

Neer Asherie

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EDUCATION

Massachusetts Institute of Technology

Cambridge, MA

- Ph.D. in Physics, awarded February 1998.
- Thesis Title: “The phase diagram of protein solutions: The role of the range of interaction.”
- Theoretical modeling, computer simulations and experimental investigation of the thermodynamic properties of protein solutions.
- Advisor: Prof. G.B. Benedek

University of Cambridge (*Gonville and Caius College*)

Cambridge, England

- B.A. in Natural Sciences (Physical) with First (Highest Distinction), awarded June 1991.
- Broad curriculum in physical sciences (physics, mathematics, chemistry, crystalline materials and computing) with emphasis on mathematical physics. Senior Thesis: “The mass of the top quark.”
- M.A. awarded March, 1995.

RESEARCH INTERESTS

- The study of the phase behavior of biological macromolecules.
- The development of a rational approach to protein crystallization.

RESEARCH EXPERIENCE

Massachusetts Institute of Technology

Cambridge, MA

Research Associate: May 2001-present

- Determining the phase diagram of globular proteins.
- Evaluating the effect of polyethylene glycol on protein interactions.
- Simulating phase behavior of proteins with highly anisotropic interactions.
- Used Monte Carlo simulations to study liquid-solid transitions in nuclei of model protein crystals.
- Examined the mechanism of enhanced crystal nucleation in recombinant mutant proteins.

Postdoctoral Associate: February 1998-April 2001

- Elucidated mechanism for the formation of three human genetic cataracts.
- Developed computationally tractable model for aeolotopic protein interactions.
- Examined self-assembly of helical ribbons in solutions of chiral amphiphiles.
- Synthesized and studied oligomers of phase-separating proteins.
- Co-Investigator on funded NASA research proposal.

Research Assistant: June 1994-January 1998

- Investigated role of interaction range in phase diagrams of colloids.
- Developed computer simulations to analyze protein phase separation.
- Studied mixtures of eye-lens proteins both theoretically and experimentally.

Research Assistant: September 1991-May 1994

- Analyzed mechanism for cyclotron emission in fusion plasmas.

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PUBLICATIONS

1. A. Lomakin, N. Asherie and G.B. Benedek, "Liquid-solid transition in nuclei of protein crystals," *Proc. Natl. Acad. Sci.* **100**, 10254-10257 (2003).
2. A. Basak, O. Bateman, C. Slingsby, A. Pande, N. Asherie, O. Ogun, G.B. Benedek and J. Pande "High resolution x-ray crystal structures of human γ D crystallin and the R58H mutant associated with aculeiform cataract," *J. Mol. Biol.* **328**, 1137-1147 (2003).
3. O. Annunziata, N. Asherie, A. Lomakin, J. Pande, O. Ogun and G.B. Benedek, "Effect of polyethylene glycol on the liquid-liquid phase transition in aqueous protein solutions," *Proc. Natl. Acad. Sci. USA* **99**, 14165-14170 (2002).
4. N. Asherie, J. Pande, A. Pande, J.A. Zarutskie, J. Lomakin, A. Lomakin, O. Ogun, L.J. Stern, J. King and G.B. Benedek, "Enhanced crystallization of the Cys18 to Ser mutant of bovine γ B crystallin," *J. Mol. Biol.* **314**, 663-669 (2001).
5. A. Pande, J. Pande, N. Asherie, A. Lomakin, O. Ogun, J. King and G.B. Benedek, "Crystal Cataracts: Human genetic cataract caused by protein crystallization," *Proc. Natl. Acad. Sci. USA* **98**, 6116-6120 (2001).
6. A. Pande, J. Pande, N. Asherie, A. Lomakin, O. Ogun, J.A. King, N.H. Lubsen and G.B. Benedek, "Molecular basis of a progressive juvenile-onset hereditary cataract," *Proc. Natl. Acad. Sci. USA* **97**, 1993-1998 (2000).
7. A. Lomakin, N. Asherie and G.B. Benedek, "Aeolotopic interactions of globular proteins," *Proc. Natl. Acad. Sci. USA* **96**, 9465-9468 (1999).
8. Y.V. Zastavker, N. Asherie, A. Lomakin, J. Pande, J.M. Donovan, J.M. Schnur and G.B. Benedek, "Self-assembly of helical ribbons," *Proc. Natl. Acad. Sci. USA* **96**, 7883-7887 (1999).
9. N. Asherie, J. Pande, A. Lomakin, O. Ogun, S.R.A. Hanson, J.B. Smith and G.B. Benedek, "Oligomerization and phase separation in globular protein solutions," *Biophys. Chem.* **75**, 213-227 (1998).
10. N. Asherie, A. Lomakin and G.B. Benedek, "Phase diagram of colloidal solutions," *Phys. Rev. Lett.* **77**, 4832-4835 (1996).
11. A. Lomakin, N. Asherie and G.B. Benedek, "Monte Carlo study of phase separation in aqueous protein solutions," *J. Chem. Phys.* **104**, 1646-1656 (1996).
12. C. Liu, N. Asherie, A. Lomakin, J. Pande, O. Ogun and G.B. Benedek, "Phase separation in aqueous solutions of lens γ -crystallins: special role of γ S," *Proc. Natl. Acad. Sci. USA* **93**, 377-382 (1996).
13. C. Liu, A. Lomakin, G.M. Thurston, D. Hayden, A. Pande, J. Pande, O. Ogun, N. Asherie and G.B. Benedek, "Phase separation in multicomponent aqueous protein solutions," *J. Phys. Chem.* **99**, 454-461 (1995).

MANUSCRIPTS IN PREPARATION

1. N. Asherie, "Protein crystallization and phase diagrams," in *Methods: A Companion to Methods in Enzymology* (invited chapter, to be published in May 2004; editor A. McPherson).
2. N. Asherie, A. Lomakin and G.B. Benedek, "Anisotropic interactions and liquid-liquid phase separation in protein solutions."
3. J. Pande, A. Pande, N. Asherie, C. Haase-Pettingell, S. Betts, O. Ogun, J. King, G.B. Benedek, "The role of specific cysteine residues of lens γ B crystallin in the aggregation and phase separation behavior of the protein."
4. A. Pande, O. Annunziata, N. Asherie, O. Ogun, G.B. Benedek and J. Pande, "Molecular basis for the human genetic cataract linked to the P23T mutant of human γ D crystallin."

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INVITED TALKS

- “Macromolecular Solutions: Properties, Interactions and Crystal Nucleation,” *Session Chair*, American Crystallographic Association, Annual Meeting, Covington, KY, July 2003.
- “Understanding protein phase behavior,” presented at the following places:
 - i. Department of Physics, University of South Florida, Tampa, FL, March 2003.
 - ii. Department of Physics, University of California, Santa Barbara, CA, February 2003.
 - iii. Division of Engineering and Applied Sciences, Harvard University, Cambridge, MA, January 2003.
- “Phase transitions in protein solutions,” Modern Optics and Spectroscopy Seminar, Massachusetts Institute of Technology, Cambridge, MA, October 2002.
- “The role of anisotropic interactions in protein phase behavior,” American Crystallographic Association, Annual Meeting, San Antonio, TX, May 2002.
- “The phase behavior of globular protein solutions,” presented at the following places:
 - i. Collège Propédeutique, University of Lausanne, Lausanne, Switzerland, March 2002.
 - ii. Department of Physics, University of Oxford, Oxford, United Kingdom, February 2002.
 - iii. Department of Physics, Rice University, Houston, TX, January 2002.
- “The phase diagram of globular protein solutions,” presented at the following places:
 - i. Laboratory for Chemical Physics, National Institutes of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, MD, January 1998.
 - ii. Center for Bio/Molecular Science and Engineering, Naval Research Laboratory, Washington, DC, November 1997.
 - iii. Interdisciplinary Workshop on Phase Transformations Occurring in Solutions of Biological Molecules, Massachusetts Institute of Technology, Cambridge, MA, October 1997.
- “Stable and metastable states in protein solutions: Why the anomalous order of phases?” Condensed Matter Seminar, Massachusetts Institute of Technology, Cambridge, MA, April 1997.

ORAL PRESENTATIONS

- **N. Asherie**, A. Lomakin and G.B. Benedek, “Liquid-solid transition in nuclei of protein crystals,” 13th New England Workshop on Complex Fluids, Cambridge, MA (Harvard University), December 2002.
- **N. Asherie**, A. Lomakin and G.B. Benedek, “The role of anisotropic interactions in protein phase behavior,” XIVth International Biophysics Congress, Buenos Aires, Argentina, April 2002.
- **N. Asherie**, “The phase diagram of the γ -crystallins,” New England Quarterly Workshop on Complex Fluids, Cambridge, MA (Massachusetts Institute of Technology), September 2000.
- **N. Asherie**, A. Lomakin and G.B. Benedek, “The phase diagram of globular protein solutions,” American Crystallographic Association, Annual Meeting, Buffalo, NY, May 1999; American Physical Society, Centennial Meeting, Atlanta, GA, March 1999.
- **N. Asherie**, A. Lomakin and G.B. Benedek, “The phase diagram of aqueous protein solutions,” Materials Research Society, Fall Meeting, Boston, MA, December 1996; New England Section of the American Physical Society, Cambridge, MA, April 1996.

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POSTER PRESENTATIONS

- **N. Asherie**, A. Lomakin and G.B. Benedek, “The role of anisotropic interactions in protein phase behavior,” Biophysical Society, 46th Annual Meeting, San Francisco, CA, February 2002.
- **N. Asherie** J. Pande, A. Pande, J. Lomakin, A. Lomakin, O. Ogun, J. King and G.B. Benedek, “The phase behavior of the C18S mutant of bovine γ B crystallin,” Biophysical Society, 45th Annual Meeting, Boston, MA, February 2001.
- **N. Asherie**, A. Lomakin and G.B. Benedek, “The phase diagram of globular protein solutions,” Biomaterials and Complex Fluids Conference, Brandeis University, Waltham, MA, October 1997.
- **N. Asherie** and B. Coppi, “Theoretical analysis of the emissions at the cyclotron frequency harmonics of fusion produced alpha particles,” International Sherwood Fusion Theory Conference, Newport, RI, March 1993.

TEACHING INTERESTS

- To develop a course in biological physics.
- To construct introductory physics courses that combine lectures, tutorials and laboratory work.

TEACHING EXPERIENCE

Massachusetts Institute of Technology

Cambridge, MA

- Member of School of Science Teaching Committee (Fall 1995).
- Teaching Assistant for undergraduate statistical physics (Spring 1994).
- Recitation Instructor for undergraduate mechanics (Fall 1992).
- Teaching Assistant for introductory graduate plasma physics courses (Fall 1991, Spring 1992).

AWARDS AND HONORS

- Travel Fellowships for the XIVth International Biophysics Congress in Buenos Aires, Argentina (2002).
- Travel grant to attend the Annual Meeting of the American Crystallographic Association (1999).
- Buechner Teaching Prize awarded by the Massachusetts Institute of Technology (1994).
- Merit Bursaries for academic excellence in Tripos exams at Cambridge University (1989-1991).
- President, chess club at Gonville and Caius College (1989-1990).

PROFESSIONAL SOCIETIES

- American Physical Society, Biophysical Society.

COMPUTER SKILLS

- Knowledge of C, HTML, LaTeX, MAPLE, and FORTRAN.

LANGUAGES

- Fluent in English, Italian, Spanish, French and Hebrew.

HOBBIES

- Chess, flute, bridge and swimming.