

# Chentao YANG (杨辰涛)\*

European Southern Observatory  
Av. Alonso de Córdova 3107  
Vitacura, Santiago  
Chile

<http://cyang.pro>  
[cyang@eso.org](mailto:cyang@eso.org)  
+56 2 2463 3053  
+56 9 8402 0876

## Personal Information

Current status: ESO Fellow in Chile (with duties at ALMA/JAO)  
Gender: Male  
Year of birth: 1988  
Citizenship: P.R. China  
Languages: Chinese (native proficiency),  
English (full professional proficiency),  
French (elementary proficiency)

## Employment

European Southern Observatory (ESO) Fellow, Santiago, Chile 2017.11 – present

## Education

Institut d'Astrophysique Spatiale, Université Paris-Sud, France 2014.11 – 2017.10  
(Co-tutelle) PhD degree in Astrophysics, *Diploma awarded in January, 2018*  
*Supervisor:* Alain Omont, Alexandre Beelen  
Purple Mountain Observatory, Chinese Academy of Sciences, P.R. China 2013.09 – 2017.10  
(Co-tutelle) PhD degree in Astrophysics, *Diploma awarded in January, 2018*  
*Supervisor:* Yu Gao  
Astronomy Department, Beijing Normal University, P.R. China 2010.09 – 2013.06  
Master's degree in Astrophysics, *Diploma awarded in July, 2013*  
*Supervisor:* Yu Gao, Biwei Jiang  
Astronomy Department, Beijing Normal University, P.R. China 2006.09 – 2010.07  
Bachelor's degree in Astronomy, *Diploma awarded in July, 2010*

## Computer Skills

Languages: IDL, FORTRAN, Matlab, ~~TeX~~TeX, Python, Julia  
Operating systems: GNU/Linux (CentOS, openSUSE, etc.), MacOS, Windows  
Software: GILDAS, Starlink, DS9, CASA, HIPE, TOPCAT

## Research interests

- Submillimeter water maser in high-redshift galaxies Current
- Observations of the interstellar medium in submillimeter galaxies Current
- Millimeter and submillimeter line surveys at high redshift Current
  - *SUNRISE* – Submillimeter molecUlar liNe suRveys in dIstant duSty galaxiES
- Submillimeter H<sub>2</sub>O lines as the ISM tracers in dusty galaxies near and far Current
- Ph.D. Thesis* • Physical conditions of the interstellar medium in high-redshift submillimetre bright galaxies (*ADS record*) 2013–2017
- Master Thesis* • Water vapor in galaxies near and far 2011–2013
- Bachelor Thesis* • Cold dust in nearby galaxies 2009–2010
- Design of the experiments for the course “Radio Astronomy” (National Undergraduates Innovative Experimentation Program) 2008

\*In Chinese, 辰涛 (chen-tao) can mean star-waves, in which 辰 (chen) means stars and 涛 (tao) means waves.

**Accepted PI Proposals<sup>‡</sup>**  
**More than 450 h**  
(<sup>A/B</sup>: A/B-rated)

- The Atacama Large Mm/submm Array (**ALMA**), **7 proposals, 62 h<sup>12m</sup> + 50 h<sup>7m</sup>**. since 2017
  - 2017.A.00053.S (ACA observatory filler program, **50 h**);
  - 2018.1.00861.S<sup>B</sup>(EU, **10.4 h**), 2018.1.00797.S<sup>B</sup>(EU, **6.6 h**), 2018.1.01710.S(EU, **9.1 h**);
  - 2019.1.00205.S<sup>B</sup>(EU, **23.2 h**), 2019.1.00533.S<sup>B</sup>(EU, **4.8 h**), 2019.1.00310.S(EU, **8.0 h**);
- The NOthern Extended Millimeter Array (**NOEMA**), **12 proposals, 138 h**. since 2013
  - W0B3<sup>B</sup>, S14CT<sup>B</sup>, S15CT<sup>B</sup>, W15EQ<sup>B</sup>, S16CG<sup>B</sup>, S16CF<sup>B</sup>, S16BT<sup>B</sup>, W16DQ<sup>B</sup>, W16DO<sup>B</sup>, S18DC<sup>A</sup>, S18CT<sup>A</sup>, W18EB<sup>A</sup>;
- The IRAM-30m telescope (**IRAM-30m**), **3 proposals, 76 h**. since 2015
  - 079-15<sup>A</sup>, 196-15<sup>B</sup>, 076-16<sup>A</sup>;
- The Karl G. Jansky Very Large Array (**JVLA/NRAO**), **3 proposals, 47 h**. since 2014
  - 14B-259<sup>B</sup>, 15B-177, 18B-190;
- The Atacama Pathfinder EXperiment (**APEX/ESO**) telescope, **2 proposal, 55 h**. since 2016
  - 097.B-0914<sup>B</sup> (SEPIA-5), 103.B-0471<sup>A</sup> (SEPIA-9);

*Accepted proposals as a co-I: > 80 approved proposals including, ALMA (22 proposals), NOEMA (35, incl. 1 large program, **z-GAL/Herschel-ATLAS**), JVLA (4), GTC(1), Spitzer (1), VLT (2, KMOS), IRAM-30m (6), APEX (2), JCMT (7, incl. 4 large programs, **JINGLE, MALATANG, AWESOME** and **RAGERS**) and GMRT (1 proposal).*

**Observing Experience**

- The IRAM 30m telescope (IRAM30/IRAM), 2013–2016: > 100 h;
- The James Clerk Maxwell Telescope (JCMT/EAO), 2016: > 100 h;
- The ALMA Observatory (ALMA/JAO), 2018–present:  
Serving as Astronomer on Duty at the ALMA Operation Support Facility > 1000 h.

**Professional Service**

- Referee for scientific journals: *Apj*;
- HST Expert external proposal reviewer;
- Individual reviewer for the Astronomy Grants Panel of STFC;
- Member of the ESO (Chile) Fellowship Selection Committee (2019–present);
- Member of the ALMA (JAO) Post-Doctoral Fellow Selection Committee (2019);
- Technical Secretary of the ALMA Proposal Review meeting, 2018 (Cycle 6) – 2019 (Cycle 7);

**Teaching & Mentorship**

- **Nina Grant**, Princeton International Internship program, Complete the rotation curve of NGC 7528 with neutral carbon emission; June–August 2019
- Lecture, Advance topics of astrophysics and astrobiology, Universidad Andrés Bello, Chile; The ISM in high-redshift dusty star-forming galaxies. 2<sup>nd</sup> Semester 2019

**Refereed Publications**  
(†: 1<sup>st</sup>/2<sup>nd</sup> author)  
*NASA/ADS library*

*8 publications as the 1<sup>st</sup>/2<sup>nd</sup> author; 390 citations in total, incl. 126 citations of the 1<sup>st</sup>-author papers; Metrics: (NASA/ADS) h-index = 13, h-index/(years since PhD defence) = 4.3*

26. **ALMA [N II] 205  $\mu$ m imaging spectroscopy of the lensed submillimeter galaxy ID 141 at redshift 4.24**  
Cheng Cheng, Xiaoyue Cao, Nanyao Lu, **Chentao Yang**, Dimitra Rigopoulou, Vassilis Charmandaris et al. 2020, *ApJ*, 898, 33;
- †25. **Etching glass in the early Universe: Luminous HF and H<sub>2</sub>O emission in a QSO-SMG pair at z = 4.7**  
M. D. Lehnert, **C. Yang**, B.H.C. Emonts, A. Omont, E. Falgarone, P. Cox, and P. Guillard 2020, *A&A*, 641, A124;
24. **The MALATANG Survey: Dense Gas and Star Formation from High Transition HCN and HCO<sup>+</sup> maps of NGC 253**  
Xuejian Jiang, Thomas R. Greve, Yu Gao, Zhi-Yu Zhang, ..., **Chentao Yang**, Qian Jiao, Aeree Chung et al. 2020, *MNRAS*, 494, 1276;
- †23. **The first detection of the 448 GHz ortho-H<sub>2</sub>O line at high redshift: probing the structure of a starburst nucleus at z ~ 3.63**

<sup>‡</sup>Please see the titles of the proposals at the end of the CV.

- C. Yang, E. González-Alfonso, A. Omont, M. Pereira-Santaella, J. Fisher, A. Beelen, R. Gavazzi 2020, *A&A*, 634, L3;
22. **A declining starburst at  $z = 4.72$  lensed by a merging pair of massive galaxies at  $z = 1.48$**   
L. Ciesla, M. Béthermin, E. Daddi, J. Richard, T. Diaz-Santos, M. Sargent, D. Elbaz, M. Boquien, T. Wang, C. Schreiber, C. Yang, J. Zabl et al. 2020, *A&A*, 635, A27;
  21. **NOEMA Redshift Measurements of Bright *Herschel* Galaxies**  
R. Neri, P. Cox, A. Omont, A. Beelen, S. Berta, T. Bakx, M. Lehnert, ..., C. Yang and A.J. Young 2020, *A&A*, 635, A7;
  20. **A SCUBA-2 Selected *Herschel*-SPIRE Dropout and the Nature of this Population**  
J. Greenslade, E. Aguilar, D. L. Clements, H. Dannerbauer, T. Cheng, G. Petitpas, C. Yang, H. Messias et al. 2019, *MNRAS*, 490, 5317;
  19. **JINGLE V: Dust properties of nearby galaxies derived from hierarchical Bayesian SED fitting**  
Isabella Lamperti, Amélie Saintonge, Ilse De Looze, Gioacchino Accurso, Christopher J. R. Clark, Matthew W. L. Smith, Christine D. Wilson, ..., Chentao Yang 2019, *MNRAS*, 489, 4389;
  18. **JINGLE, a JCMT legacy survey of dust and gas for galaxy evolution studies: II. SCUBA-2 850  $\mu\text{m}$  data reduction and dust flux density catalogues**  
Matthew W. L. Smith, Christopher J. R. Clark, Ilse De Looze, Isabella Lamperti, Amélie Saintonge, Christine D. Wilson, ..., Chentao Yang and Ming Zhu 2019, *MNRAS*, 486, 4166;
  17. **The molecular-gas properties in the gravitationally lensed merger HATLAS J142935.3-002836;**  
Hugo Messias, Neil Nagar, Zhi-Yu Zhang, Iván Oteo, Simon Dye, Nicholas Timmons, Eduardo Ibar, ..., and Chentao Yang 2019, *MNRAS*, 486, 2366;
  - †16. **CO, H<sub>2</sub>O, H<sub>2</sub>O<sup>+</sup> line and dust emission in a  $z = 3.63$  strongly lensed starburst merger at sub-kiloparsec scales;**  
C. Yang, R. Gavazzi, A. Beelen, P. Cox, A. Omont, M. Lehnert, Y. Gao, R. J. Ivison, A. M. Swinbank, L. Barcos-Múnoz, R. Neri, A. Cooray, S. Dye, S. Eales et al. 2019, *A&A*, 624, A138;
  15. **Planck's Dusty GEMS. VII. Atomic carbon and molecular gas in dusty starburst galaxies at  $z = 2$  to 4;**  
N. P. H. Nesvadba, R. Canameras, R. Kneissl, S. Koenig, C. Yang, E. Le Floch, A. Omont and D. Scott 2019, *A&A*, 624, A23;
  14. **VALES V: A kinematic analysis of the molecular gas content in *H*-ATLAS galaxies at  $z \sim 0.03$ – $0.35$  using ALMA;**  
J. Molina, E. Ibar, V. Villanueva, A. Escala, C. Cheng, M. Baes, H. Messias, C. Yang, F.E. Bauer, P. P. Van der Werf, R. Leiton, M. Aravena, ..., S. Eales & L. Dunne 2019, *MNRAS*, 482, 1499;
  - †13. **Planck's Dusty GEMS. VI. Multi-*J* CO excitation and interstellar medium conditions in dusty starburst galaxies at  $z = 2$ – $4$**   
R. Cañameras, C. Yang, N. P. H. Nesvadba, A. Beelen, R. Kneissl, S. Koenig, E. Le Floch, M. Limousin, S. Malhotra, A. Omont, D. Scott 2018, *A&A*, 620, A61; (*IRAM Press Release*)
  12. **JINGLE, a JCMT legacy survey of dust and gas for galaxy evolution studies: I. Survey overview and first results;**  
Amélie Saintonge, Christine D. Wilson, Ting Xiao, Lihwai Lin, Ho Seong Hwang, Tomoka Tosaki, ..., Chentao Yang, Ming Zhu et al. 2018, *MNRAS*, 481, 3497;
  11. **Far-infrared *Herschel* SPIRE spectroscopy of lensed starbursts reveals physical conditions of ionised gas;**  
Zhi-Yu Zhang, R. J. Ivison, R. D. George, Yinghe Zhao, L. Dunne, ..., Chentao Yang, Stephen Eales, Ros Hopwood, Steve Maddox, Alain Omont et al. 2018, *MNRAS*, 481, 59;
  10. **Extreme conditions in the molecular gas of lensed star-forming galaxies at  $z \sim 3$ ;**  
Paola Andreani, Edwin Retana-Montenegro, Zhi-Yu Zhang, Padelis Papadopoulos, Chentao Yang, Simona Vegetti 2018, *A&A*, 615, A142;
  9. **The MALATANG Survey: the  $L_{\text{gas}}-L_{\text{IR}}$  correlation on sub-kiloparsec scale in six nearby star-forming galaxies as traced by HCN  $J = 4 - 3$  and HCO<sup>+</sup>  $J = 4 - 3$ ;**  
Qing-Hua Tan, Yu Gao, Zhi-Yu Zhang, Thomas Greve, Xue-Jian Jiang, Christine Wilson, Chen-Tao Yang, Ashley Bemis, Aeree Chung et al. 2018, *ApJ*, 860, 165;

8. **VALES: IV. Exploring the transition of star formation efficiencies between normal and starburst galaxies using APEX/SEPIA and ALMA at low redshift;**  
C. Cheng, E. Ibar, T. M. Hughes, V. Villanueva, R. Leiton, G. Orellana, A. Munoz-Arancibia, N. Lu, C. K. Xu, C. N. A. Willmer, J. Huang, T. Cao, C. Yang et al. 2018, *MNRAS*, 475, 248;
7. **The *Herschel* Bright Sources (HerBS): Sample definition and SCUBA-2 observations;**  
Tom J. L. C. Bakx, S. A. Eales, M. Negrello, M. W. L. Smith, E. Valiante, W. S. Holland, M. Baes, N. Bourne, D. L. Clements, ..., P. van der Werf, C. Yang, 2018, *MNRAS*, 273, 1751;
6. **High dense gas fraction in intensely star forming dusty galaxies;**  
I. Oteo, Z-Y. Zhang, C. Yang, R. J. Ivison, A. Omont, M. Bremer, S. Bussmann, A. Cooray, P. Cox, H. Dannerbauer, L. Dunne, S. Eales, ..., and P. Van der Werf 2017, *ApJ*, 850, 170;
- †5. **Molecular gas in the *Herschel*-selected strongly lensed submillimeter galaxies at  $z \sim 2-4$  as probed by multi-J CO lines;**  
C. Yang, A. Omont, A. Beelen, Y. Gao, P. van der Werf, R. Gavazzi, Z.-Y. Zhang, R. Ivison, M. Lehnert, D. Liu, I. Oteo, E. González-Alfonso et al. 2017, *A&A*, 608, A144;
- †4. **Submillimeter H<sub>2</sub>O and H<sub>2</sub>O<sup>+</sup> emission in lensed ultra- and hyper-luminous infrared galaxies at  $z \sim 2-4$ ;**  
C. Yang, A. Omont, A. Beelen, E. González-Alfonso, R. Neri, Y. Gao, P. van der Werf, A. Weiß, R. Gavazzi, N. Falstad, A. J. Baker, R. S. Bussmann, A. Cooray et al. 2016, *A&A*, 595, A80;
3. **High-J CO Versus far-infrared relations in normal and starburst galaxies;**  
Daizhong Liu, Yu Gao, Kate Isaak, Emanuele Daddi, Chentao Yang, Nanyao Lu and Paul van der Werf 2015, *ApJ*, 810, L14;
- †2. **Water vapor in nearby infrared galaxies as probed by *Herschel*;**  
Chentao Yang, Yu Gao, A. Omont, Daizhong Liu, K. G. Isaak, D. Downes, P. P. van der Werf and Nanyao Lu 2013, *ApJ*, 771, L24;
- †1. **H<sub>2</sub>O emission in high-z ultra-luminous infrared galaxies;**  
A. Omont, C. Yang, P. Cox, R. Neri, A. Beelen, R. S. Bussmann, R. Gavazzi, P. van der Werf, D. Riechers, D. Downes and 40 other authors 2013, *A&A*, 551, A115; ([A&A Highlight](#))

**Submitted Publications**  
(†: 1<sup>st</sup>/2<sup>nd</sup> author)

- **Planck’s Dusty GEMS. VIII. Dense gas reservoirs in the most active dusty starbursts at  $z \sim 3$**   
R. Cañameras, N. P. H. Nesvadba, R. Kneissl, S. König, C. Yang, A. Beelen, R. Hill, E. Le Floch and D. Scott 2020, submitted to *A&A*;
- **A proto-pseudobulge in ESO 320-G030 fed by a massive molecular inflow driven by a nuclear bar**  
E. González-Alfonso, M. Pereira-Santaella, J. Fischer, S. García-Burillo, C. Yang, A. Alonso-Herrero, L. Colina, M. L. N. Ashby, H. A. Smith, F. Rico-Villas et al., submitted to *A&A*;

**Presentations**

- Ordered by category (*2 invited talks, 6 contributed talks, and 10 seminar talks, since 2015*)
- Invited review talk* • “Water in the Universe” Symposium, ACS Fall 2019 National Meeting & Exposition, San Diego, California, USA August 25–29, 2019  
**Water vapor in galaxies at high redshift**
- Invited talk* • The ALMA Quest for Our Cosmic Origins, Joint ALMA Observatory (JAO), Vitacura, Santiago, Chile March 27, 2018  
**Physical conditions of the ISM in high-redshift lensed submillimeter galaxies**
- Contributed talk* • Multi-line Diagnostics of the Interstellar Medium, Nice, France TBD, 2021  
**The rich molecular inventory of two dusty galaxies twelve billion years ago**  
(*postponed due to COVID-19*)
- Contributed talk* • KIAA forum on gas in galaxies: Multiple-phase Interstellar medium – Probing the Activities and Power Engines from Local to Distant Universe, Beijing, China September 9–13, 2019  
**The interstellar medium in high-redshift strongly gravitational lensed galaxies**
- Contributed talk* • Views on the Interstellar Medium in galaxies in the ALMA era, Bologna, Emilia-Romagna, Italy September 2–6, 2019

- Studying the ISM in high-redshift strongly lensed galaxies in the ALMA era**
- Contributed talk* • The Laws of Star Formation: From the Cosmic Dawn to the Present Universe, Cambridge University, UK July 2–6, 2018  
**Molecular gas in high-redshift strongly lensed dusty starbursts as traced by multi-J CO lines**
- Contributed talk* • The Eighth Sino-French “LIA-origins” Workshop: Probing Baryons in the Universe, Sèvres, Hauts-de-Seine, France November 14–18, 2016  
**H<sub>2</sub>O and H<sub>2</sub>O<sup>+</sup> emission in lensed hyper/ultra-luminous infrared galaxies at  $z \sim 2-4$**
- Contributed talk* • Water in the Universe: From Clouds to Oceans, European Space Agency (ESA/ESTEC), Noordwijk, Netherland April 11–15, 2016  
**H<sub>2</sub>O Emission in Ultra-luminous Infrared Galaxies at High- $z$**
- Invited seminar talk* • Dominion Radio Astrophysical Observatory, Victoria, BC, Canada (remote) October 7, 2020  
**Extragalactic water across cosmic time**
- Invited seminar talk* • CAS South America Center for Astronomy, Santiago, Chile January 8, 2020  
**Water vapor in galaxies near and far**
- Seminar talk* • European Southern Observatory (ESO Santiago), Chile November 21, 2019  
**Water vapor in galaxies near and far**
- Invited seminar talk* • The Cosmic Dawn Center, DTU-Space division, Denmark December 12, 2018  
**Physical conditions of the ISM in strongly lensed dusty star-forming galaxies in the early universe**
- Seminar talk* • Centre for Extragalactic Astronomy, Durham University, UK June 29, 2018  
**Physical conditions of the interstellar medium in strongly lensed submillimeter galaxies at high-redshift**
- Seminar talk* • Department of Physics, Oxford University, UK June 28, 2018  
**Physical conditions of the ISM in high-redshift strongly lensed dusty star-forming galaxies**
- Seminar talk* • Instituto de Física y Astronomía, Universidad de Valparaíso, Chile January 18, 2018  
**Physical conditions of the ISM in high-redshift lensed submillimeter galaxies**
- Seminar talk* • Institute of Astrophysics, PUC de Chile, Santiago, Chile December 20, 2017  
**Physical conditions of the interstellar medium in high-redshift lensed submillimeter galaxies**
- Seminar talk* • CAS South America Center for Astronomy, Santiago, Chile December 11, 2017  
**Tracing the physical conditions of the interstellar medium in high-redshift lensed submillimeter galaxies**
- Seminar talk* • Astronomy department of Beijing Normal University, Beijing, China December 23, 2016  
**Physical conditions of the ISM in high-redshift submillimeter galaxies**
- Poster* • IAU Symposium 352: Uncovering early galaxy evolution in the ALMA and JWST era, Viana do Castelo, Portugal June 3–7, 2019  
**CO, H<sub>2</sub>O, H<sub>2</sub>O<sup>+</sup> line and dust emission in a  $z = 3.63$  strongly lensed starburst merger at sub-kiloparsec scales**
- Poster* • Journées Nationales PNCG 2015, Nice, France December 15–16, 2015  
**Submillimeter H<sub>2</sub>O line emission in the lensed ultra-luminous infrared galaxies at  $z \sim 2-4$**
- Poster* • XXIX IAU-GA IAUS315: From interstellar clouds to star-forming galaxies: universal processes? Honolulu, Hawaii, USA August 03–07, 2015  
**Submillimeter H<sub>2</sub>O emission in infrared bright galaxies near and far**
- Poster* • XXIX IAU-GA FM15: Search for Water and Life’s Building Blocks in the Universe, Honolulu, Hawaii, USA August 03–05, 2015  
**Water vapor emission in ultra-luminous infrared galaxies at  $z \sim 2-4$**
- Visitor/Travel Grants** • **IAP Visitorship Grant** March 17-29, 2020; May 20–31, 2019; July 7–21, 2018  
Institut d’Astrophysique de Paris, France

- **International Astronomical Union (IAU) Travel Grant** August 3–14, 2015  
XXIX IAU General Assembly, Honolulu, Hawaii, USA
- **The LIA-Origins Short Visit Program Grant** 2012, 2013  
Institut d'Astrophysique de Paris & Institut d'Astrophysique Spatiale, France

## *Appendix: Titles of the PI proposals*

- ALMA:**
- **2017.A.00053.S:** ALMA ACA Band 8 Pbservatory Project: Mapping fine structure lines of neutral atomic carbon in local bright galaxies
  - **2018.1.00797.S:** Probing the dense gas properties and star formation in a  $z = 3.6$  lensed SMG using dense gas tracers and CO isotopologues
  - **2018.1.00861.S:** The Shape of Water: Dissecting the ISM in high-redshift dusty starbursts with luminous water emission lines
  - **2018.1.01710.S:** Resolving into clumps scales in a redshift 3.6 hyper-luminous major merger
  - **2019.1.00205.S:** Physical conditions and chemical processes of the ISM at high redshift: a line survey towards BR1202-0725
  - **2019.1.00533.S:** Constrain the ISM conditions and ionization states at high redshift with mult-transitions of the  $\text{H}_2\text{O}^+$  and  $\text{H}_2\text{O}$  lines
  - **2019.1.00310.S:** Resolving into clump scales in a redshift 3.6 hyper-luminous gas-rich merger
- NOEMA:**
- **W0B3:** Exploring the dense molecular gas in two lensed Herschel galaxies at  $z \sim 3.6$
  - **S14CT:** Probing the dense molecular gas in a  $z \sim 3.6$  lensed ULIRG
  - **S15CT:** Exploring the dense molecular gas in two  $z > 3$  lensed ULIRGs
  - **W15EQ:**  $\text{H}_2\text{O}^+$  and  $\text{OH}^+$  in high- $z$  ULIRGs: diagnostic of their starburst, AGN and chemistry
  - **S16CG:** Probing the high- $J$  CO excitation component in high- $z$  lensed, submillimeter  $\text{H}_2\text{O}$  bright ULIRGs
  - **S16CF:** Low level  $\text{H}_2\text{O}/\text{H}_2\text{O}^+$  lines in high- $z$  lensed ULIRGs: completing the diagnostic of  $\text{H}_2\text{O}$  excitation, chemistry and tracing the kinematics
  - **S16BT:** Observing the neutral carbon lines in lensed high- $z$  ULIRGs with bright  $\text{H}_2\text{O}$  emission
  - **W16DQ:** Low- $J$  level  $\text{H}_2\text{O}/\text{H}_2\text{O}^+$  lines in high- $z$  lensed ULIRGs: access to the full diagnostic power of  $\text{H}_2\text{O}$ , constraining the chemistry and kinematics
  - **W16DO:** Observing the neutral carbon lines in lensed high- $z$  ultra-luminous infrared galaxies with bright  $\text{H}_2\text{O}$  emission
  - **S18DC:** Probing the gas content and star formation in a  $z = 3.6$  strongly lensed submillimeter galaxy using dense gas tracers and C/O isotopes
  - **S18CT:** Probing the gas conditions in high-redshift submillimeter galaxies with the fine structure lines of neutral atomic carbon
  - **W18EB:** Dense gas conditions and chemical signatures of the AGN environment in the  $z = 3.91$  strongly lensed quasar APM 08279+5255
- IRAM-30 m:**
- **079-15:** Molecular gas in lensed high- $z$  ULIRGs with submillimeter  $\text{H}_2\text{O}$  emission
  - **196-15:** Molecular gas excitation in lensed high- $z$  ULIRGs with submillimeter  $\text{H}_2\text{O}$  emission
  - **076-16:** Observing the neutral carbon lines in lensed high- $z$  ULIRGs with bright  $\text{H}_2\text{O}$  emission
- JVLA:**
- **14B-259:** Exploring the dense molecular gas in two high- $z$  lensed ULIRGs
  - **15B-177:** A search for  $\text{H}_2\text{O}$  183.3 GHz line in high- $z$  sub-mm galaxies
  - **18B-190:** Cold molecular gas reservoir in a lensed submillimeter galaxy at  $z = 3.6$
- APEX (via ESO):**
- **097.B-0914:** A survey of 183.3 GHz  $\text{H}_2\text{O}$  line in local starburst galaxies
  - **103.B-0471:** Submillimeter water emission in local ultra-luminous infrared galaxies

*(last update: September 22, 2020)*