

# ALEXANDER B. BARNES, PH.D.

## OBJECTIVE

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Development of dynamic nuclear polarization instrumentation and methodology for sensitivity enhancement of solid state NMR, with applications to improve human health, such as the eradication of HIV/AIDS.

## EXPERIENCE

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2011-present Department of Chemistry, Stanford University

*Post-doctoral Scholar*

- Investigating the structural basis of ligand and drug binding to Protein Kinase C in relevant membrane environments using solid-state NMR
- Professor Lynette Cegelski, Research Advisor

2004-2011 Department of Chemistry, Massachusetts Institute of Technology

*Doctoral Thesis Researcher*

- Development of dynamic nuclear polarization instrumentation and methods; design and construction of a 700 MHz DNP spectrometer, a high-power voltage tunable gyrotron, and a high-resolution magic angle spinning NMR probe with a cryogenic sample exchange
- Applications of dynamic nuclear polarization to probe structure of bacteriorhodopsin, influenza protein M2, and amyloid forming peptides
- Professor Robert Griffin, Research Advisor
- Dr. Richard Temkin, Research Co-advisor

2004 Institute fuer Physicalische Chemie, Universitaet Muenster

*Undergraduate Research Technician*

- Probed the dynamics of phosphide inclusion compounds with solid-state NMR
- Applied 2D NMR spectroscopy to probe connectivity in phosphorus compounds
- Professor Hellmut Eckert, Research Advisor

2003 Department of Chemistry, Whitman College

*Undergraduate Researcher*

- Used inverse gas chromatography and solid-state FTIR to determine surface characteristics and oxidation of polypropylene materials
- Professor Allison Calhoun, Research Advisor

2003 Department of Chemistry, Washington University

*Undergraduate Researcher and Participant in the NSF Summer Research Program in Solid-state Chemistry*

- Grew single crystals of trans-cinnamic acid

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- Conducted CPMAS (cross polarization magic angle spinning) solid-state NMR experiments to investigate (2+2) photodimerizations

- Professor Sophia Hayes, Research Advisor

2002 Department of Chemistry, Washington University

*Undergraduate Researcher*

- Formed crystals of azulene using a modified Bridgman technique

- Professor Sophia Hayes, Research Advisor

2000 Department of Psychology, Whitman College

*Undergraduate Researcher*

- Investigated explicit and implicit memory in younger and older individuals

- Professor Matthew Prull, Research Advisor

## EDUCATION

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2004-2011 Massachusetts Institute of Technology Cambridge, MA

- Ph.D., Physical Chemistry

2003 Whitman College

Walla Walla, WA

- B.A., Chemistry with Honors

## HONORS AND MEMBERSHIPS

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- Center for Molecular Analysis and Design (CMAD) post-doctoral fellowship

- National science foundation graduate research fellowship

- Phi Beta Kappa

- Stephen Penrose scholarship for undergraduate education

- Outstanding achievement in physical chemistry award

- Distinction on undergraduate comprehensive oral examination

## PUBLICATIONS

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Andreas L.B., **Barnes A.B.**, Eddy M.T., Corzilius B., Chou J., Griffin R. G. Dynamic Nuclear Polarization Enhanced NMR of Ramantadine Bound to Influenza M2. *Submitted to Journal of Biochemistry.*

**Barnes A.B.**, Markasin E., Daviso E., Michaelis V.K., Mena E., DeRocher, R., Thakkar A., Nanni E.A., Jawla S., Woskov P., Herzfeld J., Temkin R.J., Griffin R.G. Dynamic Nuclear Polarization at 700 MHz/460 GHz. 2012.

*Journal of Magnetic Resonance.* doi:

<http://dx.doi.org/10.1016/j.jmr.2012.08.002>

**Barnes A.B.**, Nanni A. N., Herzfeld, J., Griffin R.G., Temkin R.J. A 250 GHz Gyrotron with a 3 GHz Tuning Bandwidth For Dynamic Nuclear

Polarization. 2012. *Journal of Magnetic Resonance*. 221, 147-153.

Smith A.A., Corzilius B., **Barnes A.B.**, Maly T., Griffin R.G. 2011. Solid Effect Dynamic Nuclear Polarization and Polarization Pathways. 2012. *Journal Chemical Physics*. 136, 015101.

Nanni E.A., **Barnes A.B.**, Griffin R.G., Temkin R.J. THz Dynamic Nuclear Polarization NMR. 2011. *IEEE THz*. 1, 145-163. **(review)**

Corzilius B., Smith A.A., **Barnes A.B.**, Luchinat C., Bertini I., Griffin R.G. High Field Dynamic Nuclear Polarization with High-Spin Transition Metal Ions. 2011. *Journal of the American Chemical Society*. 133, 5648-5651.

Nanni E. A., **Barnes A.B.**, Matsuki Y., Woskov P., Corzilius B., Griffin R. G., Temkin R. J. Microwave Field Distribution in a Magic Angle Spinning Dynamic Nuclear Polarization Probe. 2011. *Journal of Magnetic Resonance*. 210, 16-23.

**Barnes A.B.**, Corzilius B., Mak-Jurkauskas M.L., Andreas L. B., Bajaj V.S., Matsuki Y., Belenky M., Lugtenburg J., Sirigiri J.R., Temkin R.J., Herzfeld J., Griffin R.G. Resolution and Polarization Distribution in Cryogenic DNP/MAS Experiments. 2010. *Physical Chemistry Chemical Physics*. 12, 5861-5861.

Debelouchina G., Bayro M., van der Wel P., Caporini M., **Barnes A.B.**, Rosay M., Maas W., Griffin R.G. Dynamic Nuclear Polarization-Enhanced Solid-state NMR Spectroscopy of GNNQQNY Nanocrystals and Amyloid Fibrils. 2010. *Physical Chemistry Chemical Physics*. 12, 5911-5919.

Torrezan A.C., Han S-T., Mastovsky I., Shapiro M. A., Sirigiri J. R., Temkin R. J., **Barnes A.B.**, Griffin R.G. Continuous-Wave Operation of a Frequency-Tunable 460-GHz Second-Harmonic Gyrotron for Enhanced Nuclear Magnetic Resonance. 2010. *IEEE Transactions in Plasma Science*. 38, 1150-1159.

**Barnes A.B.**, Mak-Jurkauskas M.L., Matsuki Y., Bajaj V.S., van der Wel P. C.A., DeRocher R., Bryant J., Sirigiri J.R., Temkin R.J., Lugtenburg J., Herzfeld J., Griffin R.G. Cryogenic sample exchange NMR probe for magic angle spinning dynamic nuclear polarization. *Journal of Magnetic Resonance*. 2009. 198 (2), 261-270. **(Cover article)**

**Barnes A.B.**, Andreas L.B., Huber M., Ramachandran R., van der Wel P. C.A., Veshtort M., Griffin R.G., Mehta M.A., High-resolution solid-state NMR structure of Alanyl-Prolyl-Glycine. 2009. *Journal of Magnetic Resonance*. 200 (1), 95-100.

**Barnes, A.B.**, De Paëpe, G., van der Wel, P., Hu, K., Joo, C., Bajaj, V.,

Mak-Jurkauskas, M., Sirigiri, J., Herzfeld, J., Temkin, R., Griffin, R.G. High-Field Dynamic Nuclear Polarization for Solid and Solution Biological NMR. 2008. *Applied Magnetic Resonance*. 34 (3), 237-263. (review)

Bertmer M., Nieuwendaal R.C., **Barnes A.B.**, Hayes S.E. Solid-state photodimerization kinetics of alpha-trans-cinnamic acid to alpha-truxillic acid studied via solid-state NMR. *Journal of Physical Chemistry B*. 2006. 110 (12), 6270-6273.

Calhoun A., Nicholson P., **Barnes A.B.**, The Use of Inverse Gas Chromatography to Study Surface Thermal Oxidation of Polypropylene. 2006. *Polymer Degradation and Stability*. 91 (9), 1964-1971.

ResearcherID: D-5354-2009

#### SELECTED PRESENTATIONS

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A 250 GHz Gyrotron with a 3 GHz Tuning Bandwidth for Dynamic Nuclear Polarization. April 2012. International Vacuum Electronics Conference. (selected oral presentation)

Dynamic Nuclear Polarization at 16.4 and 8.9 Tesla With Tunable Gyrotrons. Dynamic Nuclear Polarization Symposium, July 2011 (selected oral presentation)

Dynamic Nuclear Polarization at 16.4 and 8.9 Tesla With Tunable Gyrotrons. Chemistry Department, Washington University 2011 (invited talk)

Instrumentation for High-frequency DNP and Cryogenic MAS; Applications to Membrane Proteins and Peptides, July 2010. Rocky Mountain NMR Conferences. (selected oral presentation)

Instrumentation for DNP and Cryogenic MAS, January 2010. Winter School on Biomolecular Solid State NMR. (oral presentation)

High-Frequency Dynamic Nuclear Polarization, November 2009. Physics symposium at the University of Idaho, Moscow. (invited talk)

C15=N Torsion Measured by DNP-Enhanced Solid State NMR in Bacteriorhodopsin Intermediates, 2009. Biophysical Society. (poster)

Solid State MAS DNP Probe Development; Cryogenic Sample Exchange, August 2007. Dynamic Nuclear Polarization Symposium. (oral presentation)