TAGUNGSBERICHT 33/1995

GANZZAHLIGE QUADRATISCHE FORMEN UND GITTER

20.8. — 26.8.95

Die Tagung wurde organisiert von Eva Bayer–Fluckiger (Besancon), Helmut Koch (Berlin) und Boris Venkov (St. Petersburg).

Im Mittelpunkt des Interesses standen

- neue Ergebnisse bei der starken Approximation quadratischer Formen,
- modulare Gitter,
- Verallgemeinerungen der Definition und Klassifikation eutaktischer und perfekter Gitter,
- im Zusammenhang mit der Darstellungstheorie endlicher Gruppen, algebraischer Geometrie und Codes konstruierte Gitter,
- weitere neue Klassifikationen und Konstruktionen von Gittern, insbesondere unimodularer,
- Thetareihen als Modulformen von Gittern.

Unter den vorzüglichen Arbeitsbedingungen von Oberwolfach fanden die Vorträge ihre Fortsetzung in vielen Diskussionen. Trotz der Spannweite dieser Themen zeigten die vielen Querbezüge in diesen Gesprächen den Zusammenhalt dieses klassischen und lebendigen Gebiets.

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J. S. Hsia: Almost strong approximation for definite quadratic spaces

A fundamental theorem in the theory of integral quadratic forms is the strong approximation theorem for the kernel O'_m of the spinor norm function where the quadratic structure is indefinite and $m \geqslant 3$. This theorem was the result of works by Eichler and Kneser in 1950s and has been a central point in the proofs of many important results in the subject ever since. It is known that such a theorem cannot possibly hold when the quadratic spaces are *definite.* Nevertheless, we present two almost strong approximations theorems (ASAPs) for definite spaces, one for O' and one for O^+. We show that these results give significant applications in

(1) the distributions of classes in certain graphs naturally constructed $Z(M : q)$ when q is a large prime; in particular, when M is a positive definite even unimodular lattices in any dimension, *all* the classes in the genus of M are already "q–neighbors" when $g \gg 0$;
(2) asymptotic representations of one positive definite form by another.

This latter application, in particular, answers in a stronger manner an open problem posed by Kitaoka in his recent book, as well as proving *arithmetically* a result of representations of numbers by ternary quadratic forms which previously had been proved only via analytic methods (Siegel, Linnik–Malyshev or modular forms of weight 3/2) by Schulze–Pillot (and Duke and Schulze–Pillot), Earnest, and Peters.

J.S. Hsia (Columbus, Ohio); joint work with M. Jöchner.

Jacques Martinet: Classification of eutactic lattices

Let E be an Euclidean space and $n = \dim E$. For a (rank n) lattice Λ in E, let S be its set of minimal vectors, N its minimal norm and $\gamma(\Lambda) = N/\det(\Lambda)^{1/n}$ its Hermite invariant. For $x \in E, x \neq 0$, let $p_x \in \mathrm{End}^s(E)$ (= space of symmetric endomorphisms of E) be the orthogonal projection on the line $\mathbb{R}x \subset E$. We say that Λ is *perfect* (resp. *eutactic*) if the p_x's, $x \in S(\Lambda)$ span $\mathrm{End}^s(E)$ (resp. if there exists a representation $\mathrm{Id} = \sum_{x \in S} \rho_x p_x$ with $\rho_x > 0$).

Avner Ash proved in 1977 that there are only finitely many eutactic lattices (up to similarity) in E and gave for them in 1980 a "mass formula with signs".

We introduce the notion of *weak eutaxy* by forgetting the restriction $\rho_x > 0$ (thus, perfect $\Rightarrow$ weakly eutactic) and proved the following results which improve on Ash's work:

(1) We divide the set of lattices into finitely many *minimal classes* defined by the configuration of minimal vectors.
(2) We prove that each class contains at most one weakly eutactic lattice.

(3) We prove that this weakly eutactic lattice, if any in the class c, realizes the minimum of $\gamma(\Lambda)$ for $\Lambda \in c$.
(4) We prove that these lattices are algebraic (up to similarity).
(5) We give the classification of weakly eutactic lattices for $n = 2, 3$ and 4, and verify explicitely the mass formula for these dimensions.

Jacques Martinet; joint work with Anne-Marie Bergé.

A.–M. Bergé: LOCAL MAXIMA OF DENSITY FOR SYMPLECTIC LATTICES

To construct reasonable dense and "nice" lattices, we restrict the study of the Hermite invariant (or equivalently the lattice sphere packing density) to some families connected with arithmetical or geometrical questions. One of them arose recently from Riemannian geometry, that of symplectic lattices, associated to principally polarized abelian varieties (Buser and Seirak, Invent. 94): a lattice Λ is symplectic if there is an isometry σ such that $\sigma(\Lambda)$ is equal to the dual of Λ, and $\sigma^2 = -\mathrm{Id}$. Dropping the last condition, we focus on the families of σ-isodual lattices.

We present results concerning more general families of lattices which are unions of orbits under closed subgroups of the linear group $SL(E)$. For such a family we define $\mathcal{F}$-extreme lattices to be achieving local maxima of the Hermite constant in the family $\mathcal{F}$.

(1) We characterize them by properties of perfectness and eutaxy relative to a subspace of the space $\mathrm{End}^s(E)$ of the symmetric endomorphisms of $E = \mathbb{R}\Lambda$ which is associated by Lie group theory to the group $\mathcal{G} \subset GL(E)$ definig the family $\mathcal{F}$.
(2) We classify the $\mathcal{F}$-extreme lattices by their minimal vectors, and we obtain finiteness, algebraicity theorems generalizing the classical Voronoi one, although some new phenomenons could appear, such as local maximum being not strict.

We present applications of the classification and characterization of extremality to σ-symplectic lattices, more precisely to lattices associated to Jacobians of curves of small genus.

A.–M. Bergé (Bordeaux, France); joint work with J. Martinet.

Renaud Coulangeon: RANKIN INVARIANTS: A CRITERION FOR EXTREMALITY

"Rankin invariants" were introduced by Rankin in 1953 as a natural generalization of the well–known Hermite's number attached to a quadratic form q (or equivalently to a lattice L) in which the minimal vectors have to be replaced by "minimal subsections" of any dimension: more precisely, for a given positive integer

$k < n = \dim L$ we define $S_k(L)$ to be the minimal determinant of k-dimensional sections of L and set $\gamma_k(L) := \frac{S_k(L)}{(\det L)^{k/n}}$.

The aim of this talk is to give necessary and sufficient conditions for a lattice to realize a local maximum for the function γ_k.

We prove that the celebrated Voronoi's theorem characterizing extremality (with respect to the Hermite function) in terms of "perfection" and "eutaxy", still holds in that context, with analogous notions of "k-perfection" and "k-eutaxy".

We also give some properties of "k-perfect" and "k-eutactic" lattices, such as finiteness results, and point out the relation between Rankin invariants and the exterior powers $\bigwedge^k L$ of a lattice.

Renaud Coulangeon (Bordeaux)

H.-G. Quebbemann: Even lattices similar to their duals

Given $\ell \in \mathbb{N}$ we look at even lattices Λ on euclidean n-space such that

$(*)$: $\Lambda = \sigma\Lambda^*$ for some $\sigma \in GL_n(\mathbb{R})$, $\sigma v \cdot \sigma w = \ell v \cdot w$, or more generally such that

(0): $\sqrt{\ell}\Lambda^*$ is also even and $\det \Lambda = l^{n/2}$.

Topics described in this talk (with $\ell = 1$ or a prime, so that condition (0) defines one genus): the case $n = 4$; examples given by Mordell–Weil lattices; the Fricke eigenforms on $\Gamma_0(\ell)$ given by the theta series of lattices satisfying $(*)$; extremal lattices for the seven levels $\ell = 1, 2, 3, 5, 7, 11, 23$ for which the algebra of relevant eigenforms is a polynomial ring (in two generators).

H.-G. Quebbemann (Oldenburg)

Rainer Schulze–Pillot: Linear independence of theta series

By a theorem of Kitaoka the theta series of degree $m - 1$ of an integral positive definite lattice of rank m having the same discriminant are lineary independent. The theory of representations by spinor genera shows that this is in general best possible.

In this talk we show that Kitaoka's result can be generalized to theta series with harmonic polynomials. This has applications in the theory of theta liftings. Arithmetic consequences are a characterization of certain lattices by their theta series of degree 2 with harmonic polynomials and a description of the linear relations of theta series of certain ternary lattices (with harmonic polynomials) by cusp forms whose L-series is zero at the center of the critical strip.

Rainer Schulze–Pillot (Köln)

T. Shioda: A UNIFORM CONSTRUCTION OF E_6^*, E_7^*, E_8^* AND RELATED GEOMETRY

The root lattices E_r $(r = 6, 7, 8)$ and their dual lattices E_r^* are important lattices in many sense which appear in various area of mathematics.

We give a simple construction of E_r^*, which is uniform with respect to $r = 6, 7, 8$. Indeed it is so simple that we can state it here. Let L_r be the lattice generated by the r elements $(u_1, \cdots, u_r)$ such that $\langle u_i, u_j \rangle = \delta_{ij} + \frac{1}{d}$, where $d = 9 - r$. Letting $v_o = \frac{1}{3} \sum_i u_i$, consider the sublattice $\widetilde{L_r}$ of $L_r \otimes \mathbb{Q}$ generated by $u_1, \cdots, u_r$ and v_0. Then

Theorem: $\widetilde{L_r} \cong E_r^*$ for $r = 6, 7, 8$.

An advantage of this construction is that it allows a nice, concise description of minimal vectors in E_r and E_r^*.

The construction is motivated by 1) theory of del Pezzo surfaces (including that of the 27 lines on a cubic surface) and 2) Mordell–Weil lattices.

We explain, for instance, that for $r = 6$, $\{u_1, \cdots, u_6\}$ and $\{u_1', \cdots, u_6'\}$ $(u_i' = u_i - v_0)$ correspond to a double six of 27 lines in Schläfli's sense. Similary for $r = 7, 8$.

Very explicit connections between MWL of type E_r, del Pezzo surfaces of degree $d = 9 - r$ and r points blow up of $\mathbb{P}^2$ is to be given. With a new idea of "Weierstraß transformation" (for which we had no time to give details), this connection implies an important supplement to explicit generators of MWL as well as the description of a cubic surface and the 27 lines, in terms of 6 points in general position of $\mathbb{P}^2$. As an illustration, we show some pictures of a cubic surface, the 27 lines on it c(all with $\mathbb{Q}$-coefficients) and also of the 28 bitangents to some plane quartic curve.

T. Shioda (Tokyo)

Roland Bacher: 28-DIMENSIONAL LATTICES WITHOUT ROOTS

Let Λ be a 28-dimensional unimodular lattice without roots. A neighbour by a norm 4 vector v is of the form $\mathbb{Z} + M$ where M is a 27-dimensional unimodular lattice with root system of type ${A_1}^k$. Moreover, v can be chosen such that $k \leqslant 4$. This reduces the classification of 28-dimensional unimodular lattices without roots to the classification of 27-dimensional ones with root system $\emptyset, A_1, {A_1}^2, {A_1}^3$ or ${A_1}^4$. The first 2 cases reduce by the same kind of arguments to dimension 26 where the classification can be done. If the root system is at least ${A_1}^2$ the neighbour by the sum of two orthogonal roots is of the form $\mathbb{Z}^2 + N$ where N is 25-dimensional unimodular and has only components of small rank in its root system. Such lattices have been classified by Borcherds. This strategy allows the classification of the

28-dimensional unimodular lattices without roots. Computations are not yet fully carried out but there are at least 35 such lattices.

Roland Bacher (Grenoble); joint work with Boris Venkov.

Pham Huu Tiep: GROUP REPRESENTATIONS AND INTEGRAL LATTICES

The notion of global irreducibility of rational representations of finite groups is introduced by Benedict H. Gross in order to explain new lattices constructed by N. Elkies and T. Shioda (by using Mordell-Weil groups of ellipitc curves) from the point of view of group theory. This notion generalizes some condition first distinguished by J. G. Thompson in 1975. In this talk we classify globally irreducible representations related to sporadic groups and finite groups of Lie type of rank $1, 2$. We also classify all globally irreducible representations coming from 1) Weil representations of finite classical groups; 2) basic spin representations of alternating and symmetric groups. As a by–product, we get several new series of unimodular and p-modular lattices.

The second part of the talk, which is a joint work with R. Scharlau, is concerned with lattices of rank p^n+1 which are related to the symplectic groups $Sp_{2n}(p)$, $p \equiv 3 \pmod 4$ a prime. Extending the results of R. Gow and B. B. Venkov–R. Bacher (for special values of (n,p)), we classify and explicitly construct all these lattices. There is an interesting interrelation between these lattices and self–dual codes over $\mathbb{F}_p$. In particular, using recent results of U. Dempwolff and L. Bader – W. M. Kantor – G. Lanardon, we get three extremal self–dual ternary codes of length 28.

Pham Huu Tiep (Essen)

Rudolf Scharlau: CLASSIFICATION OF INTEGRAL LATTICES

A survey was given on several construction techniques for integral lattices which have been developed over the past few years by several people (one interest is the sphere packing problem, that is the construction of lattices with large minimum). We put some emphasis on the general point of view of construction of all integral over-lattices L of some given lattice M. These are given by certain subgroups of the discriminant group $T = T(M) := M^\#/M$ of M, subject to conditions on the length function $\ell : T \to \mathbb{Q}_{\geqslant 0}$. Special cases include

- "gluing theory", where M comes along with a decomposition $M_1 \perp M_2$
- "lattices from codes", where $M = M_0 \perp \ldots \perp M_0$, thus $T = T_0^k$, and the length function involves the usual Hamming weight
- the theory of "reflective" lattices, where M is a root lattice with arbitrarily scaled components, and an appropriate "reduced" discriminant group can be defined (Scharlau & Blaschke, to appear in Journal of Algebra).

Complementing this theoretical part, some recent computational results, joint with B. Hemkemeier, on the uniqueness, resp. non-existence of extremal modular lattices in dimensions $\leqslant 14$ were mentioned; cf. Quebbemann's talk. Various genera containing such lattices, of level l and dimension n, where completely enumerated by computer, using Kneser's neighbour method. It turns out that extremal lattices are unique for $(l, n) = (3, 14), (7, 8), (11, 6), (11, 8)$, and do not exist for $(7, 12)$.

Rudolf Scharlau (Dortmund)

L. Gerstein: ALMOST UNIMODULAR LATTICES

A *nearly unimodular* lattice over $\mathbb{Z}$ is a lattice (free module of finite rank) with a gram matrix of the form

$$A = \begin{pmatrix} a_1 & 1 & & & 0 \\ 1 & a_2 & \ddots & & \\ & \ddots & \ddots & \ddots & \\ & & \ddots & a_{n-1} & 1 \\ 0 & & & 1 & a_n \end{pmatrix} = [a_1, \cdots, a_n].$$

M. Newmann has shown that every unimodular lattice has a gram matrix $\left(\begin{array}{c|c} A & b \\ \hline b & c \end{array}\right) \in \mathcal{M}_{n,n}(\mathbb{Z})$, with $A \in \mathcal{M}_{n-1,n-1}(\mathbb{Z})$ nearly unimodular. My talk described the classification of nearly unimodular lattices in the positive definite case. The main result included this statement: if $A = [a_1, \cdots, a_n]$ and $B = [b_1, \cdots, b_n]$ are nearly unimodular lattices (with $a_i, b_i \geqslant 2$, which is no loss of generality), then there is an isometry $A \cong B$ if and only if $a_i = b_i$ for $1 \leqslant i \leqslant n$ or $a_i = b_{n+1-i}$ for $1 \leqslant i \leqslant n$.

Larry Gerstein (Santa Barbara)

Ricardo Baeza: HERMITE–HUMBUT CONSTANT OF NUMBER FIELDS

$K/\mathbb{Q}$ a total real number field, $m = [K : \mathbb{Q}], d_K = \operatorname{disc} K, \mathcal{O}_K =$ ring of integers. An n-rank Humbut form over K is an m-tuple $S = (S_1, \cdots, S_m)$ of $n \times n$ real symmetric positive definite matrices. Let $\det S = \prod_i^m \det S_i$, $\min(S) = \min\{\prod_i^m S_i[u^{(i)}] \mid 0 \neq u \in \mathcal{O}_K^n\}$, $u^{(i)} = i$-th conjugate of u. These are invariant with respect to the action of $GL(n, \mathcal{O}_K)$ on the space of Humbut forms given by $\forall\, U \in GL(n, \mathcal{O}_K)$, S Humbut form, $S[U] = (S_1[U^{(1)}], \cdots, S_m[U^{(m)}])$. Let $\gamma_K(S) = \min(S)/(\det S)^{1/n}$ and $\gamma_{K,n} = \sup_S \gamma_K(S)$. If $K = \mathbb{Q}$, then $\gamma_{\mathbb{Q},n} = \gamma_n$ is Hermite's constant. Then one has:

(1) $\gamma_{K,n} \leqslant 4^m \omega_n^{-2m/n} |d_K|$ $\quad(\omega_n = \text{vol. of 1-sphere})$

(2) If $h(K) = 1$, then $\gamma_{K,n} \geqslant \omega_m [\frac{2\zeta_K(mn)}{\omega_{mn}}]^{2/n} |d_K|^{1/2}$ (ζ_K = Dedekind Zetafunction of $K/\mathcal{O}_K$).

A vector $u \in \mathcal{O}_K^n$ is minimal for S if $S[u] := \prod S_i[u^{(i)}] = \min(S)$.

In general u is not unimodular if $h(K) > 1$. We define $N(u) = |N_{K/\mathbb{Q}}(\prod_{u_i \neq 0} u_i)|$ and $N(S) = \inf\{N(u) | U \text{ unimodular vector of } S\}$ resp. $N[S] := \inf\{N(T) | T \simeq S\}$. Then one can show: **Theorem:** $\exists$ constant $C = C(K,n)$ depending only on K, n such that $N[S] \leqslant C$ for all Humbut forms S. Define $M_{K,n} := \sup_S N[S]$. Then $M_{K,n} = 1 \Leftrightarrow$ every S has at least one unimodular vector.

Example: $M_{\mathbb{Q}(\sqrt{10}),2} = 24$.

Using this constant one has the following version of Mordell's theorem: **Theorem:** $\forall n \geqslant 2$, $\gamma_{K,n}^{n-2} \leqslant (M_{K,n})^{\frac{2(n-1)}{n}} \gamma_{K,n-1}^{n-1}$.

Ricardo Baeza (Santiago, Chile)

Dennis R. Estes: CONSTRUCTING UNIMODULAR LATTICES WITH PRESCRIBED SELF ADJOINT OPERATORS (AND OTHER APPLICATIONS OF RANK 2 LATTICES)

(1) Let $m(x) \in \mathbb{Z}[x]$ be irreducible, monic of degree n. The necessary conditions that $m(x)$ have distinct and real roots suffices to imply that $m(x)$ is the minimal polynomial of a self adjoint operator on an odd positive definite unimodular quadratic lattice of rank $2n$ and an even positive unimodular lattice of rank $8n$. Such $m(x)$ of degree at most 4 are therefore minimal polynomials of symmetric matrices over $\mathbb{Z}$.

(2) Unimodular lattices over the ring $H(\Omega)$ of holomorphic functions on an open connected Riemann manifold Ω are classified. $H(\Omega)$ is Bezout, primitive quadratic forms over $H(\Omega)$ represent units and $H(\Omega)$ satisfies a very strong approximation theorem.

(3) Examples are provided to show that stable range 1 for rings does not ascend to an descend from finite integral extensions.

Dennis R. Estes (Univ. of Southern California)

Alexander Schiemann: TERNARY POSITIVE DEFINITE REAL QUADRATIC FORMS ARE DETERMINED BY THE SERIES OF THEIR REPRESENTATION NUMBERS

A modification of Eisenstein reduction yields a fundamental domain V which contains a unique representant of every class of positive definite ternary forms. This fundamental domain can be covered with finitely many polyhedral cones each of which consists of forms with same (finitely many) successive minimal vectors, i.e. is of the form

$$\{f \in V : f(x_1 \leq \ldots \leq f(x_r) \leq f(x)\ \forall x \in \mathbb{Z}^3 \setminus \{x_1, \ldots, x_r\}\}.$$

We describe the set of pairs $(f, g) \in V \times V$ with the same representation numbers up to a bound S as a finite union of polyhedral cones (the partition depending on S). Making this explicit (the calculations done by computer) we find bounds $S(f)$ linear in the coefficients of F with $(*) f, g \in V$ have the same representation numbers up to $S(f) \Longrightarrow f = g$.

Let $s_i(f)$ be the successive minima of f. Then $(*)$ holds with $S(f) = \frac{7}{2} s_3(f)$. With the additional assumption $\det f = \det g$ $(*)$ holds with $S(f) = 3 s_3(f)$.

Alexander Schiemann (Köln)

Gabriele Nebe: FINITE RATIONAL MATRIX GROUPS AND THEIR LATTICES

Finite rational matrix groups have now been classified up to degree $n = 31$ by giving representations for the conjugacy classes of irreducible maximal finite subgroups of $GL_n(\mathbb{Q})$ for $n \leqslant 31$. These groups are full automorphism groups of Euclidean lattices with high symmetry

A theorem gives a restriction on the set of prime divisors of the discriminant of an invariant lattice in case that the commuting algebra of the group is commutative, extending a result of W. Feit for absolutely irreducible groups and allowing to find the maximal finite supergroups (e.g.) of irreducible cyclic groups.

There might be not too small groups fixing lattices of more than one maximal finite group. This interrelation via common irreducible subgroups is encoded in a simplicial complex which also mesures the complexity of the degree.

To get an other interrelation between the maximal finite groups one may fix the lattice and change the Euclidean structure. This involves the inspection of the space of invariant quadratic forms of non uniform groups and also provides interesting lattices, of which the automorphism groups are not necessarily maximal finite.

Gabriele Nebe (Aachen)

Christine Bachoc: EXTREMAL CODES AND RELATED LATTICES

Let K be an imaginary quadratic field over $\mathbb{Q}$ or a quaternion field ramified at ∞ over $\mathbb{Q}$. Let $\mathcal{O}_K$ be a fixed maximal order of K. When the codifferent $\mathcal{D}_K^{-1}$ of K is principal, $\mathcal{O}_K$-unimodular hermitian lattices give rise to $|d_k|$-modular $\mathbb{Z}$-lattices for the reduced trace of the hermitian form.

One way of computing such lattices is the following: Let p a prime number, let $A = \mathcal{O}_K/p\mathcal{O}_K$, endowed with the induced form $x_i\overline{y_i}$. From a code C of length n over A one can define the lattice $L_C = \{(x_1, \cdots, x_n) \in {\mathcal{O}_K}^n \mid x_1, \cdots x_n \bmod p \in C\}$, with the form $\frac{1}{p}\sum_i^n x_i\overline{y_i}$. Then L_C is $\mathcal{O}_K$-unimodular if and only if C is a self–dual code.

One defines the following weight function over A: $\mathrm{wt}(0) = 0; \mathrm{wt}(a) = 1$ if $a \in A^*; \mathrm{wt}(a) = p$ otherwise.

Let $W_C(X, Y, Z) = \sum_{u\in C} X^{s_0(u)}Y^{s_1(u)}Z^{s_2(u)}$, where $s_0(u)$, resp. $s_1(u)$, $s_2(u)$ are the number of coordinates of u of weight resp. $0, 1, p$; this weight enumerator polynomial satisfies a MacWilliams type formula. Moreover, if C is self–dual and A is one of the following: $\mathbb{F}_q$, $q = 2, 3, 4$; $\mathbb{F}_q \oplus \mathbb{F}_q u$, $q = 2, 3, 4$; $\mathbb{F}_2 \oplus \mathbb{F}_2$; $M_2(\mathbb{F}_2)$, an additional diagonal matrix leaves W_C invariant. Then invariant theory shows that W_C belongs to a certain algebra which turns out to be a polynomial algebra in many cases. This allows us to define an extremal code to be the codes with the best possible weight with respect to this constraint.

In the case $A = \mathbb{F}_4 \oplus \mathbb{F}_4 u$, we can construct extremal codes up to length 12, which can be used to construct lattices over the Hurwitz order which are 2-modular and extremal.

Christine Bachoc (Bordeaux)

Britta Blaschke-Requate: Even unimodular lattices of rank 32 with neighbour defect 12

There are more than 80 millions even unimodular lattices Λ of rank 32. If the root system $R(\Lambda) = \{v \in \Lambda \mid (v, v) = 2\}$ is empty, only few lattices are explicitly known. For $v \in \Lambda$, $(v, v) = 8$, we define the neighbour

$$L := \Lambda(v) = \{x + \varepsilon\frac{v}{2} \mid x \in \Lambda,\ (x, v) \equiv 0 \pmod 2, \varepsilon = 0, 1\}.$$

Then the root system is of the form $R(L) = kA_1, k \geq 1$. To every Λ one associates as an invariant its neighbour defect

$$\nu(\Lambda) = \min\{32 - \dim\Lambda(v) \mid v \in \Lambda,\ (v, v) = 8\}.$$

It can be shown that $\nu(\Lambda) \in \{0, 8, 12, 14, 15, 16, \ldots, 31\}$. By the classification of Koch, Venkov, Nebe there exist 5 lattices with $\nu(\Lambda) = 8$.

My talk is about the construction of even unimodular lattices Λ with neighbour defect $\nu(\Lambda) = 12$. I start with a lattice L with $R(L) = 20A_1$. It posseses an up to isometry uniquely determined neighbour Λ. It is investigated under which conditions its neighbour defect is actually 12 (and not 0 or 8).

Britta Blaschke–Requate (Bielefeld)

M. Peters: Ternary and quaternary lattices with trivial automorphism group

The class number of ternary (resp. quaternary) $\mathbb{Z}$-lattices with trivial automorphism group is computed for discriminant $2p$ (resp. p) with $p \in \mathbb{P}$. In the ternary case the analog for $\mathbb{F}_9[X]$-lattices ($q = p^k, p \neq 2$) is investigated.

Meinhard Peters (Münster)

Berichterstatter: Boris Hemkemeier

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Emailadressen der Teilnehmer

Bacher, Roland	bacher@fourier.grenet.fr
Bachoc, Christine	bachoc@math.u-bordeaux.fr
Baeza, Ricardo	rbaeza@abello.dic.uchile.cl
Batut, Christian	batut@ceremab.u-bordeaux.fr
Bayer–Fluckiger, Eva	bayer@math.univ-fcomte.fr
Bergé, Anne–Marie	berge@ceremab.u-bordeaux.fr
Blaschke–Requate, Britta	blaschke@mathematik.uni-bielefeld.de
Coulangeon, Renaud	coulange@math.u-bordeax.fr
Estes, Dennis	destes@mtha.usc.edu
Gerstein, Larry	Gerstein@math.uscb.edu
Hemkemeier, Boris	Boris.Hemkemeier @Mathematik.Uni-Dortmund.DE
Hsia, John S.	jshsia@math.mps.ohio-state.edu
Kreck, Matthias	kreck@mfo.de
Martinet, Jacques	martinet@ceremab.u-bordeaux.fr
Mischler, Maurice	Maurice.Mischler@ima.unil.ch
Nebe, Gabriele	gabi@willi.math.rwth-aachen.de
Peters, Meinolf	petersm@math.uni-muenster.de
Quebbemann, Heinz-Georg	quebbemann@math.uni-oldenburg.de
Queguiner, Anne	queguine@math.univ-fcomte.fr
Scharlau, Rudolf	Rudolf.Scharlau @Mathematik.Uni-Dortmund.DE
Schiemann, Alexander	Alexander.Schiemann @Mathematik.Uni-Dortmund.DE
Schulze–Pilot, Rainer	schupi@MI.Uni-Koeln.DE
Shioda, Tetsuji	shioda@rkmath.rikkyo.ac.jp
Sloane, Neil J.A.	njas@research.att.com
Tiep, Pham Huu	tiep@exp-math.uni-essen.de
Venkov, Boris	venkov@fourier.grenet.fr

Tagungsteilnehmer

Prof.Dr. Roland Bacher
Laboratoire de Mathematiques
Universite de Grenoble I
Institut Fourier
B.P. 74

F-38402 Saint-Martin-d'Heres Cedex

Prof.Dr. Anne-Marie Berge
Mathematiques et Informatique
Universite de Bordeaux I
351, cours de la Liberation

F-33405 Talence Cedex

Prof.Dr. Christine Bachoc
Mathematiques et Informatique
Universite de Bordeaux I
351, cours de la Liberation

F-33405 Talence Cedex

Prof.Dr. Britta Blaschke-Requate
Fakultät für Mathematik
Universität Bielefeld
Universitätsstr. 25

33615 Bielefeld

Prof.Dr. Ricardo Baeza
Depto. Matematicas
Universidad de Chile
Casilla 653

Santiago de Chile
CHILE

Prof.Dr. Renaud Coulangeon
Mathematiques et Informatique
Universite de Bordeaux I
351, cours de la Liberation

F-33405 Talence Cedex

Prof.Dr. Christian Batut
Mathematiques et Informatique
Universite de Bordeaux I
351, cours de la Liberation

F-33405 Talence Cedex

Prof.Dr. Dennis Estes
Dept. of Mathematics
University of Southern California
1042 W 36th place

Los Angeles , Ca 90089-1113
USA

Prof.Dr. Eva Bayer-Fluckiger
Laboratoire de Mathematiques
Universite de Franche-Comte
16, Route de Gray

F-25030 Besancon Cedex

Prof.Dr. Larry Gerstein
Dept. of Mathematics
University of California

Santa Barbara , CA 93106
USA

Boris Hemkemeier
Fachbereich Mathematik
Lehrstuhl II
Universität Dortmund

44221 Dortmund

Prof.Dr. Jacques Martinet
Mathematiques et Informatique
Universite de Bordeaux I
351, cours de la Liberation

F-33405 Talence Cedex

Prof.Dr. John S. Hsia
Department of Mathematics
Ohio State University
231 West 18th Avenue

Columbus , OH 43210-1174
USA

Prof.Dr. Stephane Mischler
Universite Pierre et Marie Curie
Tour 55 - 65
BP 187

F-75252 Paris Cedex 5

Prof.Dr. Martin Kneser
Mathematisches Institut
Universität Göttingen
Bunsenstr. 3-5

37073 Göttingen

Dr. Gabriele Nebe
Lehrstuhl B für Mathematik
RWTH Aachen
Templergraben 64

52062 Aachen

Prof.Dr. Helmut Koch
Max-Planck-Gesellschaft zur
Förderung der Wissenschaften e.V.
AG Algebr. Geometrie und Zahlenthe.
Jägerstr. 10-11

10117 Berlin

Prof.Dr. Meinhard Peters
Mathematisches Institut
Universität Münster
Einsteinstr. 62

48149 Münster

Prof.Dr. Matthias Kreck
Fachbereich Mathematik
Universität Mainz

55099 Mainz

Prof.Dr. Heinz-Georg Quebbemann
Fachbereich 6 Mathematik
Carl von Ossietzky
Universität Oldenburg
Postfach 2503

26015 Oldenburg

Prof.Dr. Anne Queguiner
Laboratoire de Mathematiques
Universite de Franche-Comte
16, Route de Gray

F-25030 Besancon Cedex

Prof.Dr. Tetsuji Shioda
Dept. of Mathematics
Rikkyo University
Nishi-Ikebukuro

Tokyo 171
JAPAN

Prof.Dr. Rudolf Scharlau
Fachbereich Mathematik
Lehrstuhl II
Universität Dortmund

44221 Dortmund

Prof.Dr. Pham Huu Tiep
Institut für Experimentelle
Mathematik
Universität-Gesamthochschule Essen
Ellernstr. 29

45326 Essen

Alexander Schiemann
Mathematisches Institut
Universität zu Köln
Weyertal 86-90

50931 Köln

Prof.Dr. Boris B. Venkov
Fakultät für Mathematik
Universität Bielefeld
Universitätsstr. 25

33615 Bielefeld

Dr. Rainer Schulze-Pillot
Fachbereich 9 - Mathematik
Universität des Saarlandes
Postfach 151150

66041 Saarbrücken

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