with split multiplicative reduction (accepted for publication in Proceedings of National Academy of Sci of Belarus).
(iv) J. van Geel, V.I.Yanchevskii, Indices of hyperelliptic curves over p-adic fields (accepted for publications in Manuscripta mathematica).
(v) G. Margolin, U. Rehmann, V. Yanchevskii, Quaternion generation of the 2-torsion part of the Brauer group of a local quintic, to appear in: H. Bass, A.O.Kuku, and C. Pedrini. (Ed). Algebraic K-theory and its Applications. Proceedings of the Workshop and Symposium,(1997), ICTP, Trieste, Italy. WORLD SCIENTIFIC, Singapore, New Jersey, London, Hongkong (1999) (see also Participant 1).

Research activities and scientific results of V. Chernousov:
In joint work with A. Merkurjev [1] we constructed a norm homomorphism for the group of R-equivalence classes for all simply connected semisimple algebraic groups of classical

types and proved its functorial properties. The construction of a norm homomorphism comes as a result of the study of certain functorial properties of the group of R-equivalence classes for algebraic groups.
In joint work with V. Platonov [2] we studied the property of K-rationality for isotropic simple group varieties defined over an arbitrary field K. We proved that many of these varieties are K-rational; in particular, we showed that the variety of any K-isotropic simple group of type $G_2, F_4, {}^{3,6}D_4, E_6$ is rational over K and hence the corresponding group of R-equivalence classes is trivial. As a corollary of our results it follows that the variety of any simple algebraic group defined over either a p-adic field or an imaginary number field or a global function field K is K-rational.
In [3] I gave an alternative proof of Scheiderer's theorem on the Hasse principle for principal homogeneous spaces defined over a field of virtual cohomological dimension at most one. At present I try to apply methods of [3] to prove Serre's conjecture II and the Hasse principle for principal homogeneous spaces defined over a field of virtual cohomological dimension at most two. I have some partial results. However the work is still in process.
References.
[1] V. Chernousov, A. Merkurjev, R-equivalence and Special Unitary Groups, Groups. J. Algebra, 209, 175-198 (1998)
[2] V. Chernousov, V. Platonov, The Rationality Problem for Semisimple Group Varieties, J. Reine Angew. Math. 504 (1998), 1–28.
[3] V. Chernousov, An Alternative Proof of Scheiderer's Theorem on the Hasse Principle for Principal Homogeneous Spaces, Documenta Mathematica 3 (1998), 135–148.
3.1. Meetings and visits. V.I. Yanchevskii visited U. Rehmann.

Participant 5 – Alma Ata:

Participants are A. Dzhumadil'daev, K. Abdukhalikov, R. Kerimbaev. They contributed to the project by the below mentioned publications. Dzhumadil'daev has attended the conference C1 (supported by this project) and has visited Bielefeld in June/July 1996. For this last visit, his travel will be supported by this project, while his subsistence was supported by the Sonderforschungsbreich "Diskrete Strukturen in der Mathematik" at Bielefeld.

Results:

We develop the cohomology theory for right-symmetric algebras, i.e., for algebras with identity $ao(boc) - (aob)oc = ao(cob) - (aoc)ob$. We establish connections for these cohomologies and cohomologies of Lie, Leibniz algebras. In particular, we found:
i) the classification of simple Leibniz algebras of rank 1,

ii) a new central right-symmetric extension for a Witt algebra,

iii) right-symmetric cohomologies of gl(n).

Publications:

1. A. S. Dzhumadil'daev, Cohomologies and deformations of right-symmetric algebras,
2) A. S. Dzhumadil'daev, S.Ibraev, Modular Serre relations and Virasoro Type algebras,

3) S. Abdukasimova, Simple Leibniz algebras connected with Zassenhaus algebra (all these papers will appear)
4) K. Abdukhalikov, Modular permutation representations of PSL(n,p) and invariant lattices, Math.Sbornik, 188(1997), No.8, 1107-1117.
5) K. Abdukhalikov, "Automorphism groups of invariant lattices in the Steinberg module of groups of Lie type of odd characteristics, to appear in Math. Sbornik.

Participant 6 – Tbilisi:

Participating researchers: H. Inassaridze, M. Jibladze, T. Kandelaki, D. Pataria, T. Pirashvili, M. Uridia.
Research activities and results:
Topics: Investigation of the homotopical properties of polynomial functors, cohomology of algebraic theories and Mac Lane cohomology, investigation of Lie algebra cohomology and non-abelian group (co)homology, investigation of algebraic K-theories of special normed algebras and KK-theory. Automorphisms of semigroup rings.
Results: It was proved that group homology takes simplicial groups of finite length to simplicial groups of finite length. A Dold-Kan type theorem for Γ-groups is proved. Sufficient conditions for the equality of algebraic and topological K-groups are established. The K-theory and KK theory is defined for C^*-categories without Z_2-graded. Guin's non-abelian cohomology of groups is extended to higher dimensions. The construction of cohomology of Lie objects in the tensor category of linear maps and local Lie algebras is given. The group of graded automorphisms of polyhedral generalizations of semigroup rings has been explicitly described.

Publications:

i) H. Inassaridze, Algebraic K-theory of normed algebras, (accepted for publication in "K-Theory".
Abstract. Karoubi's Conjecture on the equality of algebraic and topological K-functors is proved for polynomial extensions of stable C*-algebras.

ii) H. Inassaridze. N. Inassaridze. Non-abelian homology of groups. (submitted to "K-Theory").
Abstract. The second non-abelian cohomology with coefficients in crossed modules is constructed and included in an exact cohomology sequence.

iii) J. Gubeladze. W. Bruns. Polyhedral algebra, arrangements of toric varieties, and their groups (submitted to Amer. J. Math., also in K-theory server N 232).
Abstract. The group of graded automorphisms of polyhedral generalizations of semigroup rings (over a field) has been explicitly described. The case of a single lattice polytope corresponds to arbitrary normal graded semigroup ring, while the case of a simplicial complex corresponds to arbitrary Stanley-Reisner ring. We consider the case of arbitrary lattice polyhedral complexes. The group of automorphisms of the corresponding projective varieties (i.e. arrangements of toric varieties) is also described. These results strengthen and generalize M. Demazure's classical and D. Cox' recent results on the automorphism groups of toric varieties.

iv) M. Jibladze, T.Pirashvili. On nilpotent algebraic theories. (in preparations)
Abstract. The aim is to establish the relationship between different approach of nilpotency for algebraic theories. The main technical tool is our cohomology of algebraic theories, which are general background of Mac Lane cohomology.

v) T. Kandelaki. On the homotopy equivalence of universal and stable C^*-algebras of a C^*-pseudocategory. (in preparation).
Abstract. The main result is that the mentioned algebras are homotopy equivalent up to M_2 matrices. In particular, they are KK-isomorphic.

vi) T. Kandelaki. K-theory and KK-theory of C^*-categories'. (in preparation).
Abstract. The paper is devoted to the construction of KK-theory (the nontrivial case) not using Z_2-graded KK-theory.

vii) R. Kurdiani. Cohomology of Lie algebras in the tensor category of linear maps. (accepted for publications in Comm. algebra)
Abstract. By the work of Loday and Pirashvili it is known, that Leibniz algebras are closely related to internal Lie algebras in the tensor category of linear maps. In this paper the cohomology of such objects are constructed as iterated cone construction starting from the ordinary Chevalley-Eilenberg complexes. Our cohomology theory turns out to be closely related to cohomology of local Lie algebras as introduced by Mathieu and Yu.

viii) D. Pataraia. On representation of second homotopy groups of polyhedra by means of planar graphs. (work in progress)

ix) T. Pirashvili. Simplicial degree of functors. (accepted for publications in Math. Proc. Cambridge Philos. soc.)
Abstract. Our work can be considered as new general method proving vanishing results in spectral sequences.

x) T. Pirashvili. Dold-Kan type theorem for Γ-groups. (submitted in Quart. J. Math. Oxford Ser.)
Abstract. Γ-spaces are combinatorial models for connective spectra. We show that any Γ-space is stably weakly equivalent to a discrete Γ-group. By mimicking the construction of normalization of simplicial groups, we prove a Dold-Kan type theorem for the category of Γ-groups.

Linear Algebraic Groups and Related Structures
Satellite Conference of ICM 1998, August 10 – 14, 1998

Universität Bielefeld, Fakultät für Mathematik, SFB 343 "Diskrete Strukturen in der Mathematik"

Organizers:	Ina Kersten	office: V4-238, phone: (0521) 106-4997
	Ulf Rehmann	office: V5-239, phone: (0521) 106-5039, priv. (0521) 105491
Secretary:	Britta Heidrich	office: V5-228, phone: (0521) 106-5022

Schedule of Talks as of August 10, 1998

All talks in Lecture Room "Hörsaal 15" Main Hall University Building
Talks given by participants from an INTAS-93-2618 partner are marked by *

Monday, August 10:

Opening session		9.30 – 9.45
R. Parimala:	u-Invariant of function fields in one variable over p-adic fields	9.45 – 10.45
M. Knebusch:	Generic splitting in the presence of bad reduction	11.00 – 12.00
G. Soifer:	Auslander conjecture - new progress	13.30 – 14.15
R. Sujatha:	Sums of squares in function fields	14.30 – 15.15
* D. Hoffmann:	On the pythagoras number of formally real fields	15.45 – 16.30
M. Monsurro:	Doubling trace forms	16.45 – 17.30

Tuesday, August 11:

E. Vinberg:	Weakly symmetric spaces and spherical varieties	9.30 – 10.15
B. Kahn:	The motive of a reductive group	10.30 – 11.15
N. Karpenko:	A direct construction of the Rost motive	11.30 – 12.15
B. Kunyavski:	Rationality problem for generic tori in simple groups	14.30 – 15.15
R. S. Garibaldi:	Exotic algebraic structures and groups of type E_6 and E_7	15.45 – 16.30
A. Steinbach:	Subgroups of $F_4(K)$ generated by long root elements	16.45 – 17.30

Wednesday, August 12:

V. Suresh:	Principal bundles over the plane	9.30 – 10.15
* A. Dzhumadild'aev:	Cohomologies and deformations of right symmetric algebras	10.30 – 11.15
S. Pumplün:	Quaternion algebras over elliptic curves	11.30 – 12.15
T. Ton-That:	Projective limits of invariants of the infinite dimensional classical groups and their applications to physics	14.30 – 15.15
J. Morita/E. Plotkin:	Results (old & new) and problems on Kac-Moody groups	15.45 – 16.45
P. Abramenko:	Economical presentations of Kac-Moody groups over fields	17.00 – 17.45
	Conference Dinner, Lotus-See Restaurant, Werther Str. 274	19.00

Thursday, August 13:

* I. Panin:	On a conjecture of Grothendieck about principal homogeneous spaces	9.30 – 10.15
* V. Chernousov:	An alternative proof of Scheiderer's theorem of Hasse principle	10.30 – 11.15
* L. Fainsilber:	Integral versus rational equivalence for Hermitean forms over local orders	11.30 – 12.15
* O. I. Tavgen:	Free Products of cyclic groups in the $PSL(2,C)$	13.45 – 14.30
V. Benyash-Krivetz:	On decomposing some finitely generated groups into amalgamated free products	14.45 – 15.15
S. Akbari:	Maximal subgroups of $\mathrm{GL}_1(D)$	15.45 – 16.30
Y. Flicker:	Orbital integrals via perverse sheaves	16.45 – 17.30

Friday, August 14:

P. Gille:	Applications of Rost's invariants	9.30 – 10.15
P. Balmer:	Derived Witt groups	10.30 – 11.15
* P. Koulmann:	Dimension of symmetric or skew-symmetric matrices with given minimal polynomial	11.30 – 12.15
* O. Izhboldin:	$H^3(F(q_1,q_2)/F)$ for a pair of quadratic forms	13.30 – 14.15
M. Mahdavi-H.:	Commutators in division rings revisited	14.30 – 15.15
A. Wadsworth:	Valued and graded divison algebras	15.45 – 16.30
J. Winkelmann:	Quotients of complex Lie groups by lattices	16.45 – 17.30

Conference on Linear Algebraic Groups and Related Structures
University of Bielefeld, August 10 – 14, 1998
List of Participants
Participants from an INTAS-93-2618 partner are marked by *

* Herbert Abels	Bielefeld	abels@mathematik.uni-bielefeld.de
Peter Abramenko	Bielefeld	abramenk@mathematik.uni-bielefeld.de
S. Akbari	Tehran	s_akbari@vax.ipm.ac.ir
P. Athanassiadis	Paris	athana@math.jussieu.fr
P. Balmer	Lausanne	paul.balmer@ima.unil.ch
Helmut Behr	Frankfurt (Main)	behr@math.uni-frankfurt.de
V. Benyash-Krivetz	Minsk	benyash@im.bas-net.by
* G. Berhuy	Besançon	berhuy@vega.univ-fcomte.fr
J. Buresi	Lille	buresi@gat.univ-lille1.fr
Philippe Calame	Lausanne	Philippe.Calame@ima.unil.ch
* V. Chernousov	Minsk/Bielefeld	chernous@mathematik.uni-bielefeld.de
Ingrid Dejaiffe	Louvain-la-Neuve	dejaiffe@agel.ucl.ac.be
* Askar Dzhumadild'aev	Alma-Ata	dzhuma@alg.itpm.alma-ata.su
* Laura Fainsilber	Gøteborg	laura@math.chalmers.se
Yuval Flicker	Columbus	flicker@math.ohio-state.edu
R. S. Garibaldi	La Jolla	skip@math.ucsd.edu
Philippe Gille	Orsay	P.Gille@dpmms.cam.ac.uk
R. Hazrat	Tehran	ROOZBEH@KARUN.ipm.ac.ir
* Detlev Hoffmann	Besançon	detlev@math.univ-fcomte.fr
Jürgen Hurrelbrink	Baton Rouge	jurgen@marais.math.lsu.edu
* Oleg Izhboldin	St. Petersburg	oleg@izh.usr.pu.ru
Bruno Kahn	Paris	kahn@mathp.jussieu.fr
Nikita Karpenko	Münster	karpenk@math.uni-muenster.de
* Ina Kersten	Bielefeld	kersten@mathematik.uni-bielefeld.de
Manfred Knebusch	Regensburg	manfred.knebusch@mathematik.uni-regensburg.de
Max Knus	Zürich	knus@math.ethz.ch
* Pascale Koulmann	Besançon	pascale@math.univ-fcomte.fr
Boris Kunyavski	Ramat Gan	kunyav@macs.biu.ac.il
Ahmed Laghribi	Paris	laghribi@math.jussieu.fr
D. Lewis	Dublin	dwlewis@ollamh.ucd.ie
M. Mahdavi-Hezavehi	Tehran	mahdavi@ROSE.IPM.AC.IR
P. Mammone	Lille	mammone@gat.univ-lille1.fr
S. Mattarei		mattarei@math.unipd.it
A. Mazzoleni	Lausanne	
J. McGarraghy	Dublin	jmcgarr@ollamh.ucd.ie
* M. Monsurro	Besançon	monsurro@vega.univ-fcomte.fr
Jun Morita	Tsukuba	morita@math.tsukuba.ac.jp
* A. Nenashev	Bielefeld	nenashev@mathematik.uni-bielefeld.de
G. Noskov	Omsk	
M. Ojanguren	Lausanne	Manuel.Ojanguren@ima.unil.ch
* Ivan Panin	St. Petersburg	panin@lomi.spb.su
R. Parimala	Bombay	PARIMALA@tifrvax.tifr.res.in
A. Pfister	Mainz	PFISTER@MAT.Mathematik.Uni-Mainz.DE
Eugene Plotkin	Ramat-Gan	plotkin@macs.biu.ac.il
Alexander Potapchik	Bielefeld	potapch@Mathematik.Uni-Bielefeld.DE
S. Pumplün	Regensburg	susanne.pumpluen@mathematik.uni-regensburg.de
* Ulf Rehmann	Bielefeld	rehmann@mathematik.uni-bielefeld.de
* Gerhard Röhrle	Bielefeld	roehrle@mathematik.uni-bielefeld.de
Claus Scheiderer	Regensburg	claus.scheiderer@mathematik.uni-regensburg.de
* V. Schönfeld	Bielefeld	vschoenf@mathematik.uni-bielefeld.de
A. Serhir	Louvain-la-Neuve	serhir@agel.ucl.ac.be
G. Soifer	Ramat-Gan	soifer@sunlight.cs.biu.ac.il
Tonny Springer	Utrecht	springer@math.ruu.nl
M. Stein	Evanston	mike@math.nwu.edu
A. Steinbach	Gießen	anja.steinbach@math.uni-giessen.de
R. Sujatha	Bombay/Regensburg	SUJATHA@tifrvax.tifr.res.in
V. Suresh	(Paris)	suresh@math.tifr.res.in
* O. Tavgen	Minsk	tavgen@isd.minsk.by
Jean-Pierre Tignol	Louvain-La-Neuve	tignol@agel.ucl.ac.be
T. Ton-That	Iowa	tonthat@math.uiowa.edu
T. Unger	Dublin	thomas.unger@ucd.ie
Wilberd van der Kallen	Utrecht	vdkallen@math.ruu.nl
E. Vinberg	Moscow	sfb17@mathematik.uni-bielefeld.de
Adrian Wadsworth	La Jolla	wadswrth@euclid.ucsd.edu
Jörg Winkelmann	Basel	winkel@math.unibas.ch
D. Witte	Oklahoma, Stillwater Univ.	dwitte@hardy.math.okstate.edu
* K. Zainoulline	St. Petersburg/Besançon	kirill@vega.univ-fcomte.fr