

Chao He, Ph. D

Blaustein Postdoctoral Scholar
Department of Earth and Planetary Science
Johns Hopkins University
E-mail: che13@jhu.edu
Phone: 1-410-516-7765 (office), 1-520-818-8845 (cell)

EDUCATION

2010 Ph. D., Inorganic Chemistry, College of Chemistry, Jilin University
Advisor: Prof. Shouhua Feng, Chinese Academician of Sciences
Dissertation: Chemical Evolution of Small Molecules and Origin of Chirality in Hydrothermal Environment

2005 B. S., Material Chemistry, College of Chemistry, Jilin University, Changchun, China

Additional Training

2016 Teaching Academy Summer School, Johns Hopkins University Teaching Institute: *Scientific Teaching*

PROFESSIONAL EXPERIENCE

06/2014 – present Blaustein Postdoctoral Scholar, Department of Earth and Planetary Science, Johns Hopkins University (Supervisor: Dr. Sarah Horst)
Experimental Simulation of Planetary Atmospheric Chemistry

10/2010 – 06/2014 Post Doctoral Fellow, Department of Chemistry, University of Arizona and University of Houston (Supervisor: Dr. Mark Smith)
Compositional Investigation of Titan Tholins by NMR: Implications for Titan's Atmospheric Chemistry

PROFESSIONAL ACTIVITIES:

- Member, American Geophysical Union, Division of Planetary Science--American Astronomical Association
- Peer Reviewer for Earth and Planetary Science Letters, Icarus, Astrobiology, Journal of Geophysical Research--Atmospheres, Origins of Life and Evolution of Biospheres, Journal of Physical Chemistry, Material and Design, Life and Chinese Chemical Letters
- Review Panel Member for NASA Exoplanets Research Program, NASA Solar System Workings Program,
- External Grant Reviewer for NASA Postdoctoral Program

RESEARCH INTERSETS

- Planetary Atmospheric Chemistry, Astrobiology, Extraterrestrial Chemistry
- Prebiotic Chemistry for Origin of Life, Origin of Biohomochirality on Earth

SKILLS

- Expertise in Instrumental and Experimental Design
- Expertise in Vacuum Technology, Hydrothermal Synthesis Technology, Photochemistry Technology and Conventional Organic Synthesis Method
- Synthesis and Analysis of Isotope Labeled Organic Mixture Sample
- Synthesis and Analysis bioorganic molecules (Amino Acid, Peptides, Nucleic Acid Base, Glycerol Phosphate and Glucose Phosphates, etc.)
- Separation and Detection Chiral Compounds (Amino Acid and Dipeptides)
- Mastery of GC-MS, GC, HPLC and LC-MS-MS, High-Resolution FT-ICR-MS (ESI and LDI)
- Mastery of Multinuclear and Multidimensional NMR
- Experience in Other Major Analytical Instruments, such as UV/VIS, CD, FTIR, TEM, SEM, XRD, ICP, XPS and Fluorescence Spectroscopy, etc.
- Skilled in Chemoffice, Origin, Microsoft Office, DataAnalysis™ software (Bruker Daltonics), Topspin (Bruker NMR), Delta (JOEL NMR) and MestReNova, etc.
- Structural Analysis of Complex Mixture Based on NMR and High-Resolution MS Results
- Low-Temperature and Low-Pressure Gas Reactions

SELECTED PUBLICATIONS

- (1) **Chao He*** and Mark A. Smith, NMR study of potential compositions in Titan's lakes, *Planetary and Space Science* 2015, 110/111, 149–153.
- (2) **Chao He*** and Mark A. Smith, A comprehensive NMR structural study of Titan aerosol analogs: Implications for Titan's atmospheric chemistry, *Icarus* 2014, 243, 31–38.
- (3) **Chao He*** and Mark A. Smith, Identification of Aminoacetonitrile and adenine in Titan Aerosols Analogs: Implication for Prebiotic Chemistry on Titan and Early Earth, *Icarus*, 2014, 238, 86–92.
- (4) **Chao He*** and Mark A. Smith, Solubility and Stability Investigation of Titan Aerosol Analogs: New Insight from NMR Analysis, *Icarus*, 2014, 232, 54–59.
- (5) **Chao He*** and Mark A. Smith, Identification of nitrogenous organic species in Titan aerosols analogs: Nitrogen fixation route in early atmospheres. *Icarus*, 2013, 226, 33–40.
- (6) **Chao He***, Guangxin Lin and Mark A. Smith, NMR identification of hexamethylenetetramine and its precursor in Titan tholins: Implications for Titan prebiotic chemistry, *Icarus*, 2012, 220, 627-634.
- (7) **Chao He**, Guangxin Lin, Kathleen T. Upton, Hiroshi Imanaka and Mark A. Smith*,

- Structural investigation of Titan tholins by solution-state ^1H , ^{13}C , and ^{15}N NMR: one-dimensional and decoupling experiments, *J. Phys. Chem. A* 2012, 116, 4760-4767.
- (8) **Chao He**, Guangxin Lin, Kathleen T. Upton, Hiroshi Imanaka and Mark A. Smith*, Structural investigation of HCN polymer isotopomers by solution-state multidimensional NMR, *J. Phys. Chem. A* 2012, 116 (19), 4751–4759.
 - (9) **Chao He**, Ge Tian, Ziwei Liu and Shouhua Feng*, A mild hydrothermal route to fix carbon dioxide to simple carboxylic acids, *Organic Letters* 2010, 12(4), 649–651.
 - (10) **Chao He**, Bin Hu, Ziwei Liu, Yu Wang, Bohui Lv, Hongming Yuan, Ge Tian* and Shouhua Feng, Some heterocyclic compound formation under hydrothermal conditions: implications for prebiotic chemistry, *Heterocycl. Commun.*, 2012, 18(1), 7–10.
 - (11) Ge Tian, **Chao He**, Yan Chen, Hongming Yuan, Ziwei Liu, Zhan Shi and Shouhua Feng*, Hydrothermal Reactions from Carbon Dioxide to Phenol, *Chemsuschem*. 2010, 3(3), 323-324.
 - (12) Shouhua Feng*, Ge Tian, **Chao He**, Hongming Yuan, Ying Mu, Yingwu Wang and Ling Wang, Hydrothermal biochemistry: from formaldehyde to oligopeptides, *Journal of Material Science* 2008, 43, 2418–2425.
 - (13) Ge Tian, Hongming Yuan, Ying Mu, **Chao He**, and Shouhua Feng*, Hydrothermal reactions from sodium hydrogen carbonate to phenol, *Organic Letters* 2007, 9(10), 2019–2021.
 - (14) Gull Maheen, Ge Tian, Zhiguang Song, **Chao He**, Zhan Shi, Ziwei Liu, Hongming Yuan, Shouhua Feng*, A Novel Synthetic Route to Synthesize 2,4,8,10-Tetraoxaspiro[5.5]-Undecane from Formaldehyde under Hydrothermal Conditions, *J. Heterocyclic Chem.* 2010, 47(2), 483-485.
 - (15) Gull Maheen, Ge Tian, Yingwu Wang, **Chao He**, Zhan Shi, Hongming Yuan and Shouhua Feng*, Resolving the Enigma of Prebiotic C-O-P Bond Formation: Prebiotic Hydrothermal Synthesis of Important Biological Phosphate Esters, *Heteroatom Chemistry* 2010, 21(3), 161-167.
 - (16) Ziwei Liu, Ge Tian, Shiyao Zhu, **Chao He**, Huijuan Yue and Shouhua Feng*, Ready hydrothermal reactions from carbon dioxide to methane, *ACS Sustainable chemistry & Engineering* 2013, 1 (3) 313-315
 - (17) M. L. Cable, S. M. Hörst, **Chao. He**, A. M. Stockton, M. F. Mora, M. A. Tolbert, M. A. Smith and P. A. Willis, Identification of Primary Amines in Titan Tholins using Nonaqueous Microchip Capillary Electrophoresis. *Earth Planet. Sci. Lett.*, 2014, 402, 99-107.

CONFERENCE PRESENTATIONS

- (1) **Chao He*** and Sarah M. Horst, Carbon Monoxide Affecting Planetary Atmospheric Chemistry, The joint 48th meeting of the Division for Planetary Sciences (DPS) and 11th European Planetary Science Congress (EPSC), Oct 16-21, 2016, Pasadena, California.

- (2) Xinting Yu, Sarah M Hörst, **Chao He**, Nathan T Bridges, Devon Burr and Joshua Sebree, Quantifying Density, Water Adsorption and Equilibration Properties of Wind Tunnel Materials, The joint 48th meeting of the Division for Planetary Sciences (DPS) and 11th European Planetary Science Congress (EPSC), Oct 16-21, 2016, Pasadena, California.
- (3) Xinting Yu, Sarah M Hörst, **Chao He**, Nathan T Bridges, Devon Burr, Quantifying Water Content and Equilibration Timescale of Wind Tunnel Materials, The 47th Lunar and Planetary Science Conference, March 21–25, 2016, Woodlands, Texas.
- (4) Mark A. Smith* and **Chao He**, Titan prebiotic chemistry, NAI Titan Team Meeting 2014, Jan 9-10, Pasadena, CA 91109.
- (5) Mark A. Smith* and **Chao He**, Identification of Nitrogenous Organic Species in Titan Aerosol Analogs: Nitrogen Fixation Routes in Early Atmospheres, 13th European Workshop on Astrobiology, July 22-25, 2013, Szczecin, Poland.
- (6) Mark A. Smith* and **Chao He**, Titan prebiotic chemistry, NAI Titan Team Meeting 2013, April 24-26, Denver, CO 80205
- (7) **Chao He*** and Mark A. Smith, Structure and composition of HCN polymers and Titan tholins: Multinuclear and multidimensional NMR investigation, 245th ACS National Meeting & Exposition, April 7-11, 2013, New Orleans, Louisiana.
- (8) **Chao He*** and Mark A. Smith, Solubility and Stability Investigation of Titan Aerosol Analogs: New Insight from NMR Analysis, 44th annual meeting of the Division for Planetary Sciences of the American Astronomical Society, Oct 14-19, 2012, Reno, NV
- (9) **Chao He***, Guangxin Lin and Mark A. Smith, NMR identification of hexamethylenetetramine and its precursor in Titan tholins: Implications for Titan prebiotic chemistry, Astrobiology Science Conference, April 16-20, 2012, Atlanta, GA 30308, USA.
- (10) **Chao He**, Ge Tian, Yingwu Wang, Hongming Yuan and Shouhua Feng*, The Origin of Homochirality from Asymmetric Hydrothermal Reactions of Alanine Dipeptides, The 13th Asian Chemical Congress, September 13-16, 2009, China, IN-IL21.
- (11) Ge Tian, **Chao He**, Ziwei Liu and Shouhua Feng*, Life hydrothermal chemistry, XV International Conference on the Origin of Life, August 24-29, 2008, Italy, P-2-69.
- (12) Ge Tian, **Chao He**, Yan Chen, Zhan Shi, Shouhua Feng*, Hydrothermal biochemistry: from formaldehyde to oligopeptides, Eighth International Symposium on Hydrothermal Reactions Seventh International Conference on Solvo-Thermal Reactions (ISHR&ICSTR2006), P-166, Japan.
- (13) Shouhua Feng*, Ge Tian, **Chao He**, Hongming Yuan, et al., Hydrothermal biochemistry: From formaldehyde to oligopeptides, The 233rd ACS National Meeting, Chicago, IL, March 25-29, 2007, INOR 203.
- (14) Shouhua Feng*, Ge Tian, **Chao He**, Hongming Yuan, et al., Copper (II) complexes of novel octadentate ligands: DFT and experimental interpretations, The 233rd ACS National Meeting, Chicago, IL, March 25-29, 2007, INOR 262.

HONORS and AWARDS

- 2010 Excellent Graduated Students of Jilin University (Top 3%)
- 2009 The Outstanding Youth in College of Chemistry of Jilin University (Top 2%)
- 2008 Second-Rate Scholarship in College of Chemistry (Top 10%)
- 2007 First-Rate Scholarship in College of Chemistry (Top 5%) and Excellent Students of Jilin University (Top 5%)
- 2002~2005 Second-Rate Scholarship in College of Chemistry (Four Consecutive Years, Top 10%)

CHINA PATENT

- (1) Patent Name: A Hydrothermal Method to Prepare Formic Acid and Acetic Acid from Carbon Dioxide (201010030812.2). The Second Inventor.
- (2) Patent Name: A Hydrothermal Method to Prepare Organic Molecules from Formaldehyde (200710056142.X). The Fourth Inventor.
- (3) Patent Name: A Time-Controlled Method to Prepare Chiral Dipeptides (200710056140.0). The Fourth Inventor.
- (4) Patent Name: A Hydrothermal Method to Prepare Phenol from Carbon Dioxide (200710056143.4). The Fourth Inventor.
- (5) Patent Name: A Hydrothermal Method to Prepare Amino Acid from Fatty Acids (200710056141.5). The Fourth Inventor.
- (6) High-temperature and High-pressure Circulation Stirring Gas-liquid Phase Reaction Cauldron (201210290811). The Third Inventor.