Shanshan Yu

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Education:

- **Ph.D. in physical chemistry (2007)**, University of Waterloo, Canada, thesis supervised by Professor Peter Bernath on "High-resolution laboratory spectroscopy of transient metal-containing molecules"
- **M.Sc. in optics (2003)**, East China Normal University, Shanghai, China, thesis supervised by Professor Yangqin Chen on "Study of hot bands of the $B\ ^2\Sigma_u^+ - X\ ^2\Sigma_g^+$ system of $\mathbf{C}_2^-$ anion by optical-heterodyne magnetic-rotation enhanced velocity modulation spectroscopy"
- **B.Eng. in optoelectronics (2000)**, East China Normal University, Shanghai, China

Professional Experience:

- **Scientist at Jet Propulsion Laboratory (JPL), 2010-Present**
  - Orbiting Carbon Observatory 2 (OCO2) absco team member, 2014-present
  - Herschel Heterodyne Instrument for Far infrared (HIFI) instrument team member, 2010-2014
  - Herschel Observations of Extra-Ordinary Sources (HEXOS) team member, 2010-2014
- **NASA postdoctoral scholar at JPL, 2008-2009**
- **Postdoctoral scholar, University of Waterloo, 2007**
- **Graduate research assistant, University of Waterloo, 2003-2007**

Honors and Awards:

- **Voyager Award, JPL Science Division 2015**
  - *For contribution in the field of molecular spectroscopic research leading to the receipt of the prestigious 2015 Flygare Award*
- **Flygare Award, International Symposium on Molecular Spectroscopy 2015**
  - *For outstanding contributions in molecular spectroscopy by an early career independent scientist*
  - *Given to four scientists in one year on a quinquennial basis*
- **NASA Group Achievement Award to U.S. Herschel HIFI Instrument Team 2014**
  - *For outstanding calibration and analysis support provided to the Herschel HIFI Instrument Control Center that enabled a superbly operating instrument until end of mission*
- **Peer Reviewing Excellence (Elsevier and Journal of Molecular Spectroscopy) 2014**
  - *In recognition of an outstanding contribution to the quality of the journal*
- **Elsevier JQSRT Outstanding Young Scientist Award in Quantitative Spectroscopy 2010**
  - *Given to one young scientist in one year on a biennial basis*
- **NASA Postdoctoral Program Fellowship at Jet Propulsion Laboratory 2008-2009**

- **University of Waterloo, Chemistry Department, F.W. Karasek Scholarship** **2007**
  - Awarded annually to a graduate student registered in the chemistry department based on ability and promise in research and performance in at least two completed graduate courses
- **Ontario Graduate Scholarship** **2006-2007**
  - Funded by the Province of Ontario in Canada
  - Awarded to students at the Master's and doctoral levels in all disciplines of academic study
  - 3000 scholarship awarded annually, 90 of these awarded to visa students such as me
- **The University of Waterloo President's Graduate Scholarship** **2006-2007**
- **University of Waterloo, Chemistry Department, H.G. McLeod Scholarship** **2006**
  - Awarded annually to a graduate student registered in the chemistry department on the basis of overall abilities, including both research and coursework
- **Chinese Government Award for Outstanding Self-Financed Students Abroad** **2005**
  - Granted annually to no more than 500 self-financed Chinese students studying overseas
- **East China Normal University, Excellent Postgraduate Student Scholarship** **2001**
- **East China Normal University, Title of Excellent Graduate** **2000**
- **East China Normal University, Excellent Student** **1999**
- **East China Normal University, Award of Top Grade** **1999**

Principle Investigator Experience:

- **NASA Astrophysics Research and Analysis (APRA)** (2013-2016)
  "*Study of NH_3 line intensities in the THz and Far-IR region*"
- **JPL Research & Technology Spontaneous Concept Task** (2013)
  "*Development of a novel apparatus for simulating the interstellar medium*"
- **French National Synchrotron Facility** (2013)
  "Spectroscopy of far-IR NH3 transitions involving $3\nu_2$ and higher vibrational states: using evolution of spectra from 200 K to 350 K to empirically estimate lower state energies"
- **French National Synchrotron Facility** (2010)
  "*Measurement of positions and intensities of the ground, ν_2, $2\nu_2$ and ν_4 inversion bands of ammonia*"
- **NASA Postdoctoral Program (NPP)** (2008-2009)
  "*Laboratory rotational spectroscopy of protonated methanol*"

Co-Investigator Experience:

- **NASA Atmospheric Composition: Laboratory Research (ACLR)**
  - "*Millermeter and submillimeter spectroscopy in support of upper atmospheric research*" *(2011-2014)*
  - "*Millermeter and submillimeter spectroscopy in support of atmospheric research*" *(2015-2018)*
- **NASA Astrophysics Research and Analysis (APRA)**
  "*Systematic spectroscopy on the primary sources of interstellar lines*" *(2010-2013)*
- **NASA Science Mission Directorate (SMD)/Planetary Science**
  "*Submillimeter spectroscopic gas analysis for life detection*" *(2010-2013)*

- **NASA Science Mission Directorate (SMD)/Astrophysics**
  "Herschel/Plank Heterodyne Instrument for Far infrared, Phase E, Instrument and science support (2010-2014)
- **Herschel Open Time Cycle-1 (OT1) and Open Time Cycle-2 (OT2) observations**
  "Investigation of the nitrogen chemistry in diffuse and dense interstellar gas" *(2010)*

  "Probing The Unique Environment Around Sgr A" (2010)*

Lead Experience with First-Author Publications Involving External Collaborations:

- "Terahertz spectroscopy and global analysis of the bending vibrations of acetylene $^{12}C_2D_2$", Astrophys. J. 698, 2114 (2009)
  - ***Collaborated with the molecular spectroscopy group at University of Toulouse in France***
- "Submillimeter-wave and far-infrared spectroscopy of high-*J* transitions of the ground and ν_2 =1 states of ammonia", J. Chem. Phys. 133, 174317 (2010)
  - ***Collaborated with the molecular spectroscopy groups at French National Synchrotron Facility and the university of Toyama in Japan***
- "High resolution spectral analysis of oxygen I. isotopically invariant dunham fit for the $X^3\Sigma_g^-$, $a^1\Delta_g$, $b^1\Sigma_g^+$ states", J. Chem. Phys. 137, 024304 (2012)
  - ***Collaborated with the molecular spectroscopy group at University of Cologne in Germany***
- "Measurement and analysis of new terahertz and far-infrared spectra of high temperature water", J. Mol. Spectrosco. 279, 16 (2012)
  - ***Collaborated with the molecular spectroscopy groups at French National Synchrotron Facility, French National center for Scientific Research and University of Cologne in Germany***

Lead Experience Involving Personnel Management:

- Peer host of Dr Takayoshi Amano as a JPL Visiting Independent Advisor (2012-present)
- Coordinated the transfer of Dr. Amano's 80 experimental apparatuses from Canada to JPL (2013-2014)
- Interacted with the following postdoctoral research fellows: Harshal Gupta (June 2011 – present), Ben Elliott (Jan. 2013 – Dec. 2014), and Adam Daly (April 2013 – present)
  - *Trained them on the operations of terahertz spectrometers*
  - *Provided guidance on approaches to generate and measure ion and radical signals*
  - *Provided advices on quantum mechanics analyses of molecules and ions*
  - *Provided revisions and comments on scientific manuscripts for journal publication*
- Provided guidance on hyperfine data analysis of O-17 oxygen ($^{16}O^{17}O$, $^{17}O^{17}O$ and $^{17}O^{18}O$) to the following graduate students and postdocs, whose affiliations were not JPL: David Long (Caltech) in 2011, Olga Leshchishina and Samir Kassi (University of Grenoble, France) in 2011

Reviewer Experience:

- Editorial Board: Journal of Molecular spectroscopy 2013-present
- Astrophysical Journal
- Journal of Molecular Spectroscopy
- Journal of Quantitative Spectroscopy & Radiative Transfer
- Chemical Physics Letters
- Physica Scripta

Peer-reviewed Publications (18 first author, 74 total, As of November 11, 2015, Total citation=1576, h-index=23 and i10-index=43):

1. **S. Yu**, X. Yang, B. Li, K. Kaniki, S. Wu, Y. Guo, Y. Liu and Y. Chen, "Study of hot bands of the $B\,^2\Sigma_u^+ - X\,^2\Sigma_g^+$ system of $\mathbf{C}_2^-$ anion", Chinese Physics, 12 (2003) 745-749.

2. K. Kaniki, X. Yang, Y. Guo, **S. Yu**, B. Li, Y. Liu and Y. Chen, "Concentration modulation laser spectroscopy of the C_2 molecular Swan system", Progress in Natural Science, 13 (2003) 736-739.

3. B. Li, X. Yang, Y. Guo, K. Kaniki, **S. Yu**, Y. Liu and Y. Chen, "Laser spectroscopy study of the (4, 0) and (5, 0) bands of the $d\,^3\Delta$–$a\,^3\Pi$ system of CO" (in Chinese), J. Optics, 24 (2004) 255-259.

4. A. Shayesteh, **S. Yu** and P.F. Bernath, "Infrared emission spectra and equilibrium structures of gaseous HgH_2 and HgD_2", J. Phys. Chem. A 109 (2005) 10280-10286.

5. A. Shayesteh, **S. Yu** and P.F. Bernath, "Gaseous HgH_2, CdH_2, and ZnH_2", Chem. Eur. J. 11 (2005) 4709-4712.

6. **S. Yu**, D. Fu, A. Shayesteh, I.E. Gordon, D.R.T. Appadoo and P.F. Bernath, "Infrared and near infrared emission spectra of SbH and SbD", J. Mol. Spectrosc. 229 (2005) 257-265.

7. **S. Yu**, A. Shayesteh, D. Fu and P.F. Bernath, "Infrared and near infrared emission spectra of TeH and TeD", J. Mol. Spectrosc. 230 (2005) 105-116.

8. **S. Yu**, A. Shayesteh, D. Fu and P.F. Bernath, "The vibration-rotation emission spectrum of gaseous HZnCl", J. Phys. Chem. A 109 (2005) 4092-4094.

9. **S. Yu**, A. Shayesteh and P.F. Bernath, "The vibration-rotation emission spectra of gaseous CdH_2 and CdD_2", J. Chem. Phys. 122 (2005) 194301/1-194301/6.

10. **S. Yu**, A. Shayesteh, P.F. Bernath and J. Koput, "The vibration-rotation emission spectrum of hot BeF_2", J. Chem. Phys. 123 (2005) 134303/1-134303/8.

11. **S. Yu**, I.E. Gordon, P.M. Sheridan and P.F. Bernath, "Infrared emission spectroscopy of the $A^4\Phi_i$–$X\,^4\Delta_i$ and $B\,^4\Pi_i$–$X\,^4\Delta_i$ transitions of CoS", J. Mol. Spectrosc. 236 (2006) 255-259.

12. **S. Yu**, J-G Wang, P.M. Sheridan, M.J. Dick and P.F. Bernath, "Laser spectroscopy of the $\tilde{A}^2\Pi - \tilde{X}^2\Sigma^+\ 0_0^0$ and $\tilde{C}^2\Pi - \tilde{A}^2\Pi\ 0_0^0$ transitions of SrOD", J. Mol. Spectrosc. 240 (2006) 26-31.

13. M.J. Dick, P.M. Sheridan, J.-G. Wang, **S. Yu** and P.F. Bernath, "Optical–optical double resonance spectroscopy of the $\tilde{D}^2\Sigma^+ - \tilde{A}^2\Pi$ transition of CaOH", J. Mol. Spectrosc. 240 (2006) 238-243.

14. R.S. Ram, I. Gordon, T. Hirao, **S. Yu**, P.F. Bernath and B. Pinchemel, "Fourier transform emission spectroscopy of the $C\ ^3\Delta - X\ ^3\Phi$, $D\ ^3\Delta - X\ ^3\Phi$, $G\ ^3\Phi - X\ ^3\Phi$ and $G\ ^3\Phi - C\ ^3\Delta$ systems of CoCl", J. Mol. Spectrosc. 243 (2007) 69-77.

15. J.-G. Wang, M.J. Dick, P.M. Sheridan, **S. Yu** and P.F. Bernath, "Further spectroscopic investigations of the high energy electronic states of SrOH: The $\widetilde{B}'\ ^2\Sigma^+ - \widetilde{A}\ ^2\Pi\ 0_0^0$ and the $\widetilde{D}\ ^2\Sigma^+ - \widetilde{A}\ ^2\Pi\ 0_0^0$ transitions", J. Mol. Spectrosc. 245 (2007) 26-33.

16. T. Hirao, **S. Yu** and T. Amano, "Submillimeter-wave spectroscopy of DCO^+ in the excited vibrational states: Does the Stark effect cause anomalies in the (02^20) state?", J. Chem. Phys. 127 (2007) 074301/1-074301/12.

17. T. Hirao, **S. Yu** and T. Amano, "Submillimeter observation of HCO^+ in the excited vibrational states", J. Mol. Spectrosc. 248 (2008) 26-40.

18. **S. Yu**, B.J. Drouin, J.C. Pearson and H.M. Pickett, "Terahertz spectroscopy and global analysis of H_3O^+", Astrophys. J. Suppl. Ser. 180 (2009) 119-124.

19. **S. Yu**, B.J. Drouin, J.C. Pearson, H.M. Pickett, V. Lattanzi and A. Walters "Terahertz spectroscopy and global analysis of the bending vibrations of acetylene $^{12}C_2D_2$", Astrophys. J. 698 (2009) 2114-2120.

20. **S. Yu**, B.J. Drouin and J.C. Pearson, "Terahertz spectroscopy of the bending vibrations of acetylene $^{12}C_2H_2$", Astrophys. J. 705 (2009) 786-790.

21. R.S. Ram, **S. Yu**, I. Gordon and P.F. Bernath, "Fourier transform infrared emission spectroscopy of new systems of NiS", J. Mol. Spectrosc. 258 (2009) 20-25.

22. Z. Kisiel, L. Pszczolkowski, B.J. Drouin, C.S. Brauer, **S. Yu** and J.C. Pearson, "The rotational spectrum of acrylonitrile up to 1.67 THz", J. Mol. Spectrosc. 258 (2009) 26-34.

23. C.S. Brauer, J.C. Pearson, B.J. Drouin, and **S. Yu**, "New ground state measurements of ethyl cyanide", Astrophys. J. Suppl. Ser. 184 (2009) 133-137.

24. B.J. Drouin, **S. Yu**, J.C. Pearson and H.S.P. Muller, "High resolution spectroscopy of $^{12}CH_3D$ and $^{13}CH_3D$", J. Quant. Spectrosc. & Radiative Transfer 110 (2009) 2077-2081.

25. **S. Yu**, J. C. Pearson, B. J. Drouin, K. Sung, O. Pirali, M. Vervloet, M.-A. Martin-Drumel, C. P. Endres, T. Shiraishi, K. Kobayashi, and F. Matsushima, "Submillimeter-wave and far-infrared spectroscopy of high-*J* transitions of the ground and $\nu_2 = 1$ states of ammonia", J. Chem. Phys. (2010) 174317/1-174317/14.

26. B. J. Drouin, **S. Yu**, C. E. Miller, H. S.P. Muller, F. Lewen, S. Brunken, H. Habara, "Terahertz spectroscopy of oxygen, O_2, in its $^3\Sigma_g^-$ and $^1\Delta$ electronic states", J. Quant. Spectrosc. & Radiative Transfer 111 (2010), 1167–1173.

27 H. Gupta, P. Rimmer, J. C. Pearson, **S. Yu**, E. Herbst, N. Harada, E. A. Bergin, D. A. Neufeld, G. J. Melnick, R. Bachiller, W. Baechtold, T. A. Bell, G. A. Blake, E. Caux, C. Ceccarelli, J. Cernicharo, G. Chattopadhyay, C. Comito, S. Cabrit, N. R. Crockett, F.Daniel, E. Falgarone, M. C. Diez-Gonzalez, M.-L. Dubernet, N. Erickson, M. Emprechtinger, P. Encrenaz, M. Gerin, J. J. Gill, T. F. Giesen, J. R. Goicoechea, P. F. Goldsmith, C. Joblin, D. Johnstone, W. D. Langer, B. Larsson, W. B. Latter, R. H. Lin, D. C. Lis, R. Liseau, S. D. Lord, F. W. Maiwald, S. Maret, P. G. Martin, J. Martin-Pintado, K. M. Menten, P. Morris, H. S. P. Müller, J. A. Murphy, L. H. Nordh, M. Olberg, V. Ossenkopf, L. Pagani, M. Pérault, T. G. Phillips, R. Plume, S.-L. Qin, M. Salez, L. A. Samoska, P. Schilke, E. Schlecht, S. Schlemmer, R. Szczerba, J. Stutzki, N. Trappe, F. F. S. van der Tak, C. Vastel, S. Wang, H. W. Yorke, J. Zmuidzinas, A. Boogert, R. Güsten, P. Hartogh, N. Honingh, A. Karpov, J. Kooi, J.-M. Krieg, R. Schieder, and P. Zaal**, "**Detection of OH^+ and H_2O^+ towards Orion KL", Astron. & Astrophys. 521 (2010) L47.

28. D. A. Neufeld, J. R. Goicoechea, P. Sonnentrucker, J. H. Black, J. Pearson, **S. Yu**, T. G. Phillips, D. C. Lis, M. De Luca, E. Herbst, P. Rimmer, M. Gerin, T. A. Bell, F. Boulanger, J. Cernicharo, A. Coutens, E. Dartois,

M. Kazmierczak, P. Encrenaz, E. Falgarone, T. R. Geballe, T. Giesen, B. Godard, P. F. Goldsmith, C. Gry, H. Gupta, P. Hennebelle, P. Hily-Blant, C. Joblin, R. Kołos, J. Krełowski, J. Mart´ın-Pintado, K. M. Menten, R. Monje, B. Mookerjea, M. Perault, C. Persson, R. Plume, M. Salez, S. Schlemmer, M. Schmidt, J. Stutzki, D. Teyssier, C. Vastel, A. Cros, K. Klein, A. Lorenzani, S. Philipp, L. A. Samoska, R. Shipman, A. G. G. M. Tielens, R. Szczerba and J. Zmuidzinas**, "**Herschel/HIFI observations of interstellar OH^+ and H_2O^+ towards W49N: a probe of diffuse clouds with a small molecular fraction", Astron. & Astrophys. 521 (2010) L10.

29. D. A. Neufeld, P. Sonnentrucker , T. G. Phillips, D. C. Lis, M. De Luca, J. R. Goicoechea, J. H. Black, M. Gerin, T. Bell, F. Boulanger, J. Cernicharo, A. Coutens, E. Dartois, M. Kazmierczak, P. Encrenaz, E. Falgarone, T. R. Geballe, T. Giesen, B. Godard, P. F. Goldsmith, C. Gry, H. Gupta, P. Hennebelle, E. Herbst, P. Hily-Blant, C. Joblin, R. Kołos, J. Krełowski, J. Martín-Pintado, K. M. Menten, R. Monje, B. Mookerjea, J. Pearson, M. Perault, C. Persson, R. Plume, M. Salez, S. Schlemmer, M. Schmidt,J. Stutzki, D. Teyssier, C. Vastel, **S. Yu**, P. Cais, E. Caux, R. Liseau, P. Morris, and P. Planesas**, "**Strong absorption by interstellar hydrogen fluoride: Herschel/HIFI observations of the sight-line to G10.6–0.4 (W31C)**",** Astron. & Astrophys. 518 (2010) L108.

30. T. G. Phillips, E. A. Bergin, D. C. Lis, D. A. Neufeld, T. A. Bell, S. Wang, N. R. Crockett, M. Emprechtinger, G. A. Blake, E. Caux, C. Ceccarelli, J. Cernicharo, C. Comito, F. Daniel, M.-L. Dubernet, P. Encrenaz, M. Gerin, T. F. Giesen, J. R. Goicoechea, P. F. Goldsmith, E. Herbst, C. Joblin, D. Johnstone , W. D. Langer,W. D. Latter, S. D. Lord, S. Maret, P. G. Martin, G. J.Melnick, K. M.Menten, P. Morris, H. S. P. Müller, J. A. Murphy, V. Ossenkopf, J. C. Pearson, M. Pérault, R. Plume, S.-L. Qin, P. Schilke, S. Schlemmer, J. Stutzki, N. Trappe, F. F. S. van der Tak, C. Vastel, H. W. Yorke, **S. Yu**, J. Zmuidzinas, A. Boogert, R. Güsten, P. Hartogh, N. Honingh, A. Karpov1, J. Kooi, J.-M. Krieg, and R. Schieder**, "**Herschel observations of EXtra-Ordinary Sources (HEXOS): Detection of hydrogen fluoride in absorption towards Orion KL**",** Astron. & Astrophys. 518 (2010) L109.

31. P. Sonnentrucker, D. A. Neufeld, T. G. Phillips, M. Gerin, D. C. Lis, M. De Luca, J. R. Goicoechea, J. H. Black, T.A. Bell, F. Boulanger, J. Cernicharo, A. Coutens, E. Dartois, M. Ka´zmierczak, P. Encrenaz, E. Falgarone, T. R. Geballe, T. Giesen, B. Godard, P. F. Goldsmith, C. Gry, H. Gupta, P. Hennebelle, E. Herbst, P. Hily-Blant, C. Joblin, R. Kołos, J. Krełowski, J. Martín-Pintado, K. M. Menten, R. Monje, B. Mookerjea, J. Pearson, M. Perault, C. M. Persson, R. Plume, M. Salez, S. Schlemmer, M. Schmidt, J. Stutzki, D. Teyssier, C. Vastel, **S. Yu**, E. Caux, R. Güsten, W. A. Hatch, T. Klein, I. Mehdi, P. Morris, and J. S.Ward**, "**Detection of hydrogen fluoride absorption in diffuse molecular clouds with Herschel/HIFI: an ubiquitous tracer of molecular gas**",** Astron. & Astrophys. 521 (2010) L12.

32. M. Gerin, M. De Luca, J. R. Goicoechea, E. Herbst, E. Falgarone, B. Godard, T. A. Bell, A. Coutens, M. Ka´zmierczak, P. Sonnentrucker, J. H. Black, D. A. Neufeld, T. G. Phillips, J. Pearson, P. B. Rimmer, G. Hassel, D. C. Lis, C. Vastel, F. Boulanger, J. Cernicharo, E. Dartois, P. Encrenaz, T. Giesen, P. F. Goldsmith, H. Gupta, C. Gry, P. Hennebelle, P. Hily-Blant, C. Joblin, R. Kołos, J. Krełowski, J. Martín-Pintado, R. Monje, B. Mookerjea, M. Perault, C. Persson, R. Plume, M. Salez, M. Schmidt, J. Stutzki, D. Teyssier, **S. Yu**, A. Contursi, K.Menten, T. R. Geballe, S. Schlemmer, P. Morris, W. A. Hatch, M. Imram, J. S. Ward, E. Caux, R. Güsten, T. Klein, P. Roelfsema, P. Dieleman, R. Schieder, N. Honingh, and J. Zmuidzinas**, "**Interstellar CH absorption in the diffuse interstellar medium along the sight-lines to G10.6–0.4 (W31C), W49N, and W51", Astron. & Astrophys. 521 (2010) L16.

33. S.-L. Qin, P. Schilke, C. Comito, T. Möller, R. Rolffs, H. S. P. Müller, A. Belloche, K. M. Menten, D. C. Lis, T. G. Phillips, E. A. Bergin, T. A. Bell, N. R. Crockett, G. A. Blake, S. Cabrit, E. Caux, C. Ceccarelli, J. Cernicharo, F. Daniel, M.-L. Dubernet, M. Emprechtinger, P. Encrenaz, E. Falgarone, M. Gerin, T. F. Giesen, J. R. Goicoechea, P. F. Goldsmith, H. Gupta, E. Herbst, C. Joblin, D. Johnstone, W. D. Langer, S. D. Lord, S. Maret, P. G. Martin, G. J.Melnick, P. Morris, J. A. Murphy, D. A. Neufeld, V. Ossenkopf, L. Pagani, J. C. Pearson, M. Pérault, R. Plume, M. Salez, S. Schlemmer, J. Stutzki, N. Trappe, F. F. S. van der Tak, C. Vastel, S.Wang4 H. W. Yorke, **S. Yu**, J. Zmuidzinas, A. Boogert, R. Güsten, P. Hartogh, N. Honingh, A. Karpov, J. Kooi, J.-M. Krieg, R. Schieder, M. C. Diez-Gonzalez, R. Bachiller, J. Martin-Pintado, W. Baechtold, M.

Olberg, L. H. Nordh, J. L. Gill, and G. Chattopadhyay**, "**Herschel observations of EXtra-Ordinary Sources (HEXOS): detecting spiral arm clouds by CH absorption lines", Astron. & Astrophys. 521 (2010) L14.

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