

# Xiong Ding

PH.D. STUDENT · PHYSICS RESEARCHER

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## Education

### Georgia Institute of Technology

Atlanta, GA, USA

Ph.D. in Physics

Aug. 2012 – Jun 2017

- adviser: Prof. Predrag Cvitanović
- Research area : cycle expansion theory in nonlinear dynamics and soliton explosion in cubic quintic Ginzburg-Landau equation

### Georgia Institute of Technology

Atlanta, GA, USA

M.S. in Computer Science & Engineering

Jan.2016 – Jun. 2016

- Interested area : High Performance Computing
- GPA: 3.86/4.0

## Skills

**Programming :** **Proficient :** C/C++, Python, Matlab; **Familiar :** Java, Fortran

**Tools :** Bash, Perl, Awk, Latex

**Libraries :** Boost.Python, Eigen, LAPACK, ARPACK, OpenMPI, FFTW, HDF5

**Web :** Django with Python, CSS, HTML

## Employment & Teaching Experience

### Center for Nonlinear Science, School of Physics, Georgia Institute of Technology

Atlanta, GA, USA

Research Assistant

2013 – Present

- Apply cycle expansion theory into high dimensional nonlinear dispative dynamical systems.
- Numerical algorithm to calculate Floquet vectors with high accuracy.
- Soliton explosion in cubic quintic Ginzburg-Landau equation.

### Center for Nonlinear Science, School of Physics, Georgia Institute of Technology

Atlanta, GA, USA

Teaching Assistant

2012 – 2013

- Guide undergraduate students in physical experiments.

### Online course : Geometry of chaos

[www.chaosbook.org/course1](http://www.chaosbook.org/course1)

Teaching Assistant

2015 Spring

- Design Homework for 16 weeks and answer questions on Piazza forum.
- Design and implement online autograder.

## Projects

### COMPUTER SCIENCE RELATED

#### Online course : Geometry of Chaos

Atlanta, GA, USA

**Project :** Online autograder

Sprint 2015

- **main goal :** Auto grade students' online submissions and email back their grades. Also, it provides a straightforward interface for the customer (the course instructor) to view the grades online.
- **Framework :** Django in Python, deployed in Heroku **Repository :** <https://github.com/dingxiong/phys7224>

#### Course project: Gatech CS6491 Computer Graphics

Atlanta, GA, USA

**Project :** Triangular Mesh

Fall 2015

- **main goal :** Represent a triangular mesh by **CSX** table, and implement navigating methods on the mesh, such as swing, opposite, left, right and so on. Also 4 interesting problems are defined and solved: **geodesic path**, **Gaussian decay swirl**, **lasso deletion** and **mesh cut**.
- **Toolbox :** Processing **Repository :** <https://github.com/dingxiong/triangularMesh> **Demo :** <https://youtu.be/mWe0YO1bbZ4>

## Course project: Gatech CS6210 Advanced Operating System

Atlanta, GA, USA

**Project :** RPC-Based Proxy Server

Spring 2015

- **main goal :** Build a proxy server by remote procedure call(RPC) and test the performance of four different cache policies : no cache, Least Recent Used (LUR), random, and First in First out (FIFO). RPC framework is provided by **Apache Thrift** library.
- **Language :** C++    **Repository :** <https://github.com/dingxiong/CS6210Project3>

## Course project: Gatech CS6290 High Performance Computer Architecture

Atlanta, GA, USA

**Project :** Cache Design for Four Different Traces

Summer 2014

- **main goal :** Design and implement a parametric cache simulator and use it to design data caches well suited to the SPEC benchmarks. Variables include  $2^C$  bytes of cache size,  $2^S$  blocks with each block  $2^{C-S}$  bytes, storage policies (ST) and replacement policies (R).
- **Language :** C++    **Repository :** <https://github.com/dingxiong/cacheDesign>

## PHYSICS RELATED

### Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

**Project :** Computation of Floquet vectors in Kuramoto-Sivashinsky system

2013-2014

- **Main result:** The Floquet multipliers of Periodic orbits in high dimensional system usually spans a large orders of magnitudes. The periodic eigendecomposition is the right tool to obtain Floquet spectrum and vectors to high accuracy. See paper[2] for more detail.

### Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

**Project :** Investigation of the local dimension of inertial manifolds in chaotic systems

2014-2015

- **Main result:** By studying the shadowing cases of periodic orbits in Kuramoto-Sivashinsky system, we show strong evidence that the inertial manifold has dimension 8. see paper [1] for more details.

### Center for Nonlinear Science, School of Physics, Georgia Tech

Atlanta, GA, USA

**Project :** Symbolic dynamics in symmetry reduced 1-d Kuramoto-Sivashinsky system

2015-PRESENT

- In the symmetry reduced state space, the attractor of 1-d Kuramoto-Sivashinsky system is low dimensional. By constructing appropriate Poincaré section, we propose to obtain the symbolic dynamics.

## MATHEMATICS RELATED

### School of Mathematics, Georgia Tech

Atlanta, GA, USA

**Project :** Integration of soliton explosion with local error control in cubic quintic Ginzburg-Landau system

Sprint 2016

- **Adviser :** Prof. Sung Ha Kang
- **Main result:** add time step control into a few popular exponential integrators. See paper [3].

## Conferences & Talks

### SIAM Conference on Application of Dynamical Systems

Snowbird, Utah, USA

**Talk :** Periodic Eigendecomposition and Its Application in Nonlinear Dynamics

May 2015

- Coauthor: Prof. P. Cvitanović

### Dynamics Days US

Atlanta, GA, USA

**Poster :** Lyapunov exponents, Floquet exponents and covariant vectors in Kuramoto-Sivashinsky equation

Jan. 2014

- Coauthor: Prof. P. Cvitanović

### SIAM Student Chapter Seminar

Atlanta, GA, USA

**Talk :** Periodic Eigendecomposition and its application in nonlinear dynamics

Sep. 2014

- Coauthor: Prof. P. Cvitanović

## Publications

[1] **X.Ding**, H. Chaté, P. Cvitanović, E. Siminos, and K. A. Takeuchi , *Estimating the dimension of an inertial manifold from unstable periodic orbits* , *Phys. Rev. Lett.* **117**, 024101 (2016)

[2] **X. Ding** and P. Cvitanović , *Periodic Eigendecomposition and its application in Kuramoto-Sivashinsky system* , *SIAM J. Appl. Dyn. Syst.* **15**, 1434–1454 (2016)

[3] **X. Ding** and S. H. Kang , *Integration of a cubic-quintic complex Ginzburg–Landau exploding soliton* , *In preparation* (2016)

[4] **X. Ding** and P. Cvitanović , *Periodic orbit explosion and its symmetry reduced state space visualization* , *In preparation* (2016)

[5] **X. Ding** and P. Cvitanović , *Symbolic dynamics and analysis of Kuramoto-Sivashinsky attractor* , *In preparation* (2016)