

# **Curriculum Vitae**

**Mao-Chang Liang**

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## **Personal Information**

1. B.S. in Physics in 1998 (1994-1998), National Tsing Hua University
2. M.S. in Physics in 2000 (1998-2000), National Tsing Hua University
3. Ph.D. in Planetary Science (Astronomy minor) in 2005 (2002-2005), California Institute of Technology

## **Honors and Awards**

1. Phi Tau Phi Scholarship (2005)
2. Li Foundation Heritage Prize (2007): Excellence in Creativity
3. National Science Council Ta-You Wu Memorial Award (2009)
4. Academia Sinica Career Development Award (2010)
5. National Science Council Project for Excellent Junior Research Investigators (2012)
6. Academia Sinica Research Award for Junior Research Investigators (2016)
7. Academia Sinica Investigator Award (2020)
8. Ministry of Science and Technology Outstanding Research Award (2019)

## **Editorial Board Services**

1. Nature Scientific Reports
2. Geosciences

## **Professional Research Activities**

1. Referee for Science, Astrophysical Journal, Astrophysical Journal and Letters, Journal of Geophysical Research, Geophysical Research Letters, Geochimica et Cosmochimica Acta, Terrestrial, Atmospheric and Oceanic Sciences, Aerosol and Air Quality Research, Atmospheric Chemistry and Physics, RCM, Geosciences, Journal of Hydrology, PNAS, etc.

## **Professional Experience**

1. Research Assistant, Institute of Astronomy and Astrophysics, Academia Sinica (2000-2002)
2. Research Assistant, Division of Geological and Planetary Sciences, California Institute of Technology (2002-5)
3. Teaching Assistant, Division of Geological and Planetary Sciences, California Institute of Technology (2003-5)
4. Staff, Division of Geological and Planetary Sciences, California Institute of Technology (2006-2006)

5. Visiting Scholar (Staff), Division of Geological and Planetary Sciences, California Institute of Technology (2006-2007)
6. Assistant Research Fellow, Research Center for Environmental Changes, Academia Sinica (2006-2008)
7. Assistant Professor (joint appointment), Graduate Institute of Astronomy, National Central University (2008-2009)
8. Associate Research Fellow (adjunct), Institute of Astronomy and Astrophysics, Academia Sinica (2009-2016)
9. Associate Research Fellow, Research Center for Environmental Changes, Academia Sinica (2008-2018)
10. Associate Professor (adjunct), Graduate Institute of Astronomy, National Central University (2009-2018)
11. Research Assistant Professor (adjunct), Department of Physics, University of Houston (2013-2018)
12. Associate Research Fellow, Institute of Earth Sciences, Academia Sinica (2018-2018)
13. Research Fellow, Institute of Earth Sciences, Academia Sinica (2018-)

### National Committee

1. Committee on Space Research (COSPAR)
2. International Association of Geomagnetism and Aeronomy (IAGA)

### Professional Membership

1. American Astronomical Society (AAS and DPS)
2. American Geophysical Union

### Journal Publications

1. H.-K. Chang, T. Guo, **M.-C. Liang**, C. Ho, Determining Emission Location and Mechanisms of High Energy Emission from Pulsars -- the Role of INTEGRAL, *Astrophysical Letters and Communications*, 38, 53, 1999.
2. **Liang, M.C.\***; Geballe, T.R.; Lo, K.Y.; Kim, D.-C., Infrared Line Emission in the Interacting Region of Arp 244 (the Antennae): Colliding Molecular Cloud Complexes?, *Astrophysical Journal Letters*, 549(1), 59, 2001.
3. Zhi-Qiang Shen, **M. C. Liang**, K. Y. Lo, M. Miyoshi, Searching for Structural Variability in Sgr A\*, *Astronomische Nachrichten*, 324(S1), DOI: 10.1002/asna.200385090, 2003.
4. Blake, G.A., **Liang M.C.**, Morgan C.G., and Yung Y.L., A Born-Oppenheimer photolysis model of N<sub>2</sub>O fractionation, *Geophysical Research Letters*, 30(12), 58, 1656, doi:10.129/2003GL016932, 2003.
5. **Liang, Mao-Chang\***; Parkinson, Christopher D.; Lee, Anthony Y.-T.; Yung, Yuk L.; Seager, Sara, Source of Atomic Hydrogen in the Atmosphere of HD 209458b, *Astrophysical Journal Letters*, 596, 247, 2003.

6. Morgan, C., M. Allen, **M.C. Liang**, R.L. Shia, G.A. Blake, and Y.L. Yung, Isotopic Fractionation of Atmospheric Nitrous Oxide, Journal of Geophysical Research, 109(D4), D04305, 2004.
7. **Liang, Mao-Chang\***; Seager, Sara; Parkinson, Christopher D.; Lee, Anthony Y.-T.; Yung, Yuk L., On the Insignificance of Photochemical Hydrocarbon Aerosols in the Atmospheres of Close-in Extrasolar Giant Planets, Astrophysical Journal Letters, 605, 61, 2004.
8. **Liang, Mao-Chang\***, Blake, Geoffrey A., and Yung, Yuk L., A Semi-Analytic Model for Photo-Induced Isotopic Fractionation in Simple Molecules, Journal of Geophysical Research, 109(D10), D10308, 2004.
9. Yung, Yuk L., **Liang, Mao-Chang**, Blake, Geoffrey A., Richard P. Muller, and Charles E. Miller, Evidence for O-Atom Exchange in the O(<sup>1</sup>D)+N<sub>2</sub>O Reaction as the Source of Mass-Independent Isotopic Fractionation in Atmospheric N<sub>2</sub>O, Geophysical Research Letters, 31(19) 19106, doi: 10.1029/2004GL020950, 2004.
10. **Liang, Mao-Chang**, Benjamin F. Lane, Robert T. Pappalardo, Mark Allen, and Yung, Yuk L., Atmosphere of Callisto, Journal of Geophysical Research, 110(E2) E02003, 10.1029/2004JE00232, 2005.
11. Yung, Yuk L., **Liang, Mao-Chang**, Blake, Geoffrey A., Richard P. Muller, and Charles E. Miller, Reply to comment by Röckmann & Kaiser on “Evidence for O-Atom Exchange in the O(<sup>1</sup>D) + N<sub>2</sub>O Reaction as the Source of Mass-Independent Isotopic Fractionation in Atmospheric N<sub>2</sub>O”, Geophysical Research Letters, 32(11), L11808 10.1029/2005GL022669, 2005.
12. Charles E. Miller, Robert M. Onorato, **Mao-Chang Liang**, and Yuk L. Yung, Extraordinary Isotopic Fractionation in Ozone Photolysis, Geophysical Research Letters, 32(14), L14814, 10.1029/2005GL023160, 2005.
13. Zhi-Qiang Shen, K. Y. Lo, **M.-C. Liang**, Paul T. P. Ho & J.-H. Zhao, A size of ~1 AU for the radio source Sgr A\* at the center of the Milky Way, Nature, 438, 62, 2005.
14. **Mao-Chang Liang\***, Run-Lie Shia, Anthony Y.-T. Lee, Mark Allen, A. James Friedson, and Yuk L. Yung, Meridional Transport in the Stratosphere of Jupiter, Astrophysical Journal Letters, 635(2), 177, 2005.
15. **Mao-Chang Liang\***, Fredrick W. Irion, Jason D. Weibel, Charles E. Miller, Geoffrey A. Blake, and Yuk L. Yung, Isotopic Composition of Stratospheric Ozone, Journal of Geophysical Research, 111, D02302, doi:10.1029/2005JD006342, 2006.
16. Run-Lie Shia, **Mao-Chang Liang**, Charles E. Miller, and Yuk L. Yung, CO<sub>2</sub> in the Upper Troposphere: Influence of Stratosphere-Troposphere Exchange, Geophysical Research Letters, 33, L14814, doi:10.1029/2006GL026141, 2006.
17. Cheng, B.-M, Lu, H.-C., Chen, H.-K., Bahou, M., Lee, Y.-P., Mebel, A. M., **Liang, M.-C.**, & Yung, Y. L., Absorption Cross Sections of NH<sub>3</sub>, NH<sub>2</sub>D, NHD<sub>2</sub>, and ND<sub>3</sub> in the Spectral Range 140-220 nm and its Implication for Planetary Isotopic Fractionation, Astrophysical Journal, 647(2), 1535, 2006.

18. **Mao-Chang Liang\***, Hyman Hartman, Robert E. Kopp, Joseph L. Kirschvink, and Yuk L. Yung, Production of Hydrogen Peroxide in the Atmosphere of a Snowball Earth and the Origin of Oxygenic Photosynthesis, Proceedings of the National Academy of Sciences, [10.1073/pnas.0608839103](https://doi.org/10.1073/pnas.0608839103), 2006
19. **Mao-Chang Liang\***, Geoffrey A. Blake, Brenton R. Lewis, and Yuk L. Yung, Oxygen Isotopic Composition of Carbon Dioxide in the Middle Atmosphere, Proceedings of the National Academy of Sciences, [10.1073/pnas.0610009104](https://doi.org/10.1073/pnas.0610009104), 2007.
20. Giovanna Tinetti, **Mao-Chang Liang**, Alfred Vidal-Madjar, David Ehrenreich, Alain Lecavelier des Etangs, Yuk L. Yung, Infrared Transmission Spectra for Extrasolar Giant Planets, Astrophysical Journal Letters, *654*(1), 99, 2007.
21. Christopher D. Parkinson, **Mao-Chang Liang**, Hyman Hartman, Candice J. Hansen, Giovanna Tinetti, Victoria Meadows, Yuk L. Yung, Enceladus: Cassini Observations and Implications for the Search of Life, Astronomy and Astrophysics, *463*, 353-357, 2007.
22. **Mao-Chang Liang\***, Bing-Ming Cheng, Hsiao-Chi Lu, Hong-Kai Chen, M. S. Alam, Yuan-Pern Lee, Yuk L. Yung, Isotopic Fractionation of Nitrogen in Ammonia in the Troposphere of Jupiter, Astrophysical Journal Letters, *657*(2), 117-120, 2007.
23. **Mao-Chang Liang\***, Yuk L. Yung, and Donald E. Shemansky, Photolytically Generated Aerosols in the Mesosphere and Thermosphere of Titan, Astrophysical Journal Letters, *661*(2), 199-202, 2007.
24. **Mao-Chang Liang\*** and Yuk L. Yung, Sources of the Oxygen Isotopic Anomaly in Atmospheric N<sub>2</sub>O, Journal of Geophysical Research, *112*, D13307, doi:10.1029/2006JD007876, 2007. [NSC 95-2111-M001-009-]
25. Giovanna Tinetti, Alfred Vidal-Madjar, **Mao-Chang Liang**, Jean-Philippe Beaulieu, Yuk Yung, Sean Carey, Robert J. Barber, Jonathan Tennyson, Ignasi Ribas, Nicole Allard, Gilda E. Ballester, Jean-Michel Desert, David Ehrenreich, Roger Ferlet, Guillaume Hebrard, Alain Lecavelier des Etangs, David K. Sing, & Franck Selsis, Water vapour in the atmosphere of a transiting extrasolar planet, Nature, *448*, 169-171, 2007.
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27. **Mao-Chang Liang**, Geoffrey A. Blake, and Yuk L. Yung, Seasonal Cycle of C<sup>16</sup>O<sup>16</sup>O, C<sup>16</sup>O<sup>17</sup>O, and C<sup>16</sup>O<sup>18</sup>O in the Middle Atmosphere: Implications for mesospheric dynamics and biogeochemical sources and sinks of CO<sub>2</sub>, Journal of Geophysical Research, *113*, D14S09, doi:10.1029/2007JD009659, 2008. [NSC 96-2628-M-001-018-]
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29. **Mao-Chang Liang**, King-Fai Li, Run-Lie Shia, and Yuk L. Yung, Short-period solar cycle signals in the ionosphere observed by FORMOSAT-3/COSMIC, Geophysical Research Letters, **35**, L15818, doi:10.1029/2008GL034433, 2008. [NSC 96-2628-M-001-018-]
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32. **Mao-Chang Liang\***, J. Tang, Zunyu Chan, X. D. Zheng, and Yuk L. Yung, Signature of Stratospheric Air at the Tibetan Plateau, Geophysical Research Letters, **35**, L20816, doi:10.1029/2008GL035246, 2008. [NSC 97-2628-M-001-001-]
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35. Yuk L. Yung, **M. C. Liang**, X. Jiang, R. L. Shia, C. Lee, B. Bezard and E. Marcq, Evidence for OCS Conversion to CO in the Lower Atmosphere of Venus, Journal of Geophysical Research, **114**, E00B34, doi:10.1029/2008JE003094, 2009. [NSC 97-2628-M-001-001-]
36. Xibin Gu, Ralf I. Kaiser, Alexander M. Mebel, Vadim V. Kislov, Stephen J. Klippenstein, Lawrence B. Harding, **Mao-Chang Liang**, and Yuk L. Yung, A Crossed Molecular Beams Study on the Formation of the Exotic Cyanoethynyl Radical in Titan's Atmosphere, Astrophysical Journal, **701**, 1797-1803, 2009. [NSC 97-2628-M-001-001-]
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38. M. R. Line, **M. C. Liang**, Y. L. Yung, HIGH TEMPERATURE PHOTOCHEMISTRY IN THE ATMOSPHERE OF HD189733B, Astrophysical Journal, **717**, 496-502, 2010. [NSC 98-2111-M-001014-MY3]
39. Li Zhou, Weijun Zheng, Ralf I. Kaiser, Alexander Landera, Alexander M. Mebel, **Mao-Chang Liang**, Yuk L. Yung, Cosmic-Ray Mediated Formation of Benzene on the Surface of Saturn's Moon Titan, Astrophysical Journal, **718**, 1243-1251, 2010. [NSC 98-2111-M-001-014-MY3]

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41. J.P. Beaulieu, D.M. Kipping, V. Batista, G. Tinetti, I. Ribas, S. Carey, J. A. Noriega-Crespo, C. A. Griffith, G. Campanella, S. Dong, J. Tennyson, R.J. Barber, P. Deroo, S.J. Fossey, **D. Liang**, M. R. Swain, Y. Yung, N. Allard, Water in HD 209458b's atmosphere from 3.6 - 8 um IRAC photometric observations in primary transit, Monthly Notices of the Royal Astronomical Society, **409**, 963-974, 2010. [NSC 98-2111-M-001014-MY3]
42. Philip Croteau, John B. Randazzo, Oleg Kostko, Musahid Ahmed, **Mao-Chang Liang**, Yuk L. Yung, and Kristie A. Boering, Experimental determination of isotope effects in the non-dissociative photoionization of molecular nitrogen and implications for Titan's atmosphere, Astrophysical Journal Letters, **728**, L32, 2011. [NSC 98-2111-M-001-014-MY3]
43. Jingqian Wang, Steven Pawson, Baijun Tian, **Mao-Chang Liang**, Run-Lie Shia, Yuk L. Yung, and Xun Jiang, El Niño-Southern Oscillation in Tropical and Mid-Latitude Column Ozone, J. Atmos. Sci., **68**, 1911-1921, 2011.
44. Yu-Jong Wu, C. Y. Robert Wu and **Mao-Chang Liang**, Quantum Chemical Calculation on the Potential Energy Surface of H<sub>2</sub>CO<sub>3</sub> and its Implication for Martian Chemistry, Icarus, **214**, 228-235, 2011. [NSC 98-2111-M-001-014-MY3]
45. Jingqian Wang, Xun Jiang\*, Moustafa T. Chahine, **Mao-Chang Liang**, Edward T. Olsen, Luke L. Chen, Stephen Licata, Thomas Pagano, and Yuk L. Yung, The Influence of Tropospheric Biennial Oscillation on Mid-tropospheric CO<sub>2</sub>, Geophysical Research Letters, **38**, L20850, 2011.
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47. Zhang X., **Liang, M. C.**, Mills, F. P., Belyaev D. A. and Yung, Y. L, Sulfur Chemistry in the Middle Atmosphere of Venus, Icarus, **217**(2), 714-739, DOI:10.1016/j.icarus.2011.06.016, 2012. [NSC 98-2111M-001-014-MY3]
48. I-Chun Tsai, **Mao-Chang Liang**, and Jen-Ping Chen\*, Methane-nitrogen binary nucleation: A new microphysical mechanism for cloud formation in Titan's atmosphere, Astrophysical Journal, **747**, DOI: 10.1088/0004-637X/747/1/36, 2012. [NSC 98-2111-M-001-014-MY3]
49. Sasadhar Mahata, S. K. Bhattacharya<sup>1</sup>, Chung-Ho Wang, **Mao-Chang Liang\***, An improved CeO<sub>2</sub> method for high precision measurements of <sup>17</sup>O/<sup>16</sup>O ratio for atmospheric carbon dioxide, Rapid Communications in Mass Spectrometry, **26**(17), 1909-1922, DOI:10.1002/rcm.6296, 2012. [NSC 982111-M-001-014-MY3]
50. Shih-Chieh Hsu, Chih-An Huh, Chuan-Yao Lin, Wei-Nai Chen, Shaw Chen Liu, C.C.K. Chou, **MaoChang Liang**, Chuen-Jinn Tsai, Yi-Tang Huang, Fei-Jan Lin, Jen-Ping Chen, Transport of

- biomass burning aerosols and non-East Asian dust to Pacific, Geophysical Research Letters, L12804, DOI:10.1029/2012GL051962, 2012. [NSC 98-2111-M-001-014-MY3]
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55. **Mao-Chang Liang**, Li-Ching Lin, Ka-Kit Tung, Yuk L. Yung, Shan Sun, Transient Climate Response in Coupled Atmospheric-Ocean General Circulation Models, J. Atmos. Sci., 70(4), 1291-1296, 2013. [NSC 101-2628-M-001-001-MY4]
56. Sasadhar Mahata, S. K. Bhattacharya, Chung-Ho Wang, **Mao-Chang Liang\***, Oxygen isotope exchange between O<sub>2</sub> and CO<sub>2</sub> over hot platinum: an innovative technique for measuring  $\Delta^{17}\text{O}$  in CO<sub>2</sub>, Analytical Chemistry, 85(14), 6894-6901, 2013. [NSC 101-2628-M-001-001-MY4]
57. **Mao-Chang Liang**, Li-Ching Lin, Ka-Kit Tung, Yuk L. Yung, Shan Sun, Impact of Climate Drift on 21st Century Projection in a Coupled Atmospheric-Ocean General Circulation Model, J. Atmos. Sci., 70(10), 3321-3327, 2013. [NSC 101-2628-M-001-001-MY4]
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- super Asian dust episode, Journal of Geophysical Research, 119, DOI: [10.1002/2013JD021096](https://doi.org/10.1002/2013JD021096), 2014.
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61. Cheng Li, Xi Zhang, Joshua A. Kammer, **Mao-Chang Liang**, Run-Lie Shia, Yuk L. Yung, A nonmonotonic eddy diffusivity profile of Titan's atmosphere revealed by Cassini observations, Planetary and Space Science, 104, 48-58, 2014.
62. Sourendra Bhattacharya, Joël Savarino, Greg Michalski, and **Mao-Chang Liang**, A new feature in the internal heavy isotope distribution in ozone, Journal of Chemical Physics, 141(13), 134301, 2014.
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