NATASHA FLYER - CURRICULUM VITAE

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RESEARCH INTERESTS

- **Computational Mathematics – Numerical Analysis**
  - Spectral and high-order methods
  - Initial-boundary value problems (IBVPs)
  - Radial basis functions
  - Highly nonlinear PDEs
  - Development of hybrid asymptotic/numerical schemes for multi-scale phenomena
- **Mathematical Modeling**
  - Coronal mass ejections
  - Nonlinear wave propagation

EDUCATION

1999 Ph.D. University of Michigan, Ann Arbor
1993 A.B. Northwestern University, Evanston, IL

EMPLOYMENT HISTORY

2003-present Scientist
National Center for Atmospheric Research (NCAR)

2000-2003 NSF Postdoctoral Fellow
Dept. of Applied Mathematics
University of Colorado, Boulder

1999-2000 NCAR Postdoctoral Fellow
Advanced Studies Program

FELLOWSHIPS & HONORS

2000-2003 **NSF** Postdoctoral Fellowship
1999-2000 **NCAR** Postdoctoral Fellowship
1995-1998 **NASA** Graduate Student Research Fellowship (only 4 awarded in all of USA in 1995)
1993-1994 University of Michigan Regents Fellowship
1998 University of Michigan Distinguished Achievement Award
1993 Phi Beta Kappa Honor Society
1993 Northwestern University Award for Outstanding Scientific Accomplishment

INVITED PRESENTATIONS

"*Corner Singularities for Initial -Boundary Value Problems - Illustration and Remedy for the 1-D Heat Equation.*", Dept. of Mathematics, Hong Kong Baptist University**,** 2002.
"*Convergence of Spectral and Finite-Difference Methods for Initial-Boundary Value Problems* ." , Dept. of Mathematics, Hong Kong Baptist University**,** 2002.
"*Accurate Numerical Resolution of Transients for Convection-Diffusion Equations*", Dept. of Scientific Computing, Uppsala University, Sweden, 2002.
"*Radial Basis Functions: A New Technique for Solving PDEs* ", NSF Review, Dept. of Applied Math, University of Colorado, Boulder, 2001.
"*Radial Basis Functions: The basics and why they are so hot*", 12th Applied Math Forum of South Korea, 2004.
"*The Elusive Time-Space Corner Singularity: The Nature of Initial-Boundary Value Problems*", given at KAIST, Taegon and Dept. of Mathematics, Kyungpook Natl. Univ., Taegu, South Korea, 2004, and Colorado School of Mines 2004.
"*Applications of asymptotics to geophysical fluid dynamics*", Uppsala University, Sweden, June 2005.

"*The Nature of Initial-Boundary Value Problems and their ramifications on high order methods*", Dept. of Mathematics , University of Utah, Salt Lake City, January 2006.
" *Solving hyperbolic PDEs in spherical geometry with radial basis functions*", Korean SIAM Annual Meeting, May 27th, 2006.
"*Transport schemes on a sphere using radial basis functions* ", Uppsala University, Sweden, June 2006.
"*Modeling simple atmospheric flows on a sphere using radial basis functions* ", CU-Boulder, April 2007.

EDUCATION AND OUTREACH

- Mentoring of post-docs and graduate students (currently serve on 5 Ph.D thesis committees)
- Aid undergraduates in developing and coding mathematical models of geophysical phenomena
- Volunteer of NCAR's educational outreach program to high schools and middle schools

LANGUAGES

Foreign: Spanish, Serbo-Croatian, French, Swedish
Computer: Matlab, Mathematica, Maple, Fortran

GRANTS

NSF/NCAR Opportunity Fund 2005-2008: PI Natasha Flyer, $163,450
Developing High-Precision Numerical Prototypes for Space-Weather Prediction

NSF Collaboration in Mathematical Geosciences 2006-2009: PI Natasha Flyer, $513,152
Freedom from Coordinate Systems, and Spectral Accuracy with Local Refinement: Radial Basis Functions for Climate & Space-Weather Prediction

PUBLICATIONS (all refereed journals)

- **Natasha Flyer** and Grady Wright, *Solving the nonlinear shallow water wave equations using radial basis functions*, in progress.
- Mei Zhang and **Natasha Flyer,** *Magnetic helicity upper bounds of force-free fields: The dependence on boundary conditions*, in progress.
- **Natasha Flyer** and Athanassios S. Fokas, *A new method for the numerical integration of evolutionary partial differential equations*, submitted, IMA J. App. Math., 2007
- B.C. Low and **Natasha Flyer**, *The topological nature of boundary value problems for force-free magnetic fields*, accepted, ApJ., 2007
- **Natasha Flyer** and Grady Wright, *Transport schemes on a sphere using radial basis functions*, submitted, J. Comp. Phys., 2007.
- Bengt Fornberg, **Natasha Flyer**, Susan Hovde, Cecile Piret, *Localization properties of radial basis function expansion coefficients for cardinal interpolation. I. Equispaced nodes*, accepted, IMA J Numer. Anal., 2007.
- Mei Zhang, **Natasha Flyer**, B.C. Low, *Magnetic field confinement in the corona: The role of magnetic helicity accumulation*, ApJ, 644(1), p. 575-586, 2006.
- **Natasha Flyer**, *Exact polynomial reproduction for oscillatory radial basis functions on infinite lattices*, Comp. Math. Appl., 51 (8): 1199-1208, 2006.
- Bengt Fornberg and **Natasha Flyer,** The Gibbs Phenomenon for Radial Basis Functions, submitted as book chapter in *The Gibbs Phenomenon in Various Representations and Applications* , 2005, ed. A. Jerri, Sampling Publishing, Potsdam, NY.

- **Natasha Flyer**, Bengt Fornberg, Steve Thomas and B.C. Low, *Magnetic field confinement in the solar corona. II. The weight of plasmas*, ApJ, 631, 1 October 2005, p.1239

- **Natasha Flyer**, Bengt Fornberg, Steve Thomas and B.C. Low, *Magnetic field confinement in the solar corona. I. Force-free fields*, The Astrophysical Journal (ApJ) , 606, 10 May 2004, p.1210.

- Bengt Fornberg and **Natasha Flyer** , *Accuracy of radial basis function interpolation and derivative approximations in 1-D.*, Adv. Comp. Math. , Volume 23, Issue 1-2, Jul 2005, p. 5.

- **Natasha Flyer** and Bengt Fornberg, *On the nature of initial-boundary value solutions for dispersive equations*, SIAM J. Applied Math., Vol. 64 (2), 2004, pp. 546-564.

- **Natasha Flyer** and Bengt Fornberg, *Accurate numerical solution of initial transients in convective-diffusive equations*, J. Comp. Phys, vol 184(2), 2003, pp 526 -539.

- **Natasha Flyer** and N. Swarztrauber, *Convergence of spectral and finite difference methods for initial-boundary value problems*, SIAM J. Scientific Computing, 2002, Vol. 23 (5), pp. 1731-1751.

- John P. Boyd and **Natasha Flyer**, *Compatibility conditions for time-dependent partial differential equations and the rate of convergence of Chebyshev and Fourier spectral methods*, Comp. Meth. Appl. Mech. Eng., 175(1999), 281-309.

- Konstantin Kabin and **Natasha Flyer** (translation), *Reminiscences about difference schemes by Sergei Konstantinovich Godunov*, J. Comp. Phys., July 1999, pp. 6-25.

- **Natasha Flyer**, *Asymptotic upper bounds for the coefficients in the Chebyshev series expansion for a general order integral of a function*, Math. Comp., 67 (1998), 1601-1616.

- **Natasha Flyer**, *The Effect of Upper Level Features in The Atmosphere on Linear Theory and Linearized BDO Theory for Internal Gravity Waves*, Ph.D Thesis, 1999, University of Michigan, Ann Arbor.