

# JONATHAN P. HANKE

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<http://www.jonhanke.com>

- Employment** Associate Director of Research, INTECH (2012 - 2014)  
Assistant Professor, University of Georgia (2008 - 2012)  
Visiting Scientist, Max Planck Institute (2007 - 2008)  
Visiting Assistant Professor, Duke University (2006 - 2007)  
Assistant Research Professor, Duke University (2003 - 2006)  
Instructor, Princeton University (2002 - 2003)  
VIGRE Hill Assistant Professor, Rutgers University (1999 - 2002)
- Education** Princeton University, Princeton, NJ.  
Ph.D. in Mathematics, June, 1999.  
Dissertation under the supervision of Prof. Goro Shimura:  
*An Exact Mass Formula for Quadratic Forms over Number Fields.*  
State University of New York at Stony Brook, Stony Brook, NY.  
B.S. in Mathematics with Departmental Honors, June, 1995.
- Research** Probability, Stochastic processes, Number theory, Automorphic forms, Quadratic forms.
- Publications** *Probabilistic and Stochastic perspectives on instantaneously rebalanced constant-weighted portfolios in an antisymmetric two stock market*,  
<http://papers.jonhanke.com/constant-weighted-preprint.pdf>, 30 pages.  
*On  $K_4$  of the Gaussian and Eisenstein integers*,  
(with H. Gangl, P.E. Gunnells, A. Schurmann, M.D. Sikirić, and D. Yasaki)  
<http://arxiv.org/abs/1411.0584>, 10 pages.  
*On the cohomology of linear groups over imaginary quadratic fields*,  
(with H. Gangl, P.E. Gunnells, A. Schurmann, M.D. Sikirić, and D. Yasaki)  
<http://arxiv.org/abs/1307.1165>, 22 pages.  
*Algorithms for computing maximal lattices in bilinear (and quadratic) spaces over number fields*, “Diophantine Methods, Lattices, and the Arithmetic Theory of Quadratic Forms”,  
Contemporary Mathematics, Vol. 587 (2013) 111–130.  
*Enumerating maximal definite quadratic forms of bounded class number over  $\mathbb{Z}$  in  $n \geq 3$  variables*, <http://arxiv.org/abs/1110.1876>, 20 pages.  
*Explicit formulas for masses of ternary quadratic lattices of varying determinant over number fields*, <http://arxiv.org/abs/1109.1054>, 27 pages.  
*The structure of masses of rank  $n$  quadratic lattices of varying determinant over number fields*,  
<http://arxiv.org/abs/1108.3580>, 38 pages.  
*Notes on “Quadratic Forms and Automorphic Forms”*,  
“Quadratic and Higher Degree Forms”, Devel. in Math., Vol. 31 (2013), 109–168.  
*A proof of the  $S$ -genus identities for ternary quadratic forms*,  
(with A. Berkovich and W. Jagy)  
*Universal quadratic forms and the 290-theorem*, (with M. Bhargava)  
Accepted Invent. Math. 2005, mentioned in 2014 Fields Medal of M. Bhargava.  
*An exact mass formula for quadratic forms over number fields*,  
J. Reine Angew. Math. **584** (2005), 1–27.  
*Local densities and explicit bounds for representability by a quadratic form*  
Duke Math. J. **124** (2004), no. 2, 351–388.

*Some recent results about (ternary) quadratic forms,*  
*Number theory*, 147–164, CRM Proc. Lecture Notes 36, 2004.

*On a local-global principle for quadratic forms,*  
(unpublished preprint – 2003)

*On an exact mass formula of Shimura,* (with W.T. Gan and J.K. Yu),  
*Duke Math. J.* **107** (2001), no. 1, 103–133.

*An exact mass formula for quadratic forms over number fields,* Ph.D. Thesis, Spring 1999.

## Software

*ECLIB modifications to allow quadratic characters (joint with John Cremona),*  
Modified John Cremona's ECLIB libraries for computing weight 2 modular symbols  
for  $\Gamma_0(N)$  to allow a quadratic character. (in progress)  
<http://code.google.com/p/eclib-with-quadchar/>

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*Quadratic Forms Library II for the SAGE computer algebra system,*  
Added classes to compute with quadratic spaces, quadratic lattices, and squareclasses  
over local and global fields, with advanced local-global and maximal lattice finding  
functionality over the rationals. This is used to enumerate all definite lattices in  $n \geq 3$   
variables over the rationals.  
Available as Ticket #11940 at <http://trac.sagemath.org/>  
 $\approx$  11,500 lines of Python Code

*Quadratic Forms Library for the SAGE computer algebra system,*  
Adds a quadratic form class that allows basic functionality for working with quadratic  
forms over rings, and advanced functionality for quadratic forms over the integers and  
rationals.  
Tickets #4470, 5418, and 5954 at <http://trac.sagemath.org/>  
Released March 2009, distributed in SAGE versions  $\geq 3.4$ ,  
 $\approx$  22,000 lines of Python Code

*Theta function Eigenform Decompositions in MAGMA,*  
Developed and wrote routines to decompose the theta series of a definite quadratic form  
in four variables as an explicit sum of normalized Hecke eigenforms, and to compute the  
normalizing coefficients in this decomposition.  
Released in June 2011, distributed at  
<http://code.google.com/p/theta-eigenform-decomposition--magma/>  
 $\approx$  1,500 lines of MAGMA Code

*Quadratic Forms Library in C++,*  
Developed and wrote routines which compute quadratic form local densities at all primes,  
determines all numbers represented by a positive definite integer-valued quadratic form  
in 4 variables, and establishes simple finiteness theorems.  
Distributed at <http://code.google.com/p/qflib/>  
 $\geq$  20,000 lines of C++ Code

*Quadratic Forms Library in Pari/GP,*  
Routines to compute local densities of integer-valued quadratic forms, decompose  
its theta series into Eisenstein and cuspidal parts, and compute simple decompositions  
into normalized Hecke eigenforms. (unpublished)

## Awards and Prizes

**National Science Foundation Grant DMS-0603976 (Aug. 2006 – Aug. 2010)**

**NSA Young Investigator Grant H98230-04-1-0076 (Feb. 2005 – Aug. 2006)**

**Alfred P. Sloan Dissertation Fellow (1998–1999)**

**National Science Foundation Graduate Fellow (1995–1998)**