Es geht auch exakt! – Meine mathematischen Lehrjahre mit Heinz-Jürgen Schmidt

Jürgen Schnack

Fakultät für Physik – Universität Bielefeld
http://obelix.physik.uni-bielefeld.de/∼schnack/

Festkolloquium, 27. Januar 2012

Universität Bielefeld

Deutsche Forschungsgemeinschaft DFG

FOR 945

IMR Research 東北大学金属材料研究所 Institute for Materials Research, Tohoku University

Legendenbildung*

* Bei der Legendenbildung ist es wichtig, dass man störenden Details nicht allzuviel Aufmerksamkeit zukommen lässt!

etwa um 2004 ± 2

Ganz Germanien ist von Evaluatoren,

Drittmitteleintreibern und Akkrediteuren besetzt!

Ganz Germanien ???

Dem Fachbereich Physik der Universität Osnabrück droht in Folge personeller Auszehrung der Untergang!

Doch eine kleine Gruppe Ausserplanmäßiger Professoren leistet tapfer Widerstand!

Klaus Betzler

Sprecher des Graduiertenkollegs und

Spiritus Rector der Betzler- und Master-Studiengänge

Jürgen Schnack & Manfred Neumann

Sprecher des Promotionsprogramms

Heinz-Jürgen Schmidt

Dekan

Wir haben so hart gearbeitet, dass wir oft nicht einmal dazu gekommen sind, den Mantel auszuziehen!

Unsere gute Laune hat darunter nicht gelitten.

Wir hatten was geschafft!

Marshall Luban about Heinz-Jürgen Schmidt

My *in-total summary* of Heinz-Jürgen is that he is one of the smartest, perhaps THE SMARTEST, mathematical physicist that I have met in my life!

Marshall Luban at the age of 75!

Paul Busch über Heinz-Jürgen Schmidt

Lieber Herr Schnack,

Ich kann noch hinzufügen, dass die Arbeit mit Heinz-Jürgen zurück zu den Anfängen in Grundlagen der Quantentheorie bei Ludwig geführt hat; es war beeindruckend zu sehen, wie leicht ihm das ganze Arsenal wieder zuflog oder einfach noch zur Verfügung steht.
Wenn Sie etwas technisches einfügen möchten, könnte ich vielleicht noch eine komplizierte Formel beibringen . . .

Herzliche Grüsse, Ihr Paul Busch

Paul Busch, York, U.K.

Heinz-Jürgen Schmidt

1. Legendenbildung $\surd$
2. Ein paar komplizierte Formeln, soweit ich das verantworten kann
3. Persönliche Anmerkungen

Wenn Sie jetzt nichts verstehen,

ist’s nicht so schlimm . . .

. . . ich versteh ja auch nichts!

Theorem 1. *$(M_4, \langle\ |\ \rangle, \prec, \prec_o)$ is isomorphic to the 4-dimensional Minkowski space.*

Accordingly, we will apply freely the terminology of Minkowski geometry and refer to $\langle\ |\ \rangle$ as the (Minkowski) scalar product. We use the same notation for vectors and for points in M_4 as an affine space.

The *forward* and *backward light cones* of an element $x \in M_4$ are defined as the sets

$$\mathcal{F}(x) := \{y \in M_4 : x \prec_o y\}, \quad \mathcal{B}(x) := \{y \in M_4 : x \succ_o y\}.$$

A vector $x \in M_4$ is called *lightlike* if $\langle x \,|\, x \rangle = 0$. If $\langle x \,|\, x \rangle > 0$ or < 0, the vector x is called *timelike* or *spacelike*, respectively. Then $x \prec_o y$ is equivalent to $y - x$ being lightlike and $y_0 - x_0 \geq 0$. Elements $x, y \in M_4$ are called *spacelike related*, $x \,\sigma\, y$, if $\langle x - y \,|\, x - y \rangle < 0$.

The set of effects can now be written as ($\mathrm{conv}(X)$ denotes the convex hull of a set X)

$$\mathcal{L} = [\mathbb{O}, \mathbb{1}] = \mathrm{conv}(\mathcal{F}(\mathbb{O})) \cap \mathrm{conv}(\mathcal{B}(\mathbb{1}))$$

$\mathcal{L}$ is convex and compact, that is, it includes its boundary ($\mathcal{F}(\mathbb{O})$

The Minkowski scalar product $\langle e \,|\, f \rangle$ admits a simple p

f are effects: it is equal to the probability of joint

effects e and f are measured by, say, Alice

entangled (singlet) state $\Phi = \frac{1}{\sqrt{2}}(\psi_+ \otimes \psi_-$

COEXISTENCE OF QUBIT EFFECTS

PAUL BUSCH AND HEINZ-JÜRGEN SCHMIDT

Structuralism in Physics

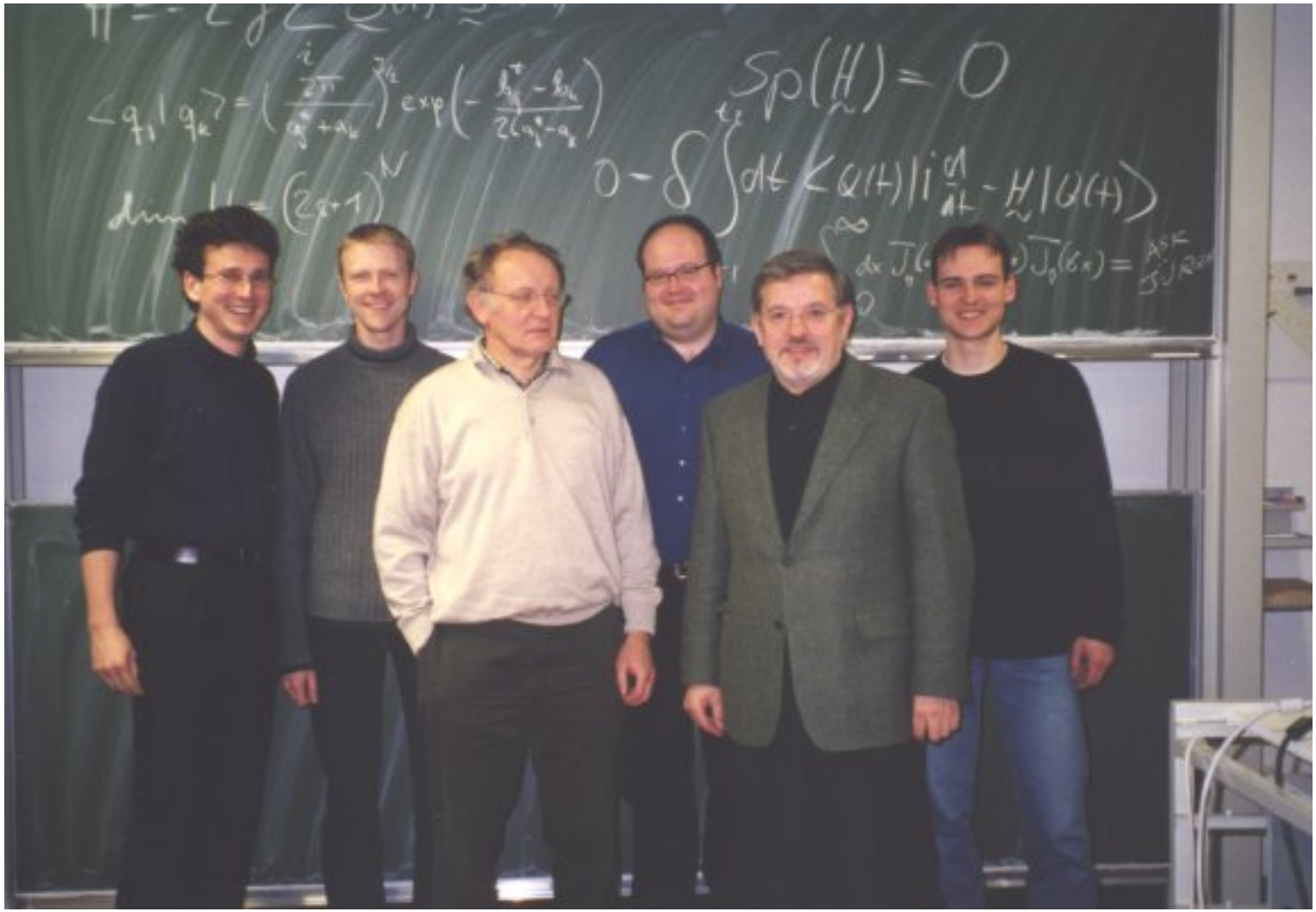
First published Sun Nov 24, 2002; substantive revision Wed Mar 5, 2008

Under the heading of "structuralism in physics" there are three different but closely related research programs in philosophy of science and, in particular, in philosophy of physics. These programs were initiated by the work of Joseph Sneed, Günther Ludwig, and Erhard Scheibe, respectively, since the begin of the 1970s. For the sake of simplicity we will use these names in order to refer to the three programs, without the intention of ignoring or minimizing the contributions of other scholars. (See the Bibliography.) The term "structuralism" was originally claimed by the Sneed school, see e.g., Balzer and Moulines (1996), but it also appears appropriate to subsume Ludwig's and Scheibe's programs under this title because of the striking similarities of the three approaches. The activities of the structuralists have been mainly confined to Europe, especially Germany, and, for whatever reasons, largely ignored in the Anglo-American discussion.

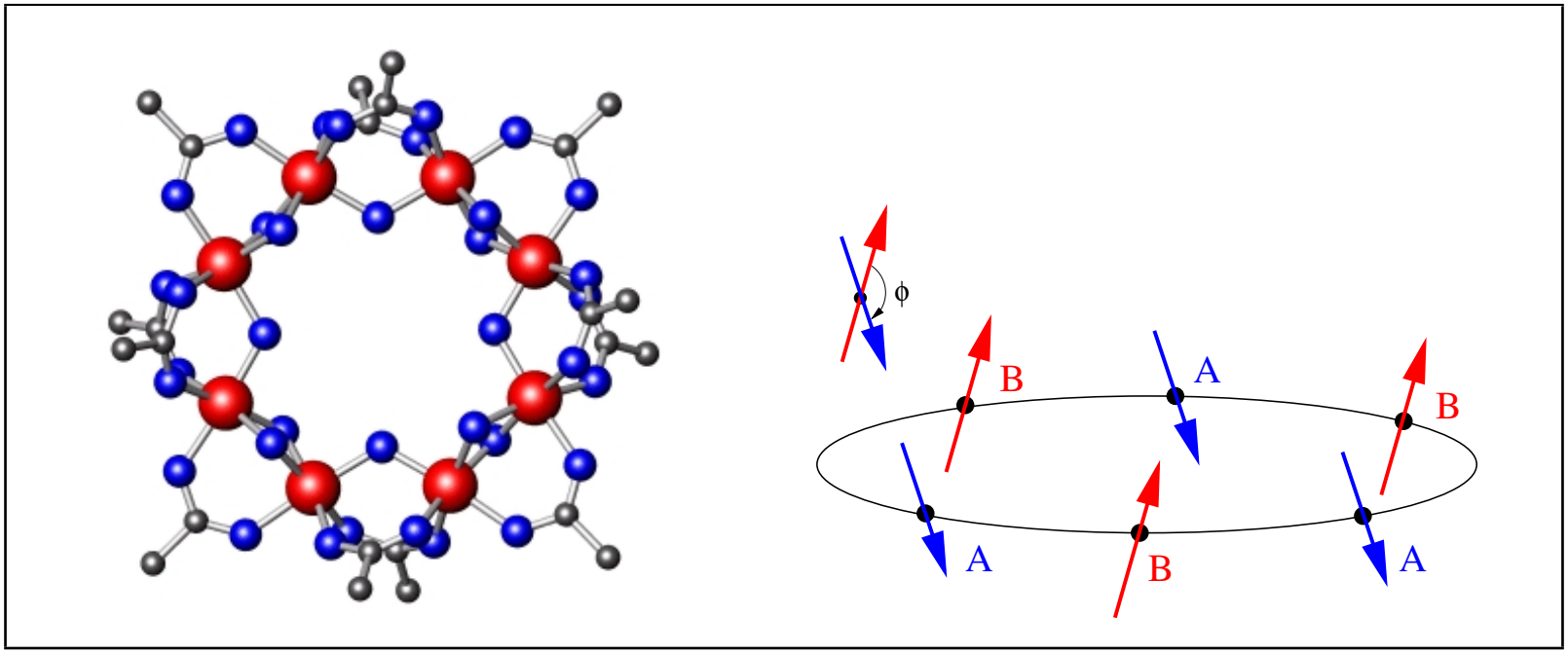
Acknowledgments

The author is indebted to John D. Norton, Edward N. Zalta, and Susanne Z. Riehemann for helpful suggestions concerning the content and the language of this entry.

Arbeitsgruppe im November 2001



Magnetische Moleküle



- Heisenberg-Modell (1): $\underset{\sim}{H} = -\sum_{i,j} J_{ij}\, \underset{\sim}{\vec{s}}(i) \cdot \underset{\sim}{\vec{s}}(j)$;

- Der molekulare Magnetismus hat uns im 4. Stock zusammengebracht (2).

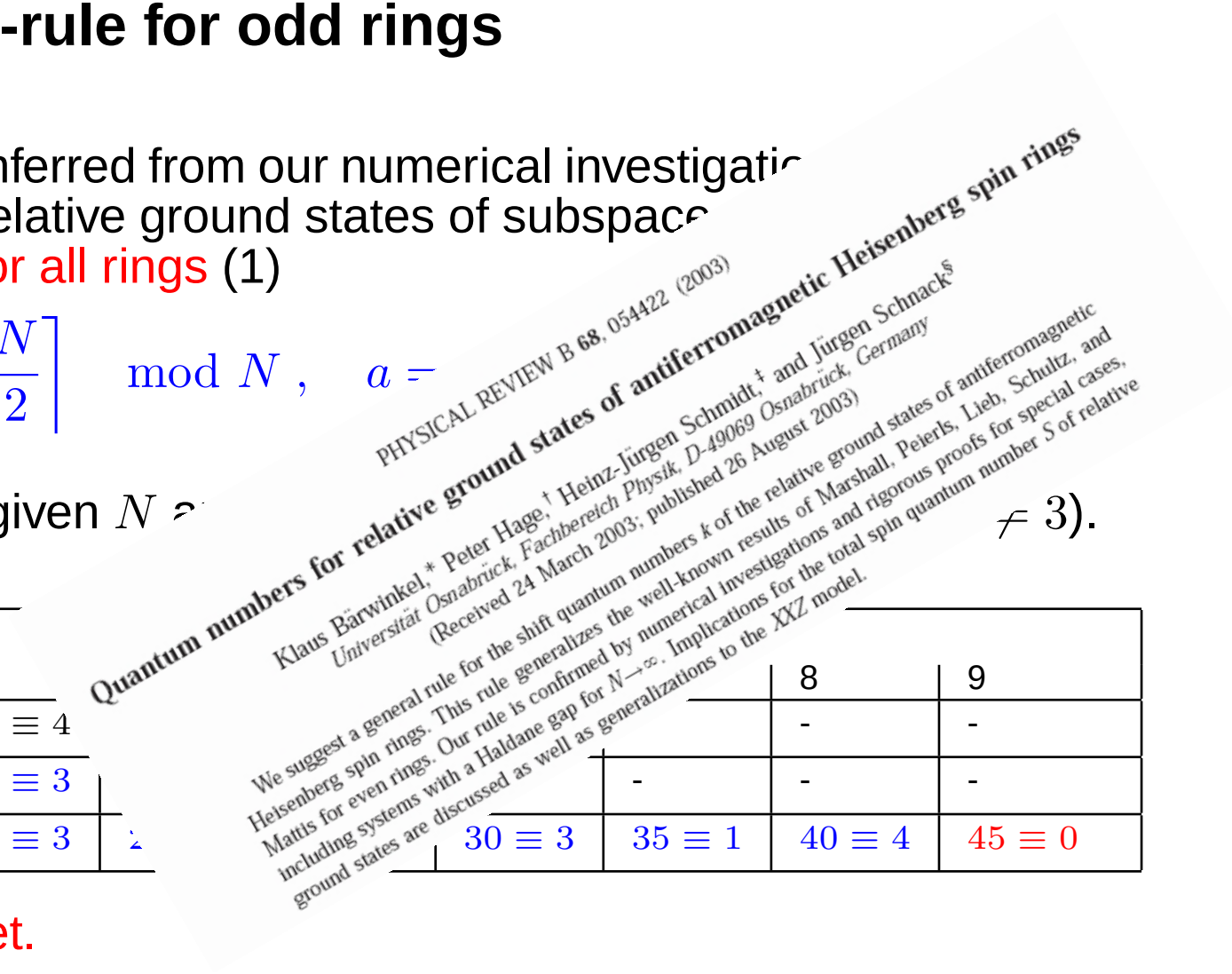
(1) W. Heisenberg, Z. f. Phys. **49**, 619 (1928)
(2) K. Bärwinkel, H.-J. Schmidt, and J. Schnack, J. Magn. Magn. Mater. **212**, 240 (2000)

k-rule for odd rings

- An extended k-rule can be inferred from our numerical investigati
  the k quantum number for relative ground states of subspac
  well as odd spin rings, i.e. for all rings (1)

$$k \equiv \pm a \left\lceil \frac{N}{2} \right\rceil \mod N , \quad a =$$

k is independent of s for a given N a $\neq 3$).


PHYSICAL REVIEW B **68**, 054422 (2003)

Quantum numbers for relative ground states of antiferromagnetic Heisenberg spin rings

Klaus Bärwinkel,* Peter Hage,† Heinz-Jürgen Schmidt,‡ and Jürgen Schnack§
Universität Osnabrück, Fachbereich Physik, D-49069 Osnabrück, Germany
(Received 24 March 2003; published 26 August 2003)

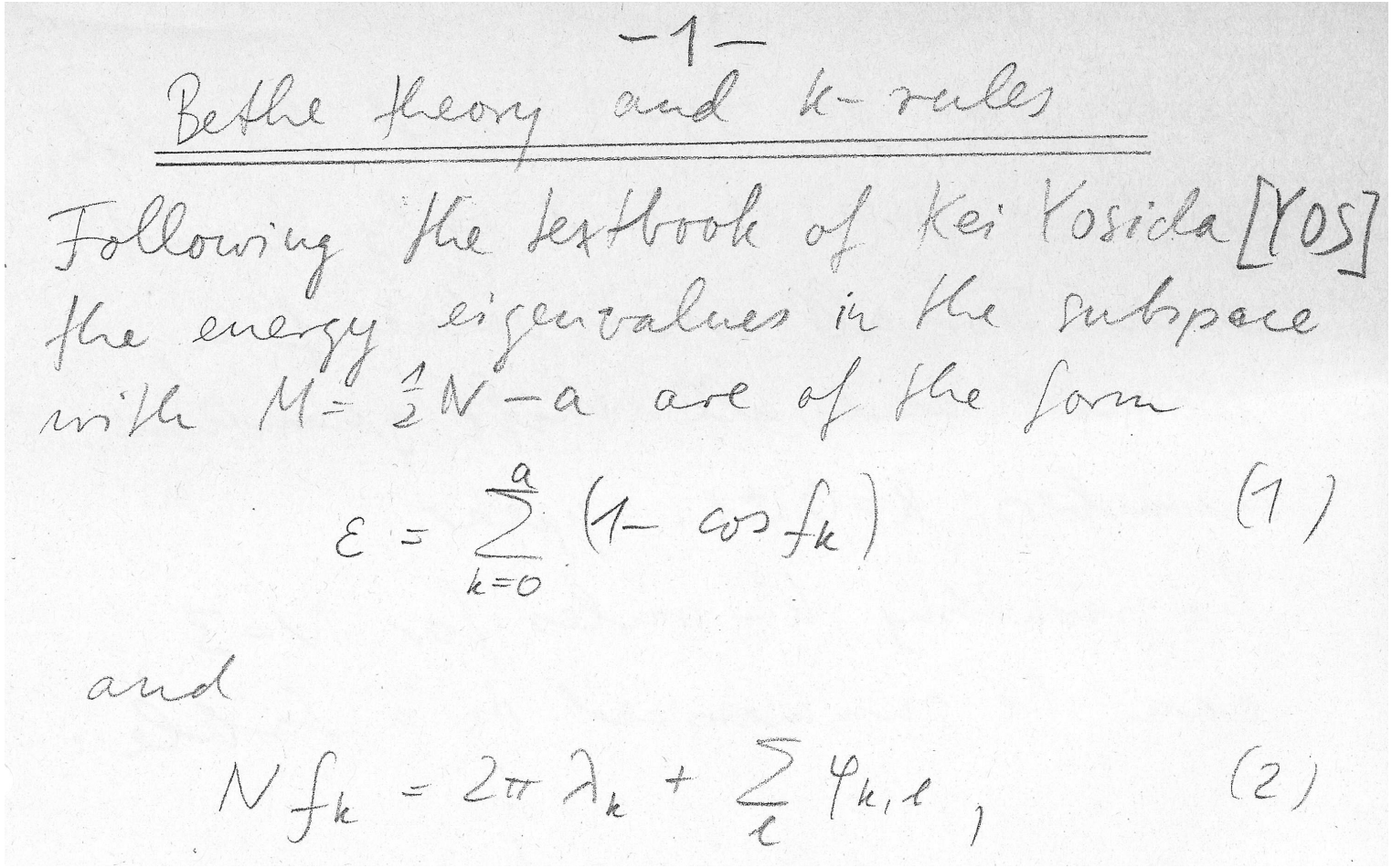
We suggest a general rule for the shift quantum numbers k of the relative ground states of antiferromagnetic Heisenberg spin rings. This rule generalizes the well-known results of Marshall, Peierls, Lieb, Schultz, and Mattis for even rings. Our rule is confirmed by numerical investigations and rigorous proofs for special cases, including systems with a Haldane gap for $N \to \infty$. Implications for the total spin quantum number S of relative ground states are discussed as well as generalizations to the XXZ model.

N	s	0	1	2	3				8	9
8	1/2	0	4	$8 \equiv 0$	$12 \equiv 4$				-	-
9	1/2	0	$5 \equiv 4$	$10 \equiv 1$	$15 \equiv 3$				-	-
9	1	0	$5 \equiv 4$	$10 \equiv 1$	$15 \equiv 3$	$20 \equiv 2$	$25 \equiv 0$	$30 \equiv 3$	$35 \equiv 1$	$40 \equiv 4$	$45 \equiv 0$

No general, but partial proof yet.

(1) K. Bärwinkel, P. Hage, H.-J. Schmidt, and J. Schnack, Phys. Rev. B **68**, 054422 (2003)

Originalnotizen



–1–

Bethe theory and k-rules

Following the textbook of Kei Yosida [YOS] the energy eigenvalues in the subspace with $M = \frac{1}{2}N - a$ are of the form

$$\varepsilon = \sum_{k=0}^{a} (1 - \cos f_k) \qquad (1)$$

and

$$N f_k = 2\pi \lambda_k + \sum_{\ell} \varphi_{k,\ell}\,, \qquad (2)$$

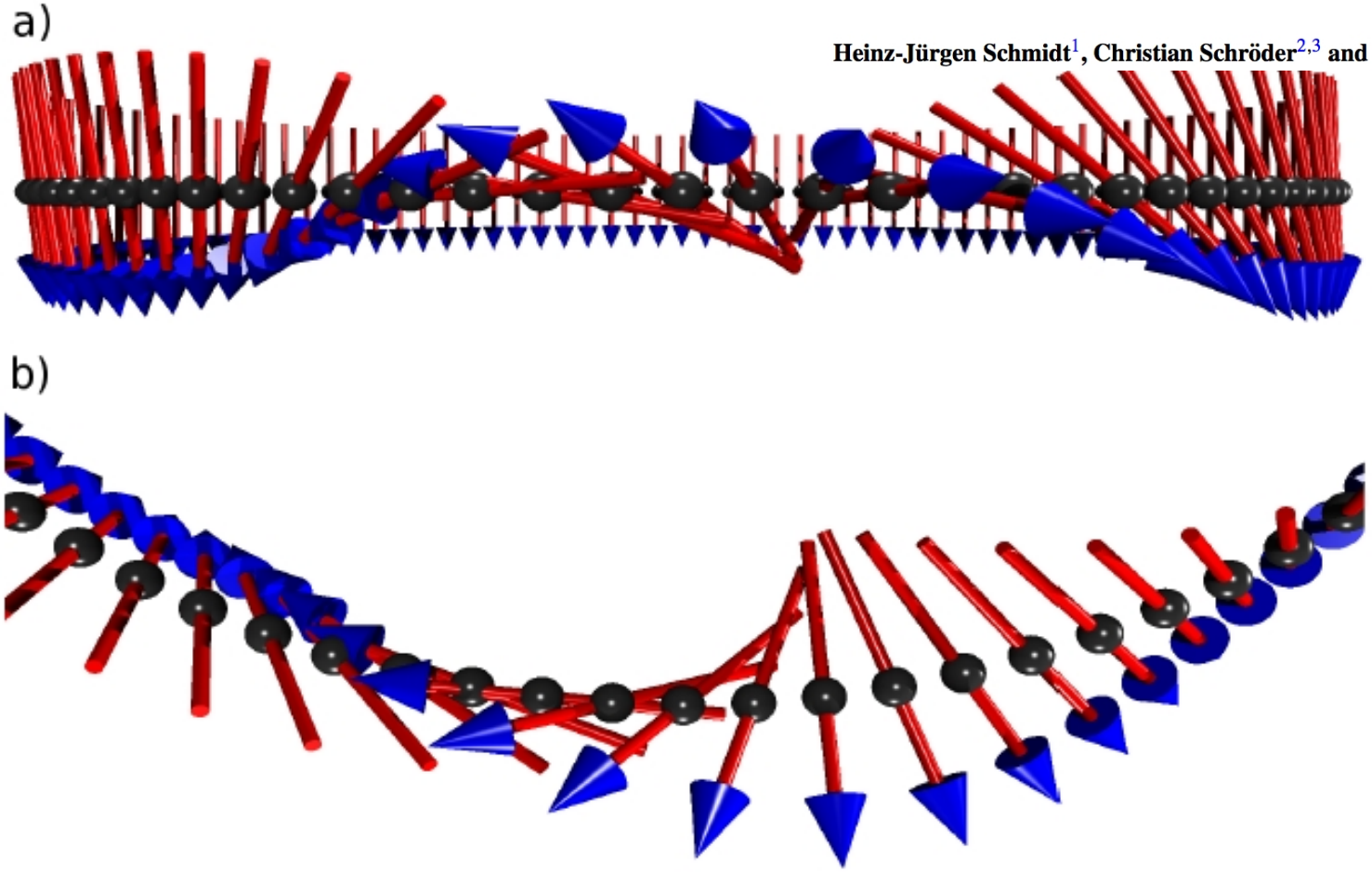
Arbeitsgruppe im August 2002

Du konntest mit jedem – 2004

IOP PUBLISHING JOURNAL OF PHYSICS: CONDENSED MATTER
J. Phys.: Condens. Matter **23** (2011) 386003 (12pp) doi:10.1088/0953-8984/23/38/386003

Modulated spin waves and robust quasi-solitons in classical Heisenberg rings

Heinz-Jürgen Schmidt[1], **Christian Schröder**[2,3] **and Marshall Luban**[3,4]



ELSEVIER

Physica A 265 (1999) 584–589

PHYSICA A

Thermodynamic fermion–boson symmetry in harmonic oscillator potentials

H.-J. Schmidt, J. Schnack *

Using the usual dependence on the inverse temperature β this property expresses itself as

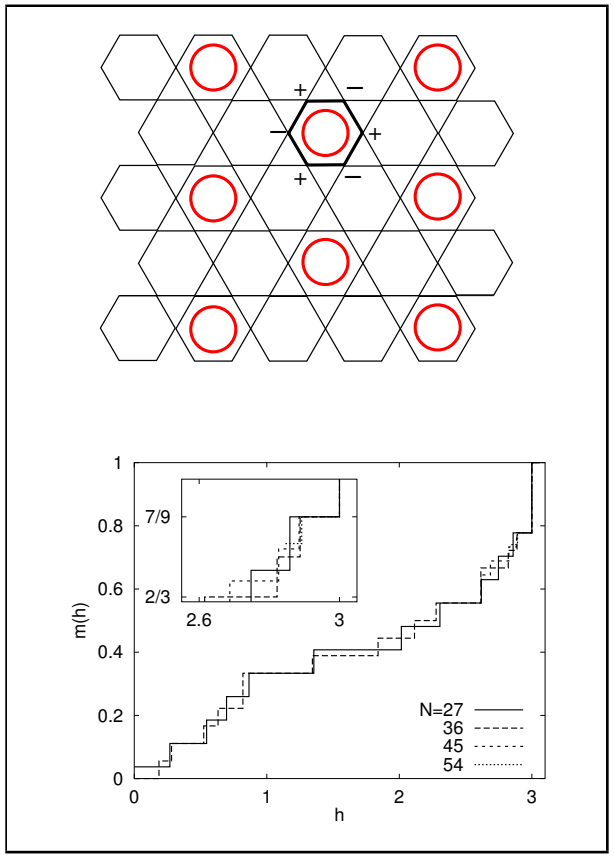
$$Z_N^+(\beta) = (-1)^N Z_N^-(-\beta)\,, \tag{11}$$

where the partition function with the negative argument has to be understood as the analytic continuation into the region of $y = \exp(-\beta\hbar\omega) > 1$. In thermodynamic mean values like mean energy or specific heat this symmetry also shows up

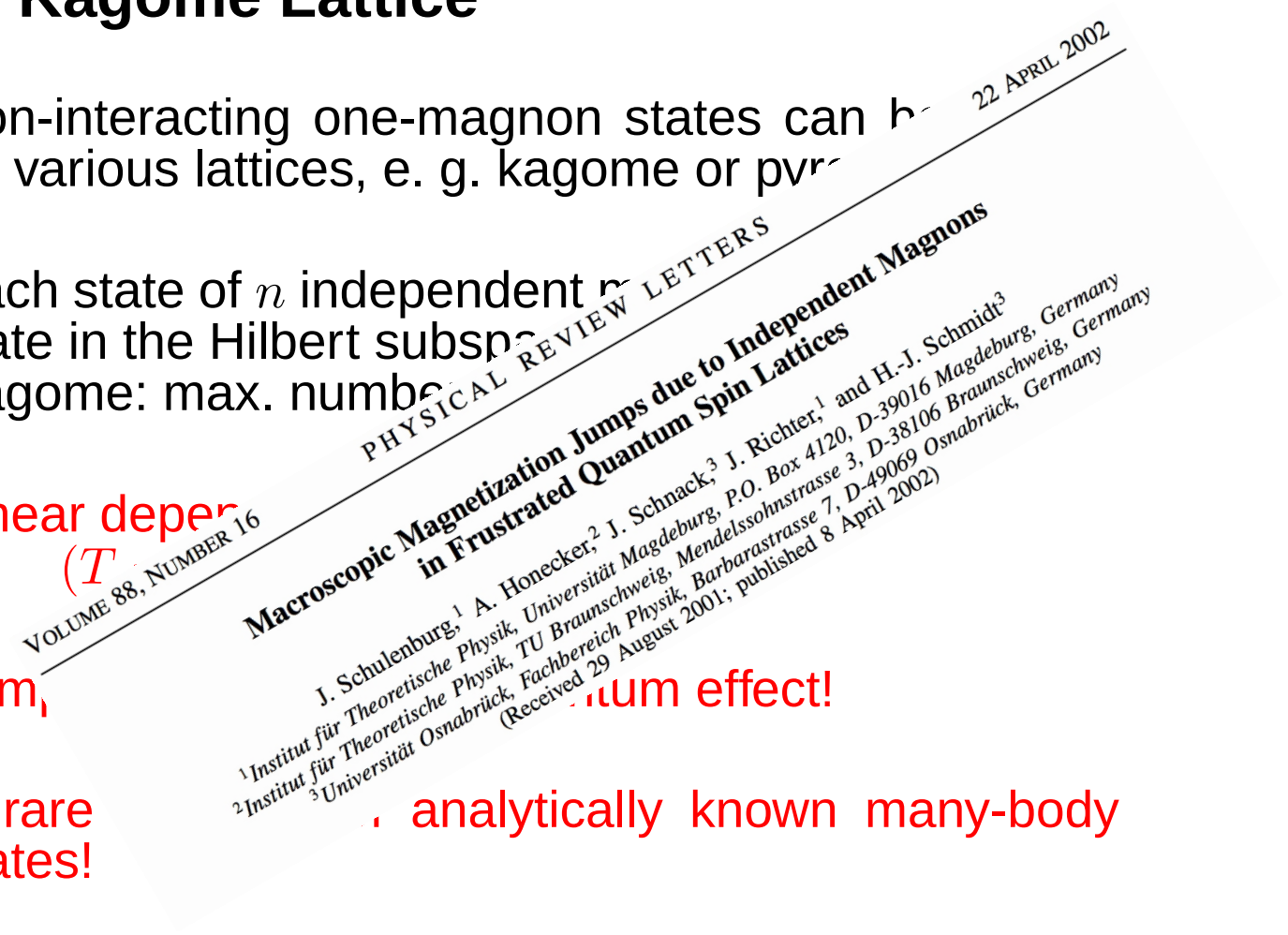
$$E_N^+(\beta) = -E_N^-(-\beta)\,, \qquad C_N^+(\beta) = C_N^-(-\beta)\,. \tag{12}$$

A straightforward application of the above result is to calculate fermionic partition functions and mean values by evaluating the respective bosonic ones at negative temperatures and thereby to avoid the sign problem.

Giant magnetization jumps in frustrated antiferromagnets III
Kagome Lattice



- Non-interacting one-magnon states can b… on various lattices, e. g. kagome or pyr…
- Each state of n independent m… state in the Hilbert subsp… Kagome: max. numbe…
- Linear depe… $\Rightarrow$ $(T$…
- Jum… …tum effect!
- A rare … analytically known many-body states!


PHYSICAL REVIEW LETTERS
VOLUME 88, NUMBER 16
22 APRIL 2002

Macroscopic Magnetization Jumps due to Independent Magnons in Frustrated Quantum Spin Lattices

J. Schulenburg,[1] A. Honecker,[2] J. Schnack,[3] J. Richter,[1] and H.-J. Schmidt[3]
[1]Institut für Theoretische Physik, Universität Magdeburg, P.O. Box 4120, D-39016 Magdeburg, Germany
[2]Institut für Theoretische Physik, TU Braunschweig, Mendelssohnstrasse 3, D-38106 Braunschweig, Germany
[3]Universität Osnabrück, Fachbereich Physik, Barbarastrasse 7, D-49069 Osnabrück, Germany
(Received 29 August 2001; published 8 April 2002)

J. Schnack, H.-J. Schmidt, J. Richter, J. Schulenburg, Eur. Phys. J. B **24**, 475 (2001)
J. Schulenburg, A. Honecker, J. Schnack, J. Richter, H.-J. Schmidt, Phys. Rev. Lett. **88**, 167207 (2002)

Persönliche Anmerkungen

Engagierte Lehre

voller Einsatz – selbstkritisch – kommunikativ

Workshop 2005

Ehrendoktorwürde für Marshall Luban 2006

Physica A 387 (2008) 4581–4588

Contents lists available at ScienceDirect

Physica A

journal homepage: www.elsevier.com/locate/physa

van der Waals revisited

Klaus Bärwinkel [a,1], Jürgen Schnack [b,*]

[a] Universität Osnabrück, Fachbereich Physik, D-49069 Osnabrück, Germany
[b] Universität Bielefeld, Fakultät für Physik, Postfach 100131, D-33501 Bielefeld, Germany

4. Summary

The summary of our elaboration is that for a large region of temperatures, the functions $\langle\langle F_{\pm}\rangle\rangle = a$ and $\langle\langle G_{\pm}\rangle\rangle = b$ may be nearly considered as constants, i.e. not dependant on temperature, see Fig. 1. Moreover, the respective kind of statistics (Bose–Einstein or Fermi–Dirac) does not matter. This constitutes a fermion-boson symmetry in non-ideal quantum gases. For ideal quantum gases such symmetries have been known for about ten years [8,9].

The slight residual dependence of a and b on temperature (cf. Fig. 1) reflects the fact that these are parameters not of an exact but of a model theory.

Acknowledgments

A long-standing collaboration with our colleague and friend Heinz–Jürgen Schmidt is gratefully acknowledged. This article is dedicated to him on the occasion of his 60th birthday.

Lieber Heinz-Jürgen,

in Zeiten, in denen jeder*

Daten fittet bis der Arzt kommt,

* Falls Sie es nicht selbst merken,
hier ist auch etwas Selbstkritik verborgen!

. . . hast Du mich fragen und denken gelehrt!

Vielen Dank für 9 schöne Jahre 1997 – 2006

Ich bin sicher, Dein Ruhestand wird zwar ruhig, aber intellektuell voll ausgefüllt sein.

Alles Gute!