Guang-Xing Li, Ph.D.

Principal AI Scientist · World Models & AI for Science Architect

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Summary

- **AI for Sciencex:** 15+ years of experience leading cutting-edge research at the intersection of large-scale deep learning and multi-scale physical systems, specialized in computationally-driven discovery.
- **World Models Architect:** Creator of ScaleAware-JEPA (Li, 2026), a pioneering self-supervised joint embedding predictive architecture designed to model multi-dimensional continuous fields for discovery.
- **Computational Physics & Systems:** 15+ years of research experience in (astro)hydrodynamics and dynamical systems, translating complex, high-dimensional physical frameworks into scalable machine learning architectures using PyTorch, and HPC/Linux ecosystems.
- **Scientific Leadership & Strategy:** Proven track record of defining visionary research agendas, securing over 520,000 EUR in competitive funding, and establishing global collaborations (e.g., Max Planck Partner Group) bridging AI and the natural sciences.
- **Extensive Publication Record:** Author of 111 peer-reviewed publications (1,500+ citations, h-index 21), including high-impact first/corresponding-author breakthroughs in *Nature Astronomy* and *Nature Communications*.

Technical Skills

Core AI/ML Research: Self-supervised learning, Joint Embedding Predictive Architectures (JEPA), World Models, Representation Learning, Foundation Models for Continuous/Structured Data

ML Systems & Architecture: PyTorch, Custom CUDA Kernel Optimization, Scalable Distributed Systems, High-Performance Computing (HPC), Linux, Multi-Scale Architectures (e.g., CDD-ConvNeXt)

Scientific Modeling: (Astro)hydrodynamics, dynamical systems, multi-scale spatial-temporal data, continuous vector fields, structural thresholds, large volumes of heterogeneous data

Leadership: Cross-disciplinary AI/Science strategy, research agenda definition, academic-industrial global liaison

Featured Open-Source AI Research

ScaleAware-JEPA — arXiv:2606.29723 *Lead Architect & Sole Author (2026)*

Architected a state-of-the-art self-supervised world model framework for continuous physical fields, fundamentally solving representational collapse across sharp boundaries by replacing standard tokenization with physical-coordinate scale priors.

- Released as an open-source foundational framework, rapidly gaining massive community traction to become a **trending paper on alphaXiv** (achieving ∼70 likes shortly after publication).
- Engineered Constrained Diffusion Decomposition (CDD), an innovative scale-decomposition framework enabling standard vision encoders to process complex, continuous scientific fields seamlessly.
- Built and optimized highly efficient distributed-ready data pipelines, leveraging custom PyTorch/CUDA kernels to maximize throughput for massive heterogeneous datasets on hardware-constrained environments.

Professional Experience

Principal Investigator & Associate Professor — Yunnan University (SWIFAR) 2018 – Present

- **Research Leadership:** Direct a cross-functional squad of researchers and scientists, defining the long-term AI agenda for modeling multi-scale turbulence, (astro)hydrodynamics, and complex continuous systems.
- **Global Collaboration:** Established and co-led a 60,000 EUR Max Planck Partner Group (Germany), serving as the primary liaison managing high-level scientific breakthroughs across European and Asian institutions.
- **High-Performance Computing:** Oversee the architecture and deployment of large-scale ML models on HPC clusters, optimizing massive scientific data ingestion and distributed training paradigms.
- **Scientific Mentorship:** Supervise PhD and MSc candidates through to groundbreaking research publications, placing them into prestigious international research institutes.

DFG Research Fellow — LMU München (Universitäts-Sternwarte), Germany 2014 – 2018

- Awarded a prestigious 220,000 EUR DFG grant to independently engineer and execute a multi-scale structural analysis research program using large-scale Linux-based computing environments.
- Pioneered the "G-virial method," a novel mathematical framework combining analytical theory with advanced numerical simulations to decode structural thresholds in highly turbulent media.

Ph.D. Researcher — Max Planck Institute for Radio Astronomy, Germany 2010 – 2014

- Graduated *magna cum laude*. Developed robust, scalable algorithms and computational models to resolve multi-scale structures in complex, high-dimensional heterogeneous environments.

Selected Publications (AI-Physics Intersection, High-stake discovery)

- **G.-X. Li**, "ScaleAware-JEPA: Latent Representation for Discovery in Multiscale Physical Fields," *arXiv:2606.29723* (2026). Sole author.
- B. Chen, **G. Li**, H. Yuan *et al.*, "A large, long-lived, slowly-expanding superbubble across the Perseus arm," *Nature Communications* 16, 10558 (2025).

- R.-Z. Yang, **G.-X. Li**, E. de Oña Wilhelmi *et al.*, "Effective shielding of $\lesssim 10$ GeV cosmic rays from dense molecular clumps," *Nature Astronomy* 7, 351–358 (2023).
- **G.-X. Li** and B.-Q. Chen, "Discovery of a coherent, wave-like velocity pattern for the Radcliffe wave," *MNRAS Letters* 517, L102–L107 (2022). First author.

Education

Ph.D. in Astrophysics / Computational Modeling (Physics) 2014
Max Planck Institute for Radio Astronomy & University of Bonn, Germany (*Magna Cum Laude*)

M.Sc. in Astrophysics (Physics) 2010
University of Science and Technology of China (USTC)

B.Sc. in Electronics (Engineering) 2007
Peking University (PKU)