# Di Li

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## EDUCATION

**Ph.D.:** Astrophysics, Cornell University, Ithaca, NY — Feb 2002
**Bachelor of Science:** Nuclear Physics, Beijing University, Beijing, China — July 1995
**Graduation Certificate**: Computer Science, Beijing University, Beijing, China — July 1995

## EMPLOYMENT

**Chief Scientist** — July 2018 – **Present**
The Five-hundred-meter Aperture Spherical radio Telescope (FAST) Project

**Chief Scientist** — Jan 2012 – **Present**
Radio Astronomy Division, National Astronomical Observatories of China

**Research Scientist** — Jan 2007- Dec 2011
Jet Propulsion Lab, California Institute of Technology

**National Research Council Fellow** — May 2005 – Dec 2006
Jet Propulsion Laboratory/California Institute of Technology

**Astronomer** — Feb 2002 – May 2005
Harvard-Smithsonian Center for Astrophysics

## SELECTED GRANTS , AWARDS, COMMITTEE MEMBERSHIPS

**Leader, FRB Research Group**
Chinese Academy of Sciences, 2022
"Outstanding Science and Technology Achievement Prize"

**Member, Basic Science Center**
National Natural Science Foundation of China , 2020-2025
*"LAMOST and FAST: A Study of the MilkyWay and the Local Universe"*

**PI, Distinguished Young Fellowship**
National Natural Science FOUNDATION of China , 2017-2022
*"Surveys with Large Radio Facilities and Evolution of the Interstellar Medium"*

**Honorary Research Fellow**
University of KwaZulu-Natal, South African, **2020-2023**

**PI, National Key R&D Program of China**
Ministry of Science and Technology of China**,** 2017-2022
*"A Commensal Radio Astronomy FAST Survey (CRAFTS)"*

**Member,** Major Facilities User-Guidance Council**,** Chinese Academy of Sciences, 2015-2018

**PI, International Partnership Key Program,** Chinese Academy of Sciences, 2017-2022

**CoI, Gravitational Wave and General Relativity,** Key Program of National Natural Science Foundation of China , 2017-2022

**Chair,** Cradle of Life Science Working Group, The Square Kilometer Array Organization, 2015-2016

**PI, COsmology and Molecule Explorer (COME)**
concept study, "Pilot-A" Space Program, Chinese Academy of Sciences, 2015

**Member, Australia Telescope National Facility Steering Committee (ATNF),** 2012-2014
The Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

**PI, Fundamental Science Key Program (973)**
Ministry of Science and Technology of China, 2012-2016
*"The Frontiers of Radio Astronomy and FAST Early Sciences"*

**Member, Stratospheric Observatory for Far Infrared Astronomy (SOFIA) Science User Group**
Universities Space Research Association (USRA), 2012-2014

**Member of the Judge Panel, Chinese National Science and Technology Achievement Award**
Ministry of Science and Technology of China, 2012

**PI, Herschel Open Time Project,** ESA/NASA, 2011
*"The Conditions of Isolated Dark Clouds with Signs of On Going H2 Formation"*

**PI, SOFIA Basic Science Program, USRA/NASA,** 2011，*"Mapping Dark Gas in Rho Oph A"*

**Member of Group Achievement Award, NASA,** 2010
citation:**"**Outstanding achievements in the successful development of critical hardware"

**CoI of Herschel Open Time Key Projects**, ESA/NASA, 2008
- *"**GOT CPlus:** State of the Diffuse ISM: Galactic Observations of the Terahertz CII Line"*
- *"**HOP:** Herschel Oxygen Project"*

**CoI of 4 Herschel Open Time Projects,** ESA/NASA, 2011

**PI of Spitzer Proposal,** NASA, 2007
- "*MIPS SED Observations of Massive Quiescent Cores in Orion"*

**CoI of two Spitzer Proposals and Grants,** NASA 2006

**Resident Research Associateship Award,** National Research Council, USA**,** 2005
citation: "awarded to postdoctoral scholars of outstanding ability as a result of national competition."

## SYNOPSIS OF EXPERIENCES

LI, Di is an observer and instrumentalist. He is the Chief Scientist of the radio division of the National Astronomical Observatories, Chinese Academy of Sciences (NAOC) and the Chief Scientist of the Five-hundred-meter Aperture Spherical radio Telescope (FAST). He was trained in Nuclear physics and observational astronomy. He established a novel technique to solve the temperature distribution of interstellar dust, (co-)discovered interstellar oxygen as well as other molecules, developed and named the HI-narrow self-absorption (HINSA) technique, which enabled the first HINSA Zeeman measurement that was published as an Nature cover article. He led the science definition efforts during the commissioning phase of FAST, which resulted in its first pulsar，FRB discoveries. His research papers were voted into the "Top 10 Scientific Advances in China" of year 2021 and year 2022. He was awarded the 2022 "Outstanding Science and Technology Achievement" medal by the Chines Academy of Sciences. He served in advisory roles in various collaborations/organizations, such as the SKA, ATNF, Breakthrough Listen, etc.

## ACADEMIC ACHIEVEMENTS

Focusing on novel measurements of cosmic radio signals, I played a leading role in national and international major facilities, particularly the Five-hundred-meter Aperture Spherical radio Telescope (FAST).

A New Inversion Technique: Inversion is a common challenge in physics. I built a new, Fourier-transform based algorithm (**Li** et al. 1999 ApJ) to solve the inverse Blackbody radiation problem of interstellar dust.

Discover interstellar oxygen: A key ingredient of the interstellar medium (ISM) as well as a sign of life on Earth, abundant oxygen in the atmosphere prevent any detection of space $O_2$ until Goldsmith, Li et al. (2002 ApJ), which was made with the first generation THz space telescope.

Discover a new ISM component HI Narrow Self-Absorption (HINSA): Combining H atoms into $H_2$ molecule is a key step in the evolution of cosmic matter, at which point the dominating principles switch from physics to chemistry. We detected cold H-atoms (HI) inside molecular clouds and named it HINSA (Li & Goldsmith 2003 ApJ), which proved to be a unique tracer of molecular ISM, facilitates important measurements of star formation, e.g. an accurate measurement of interstellar magnetic field (Ching, Li* et al. 2022 《Nature》 cover article). A news report on 《Science》 called this work "potentially revolutionary".

Establish FAST's Commensal HI-Pulsar survey: In the history of radio astronomy, no major telescope has ever realized simultaneous survey of pulsars and HI, the two primary targets for the field. I proposed and led the development of a series of proprietary technologies, which facilitated the world's first multi-purpose survey, the Commensal Radio Astronomy FAST Survey (CRAFTS, Li et al. 2018 IEEE MW). CRAFTS triples the survey efficiency of FAST and produced its first batch of discoveries. Recently, CRAFTS published the world's first persistently active fast radio burst (FRB), (Niu, Aggarwal, Li* et al. 2022, Nature).

The Largest FRB sample: Li et al. (2021 Nature) published 1652 FRB bursts, more than all previous publications combined, moving this field into a new regime of statistical significance. Subsequent work (Feng, **Li*** et al. 2022 Science) starts to suggest an evolutionary picture for this mysterious, most violent cosmic explosion in radio band.

## SELECTED RECENT PUBLICATIONS

**Feng Y., Li D.*, Yang Y.-P. et al. 2022, Science, 375, 1266**
**Frequency-dependent polarization of repeating fast radio bursts-implications for their origin**

**Ching T. -C., Li D.*, Heiles, C. et al. 2022, Nature, 601, 49**
**An early transition to magnetic supercriticality in star formation**

Wang P., Li D.*, Clark C. J. et al. 2021, Science China Physics, Mechanics, and Astronomy, 64, 129562
FAST discovery of an extremely radio-faint millisecond pulsar from the Fermi-LAT unassociated source 3FGL J0318.1+0252

**Li D., Wang P., Zhu W. W. et al. 2021, Nature, 598, 267**
**A bimodal burst energy distribution of a repeating fast radio burst source**

Yao J. M., Zhu W. W., Manchester R. N., Coles W. A., Li D.* et al. 2021, Nature Astronomy, 5, 788
Evidence for three-dimensional spin-velocity alignment in a pulsar

Zhang, Z.-S., Werthimer, D., Zhang, T.-J., Cobb, J., Korpela, E., Anderson, D., Gajjar, V., Lee, R., Li, S.Y., Pei, X., Zhang, X., Huang, S.-J., Wang, P., Zhu, Y., Duan, R., Zhang, H.Y., Jin, C.J., Zhu, L.-C. & **Li, D.** 2020, *First SETI Observations with China's Five-hundred-meter Aperture Spherical Radio Telescope (FAST),* ApJ, 891, 174

Wang, J., **Li, D.,** Goldsmith, P.~F., Zhang, Z.-Y., Gao, Y., Shi, Y., Li, S., Fang, M.; Li, J. & Zhang, J.S. 2020, *Molecular Oxygen in the Nearest QSO Mrk 231*, ApJ, 889, 129

Feng, Y., **Li, D.,** Li, Y., Wang, J. 2019, *Constraints on individual supermassive binary black holes using observations of PSR J1909-3744*, RAA, 19, 178F

Zhang, L., **Li, D.**, Hobbs, G. et al. 2019, *PSR J1926-0652: A Pulsar with Interesting Emission Properties Discovered at FAST*, ApJ, 877, 55

Zarka, P., **Li, D**., Griesmeier, J.M., Lamy, Laurent, Girard, Julien N., Hess, Sébastien L. G., Lazio, T. Joseph W., Hallinan, Gregg 2019, *Detecting exoplanets with FAST?*, Research in Astronomy and Astrophysics, 19, 023

**Li, D.**, Dickey, J.M., & Liu, S. 2019, *Preface: Planning the scientific applications of the Five-hundred-meter Aperture Spherical radio Telescope,* Research in Astronomy and Astrophysics, 19, 016

*in a low-mass X-ray binary*, MNRAS, 480, 692

**Li, D.*, Wang, Pei, Qian, Lei, Krco, Marko, Dunning, Alex, Jiang, Peng, Yue, Youling, Jin, Chenjin, Zhu, Yan, Pan, Zhichen, Nan, Rendong 2018, *"Considerations for a Multi-beam Multi-purpose Survey with FAST",* IEEE Microwave, Vol. 19, Issue 3, p112-119 (arxiv:1802.03709)**

**Li, Di***, Tang, Ningyu*, Nguyen, Hiep, Dawson, J. R., Heiles, Carl, Xu, Duo, Pan, Zhichen, Goldsmith, Paul F., Gibson, Steven J., Murray, Claire E., Robishaw, Tim, McClure-Griffiths, N. M., Dickey, John, Pineda, Jorge, Stanimirović, Snežana, Bronfman, L., Troland, Thomas, the PRIMO collaboration, "*Where is OH and Does It Trace the Dark Molecular Gas (DMG)?",* ApJS, 235, 1

**Nan, R, Li, D., Jin, C., Wang, Q., Zhu, L., Zhu, W., Zhang, H., Yue, Y. & Qian, L. 2011, *"THE FIVE-HUNDRED-METER APERTURE SPHERICAL RADIO TELESCOPE (FAST) PROJECT",* International Journal of Modern Physics D, Volume No.20, Issue No. 6 (arXiv:1105.3794)**