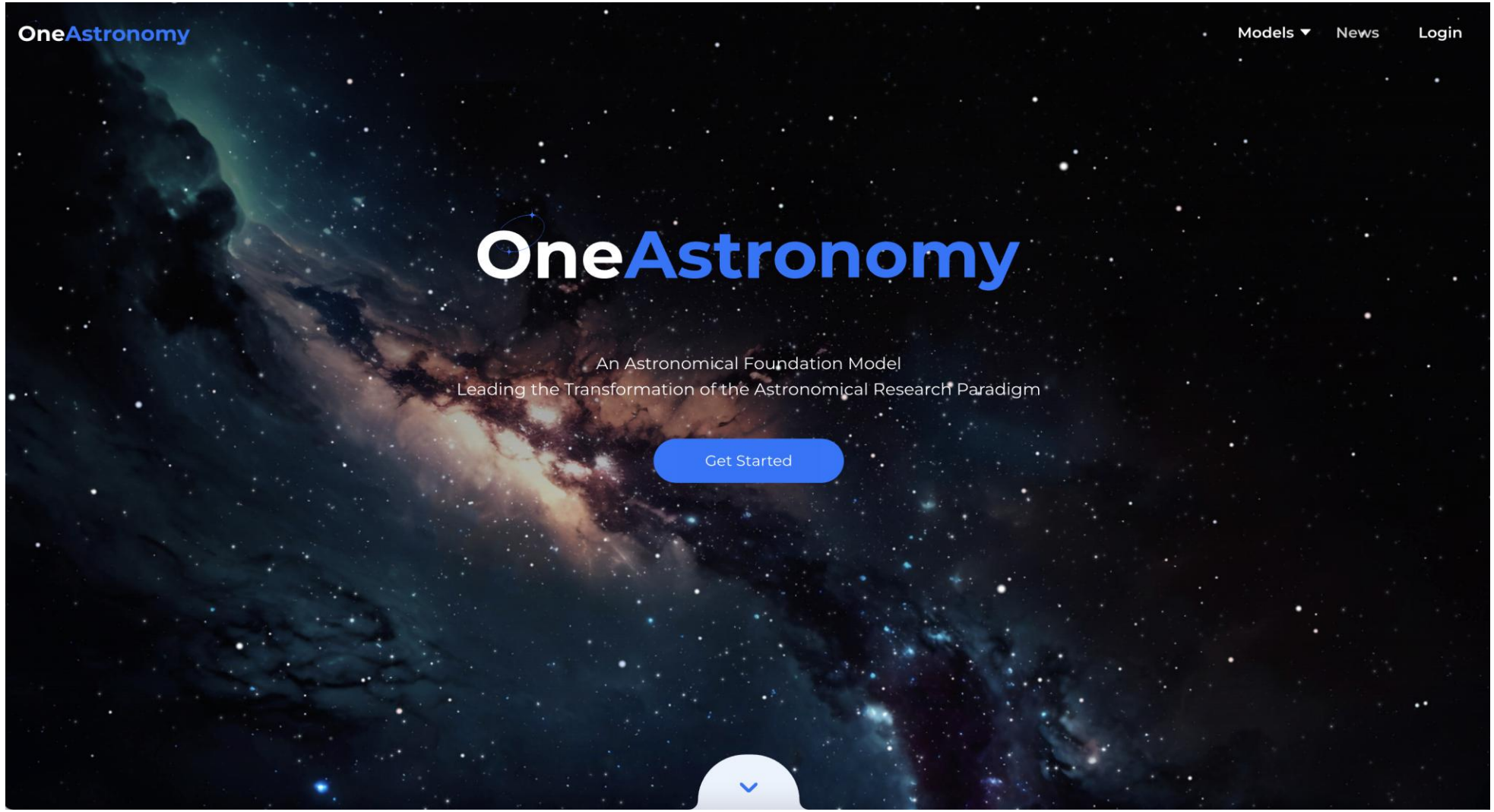
OneAstronomy

2025 Dec 10

之江实验室 ZHEJIANG LAB

Publicly available



https://oneastronomy.zero2x.org/

Part A：What is OneAstronomy

What is the underlying foundation of OneAstronomy?

OneAstronomy is an astronomy domain foundation model

What is the purpose of OneAstronomy?

Astronomical scientist

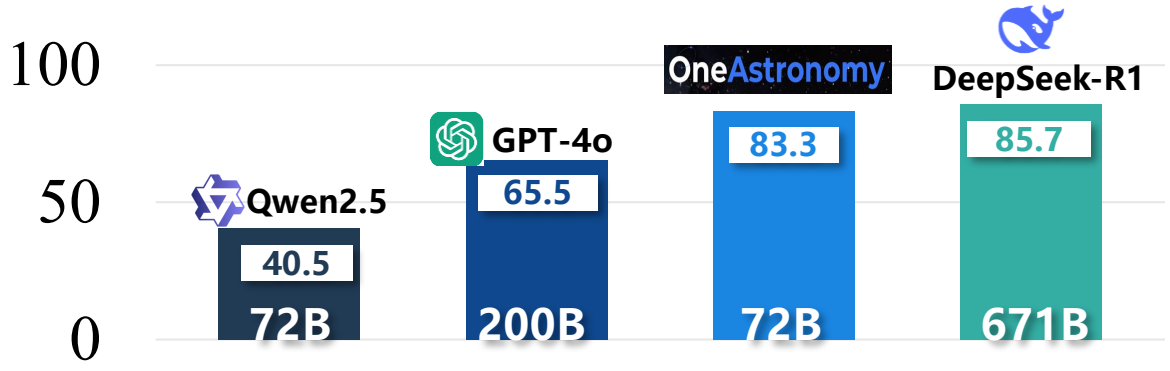
OneAstronomy possesses astronomical scientific knowledge and is capable of data analysis, supporting scientists in their research and exploration.

Embodied intelligence

OneAstronomy supports intelligent embodied systems for astronomical observation, enabling collaborative astronomical observations.

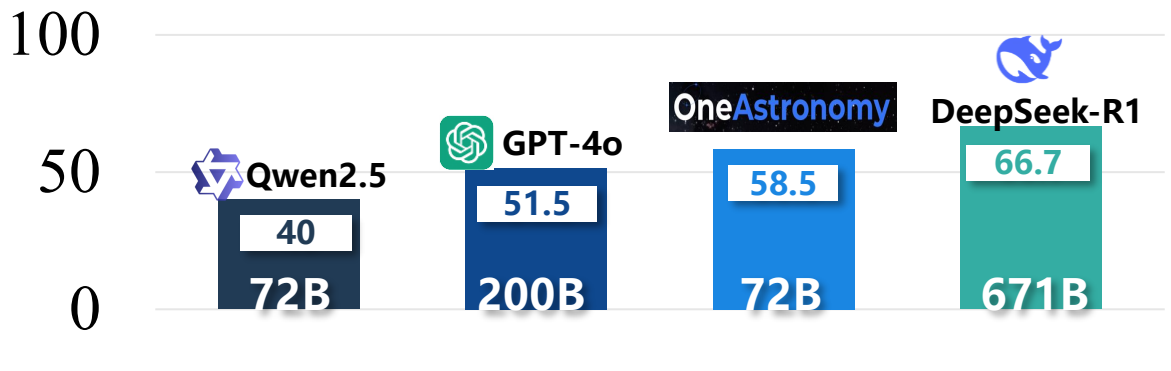
OneAstronomy astronomical capability evaluation

OneAstronomy demonstrates superior astronomical reasoning capabilities.



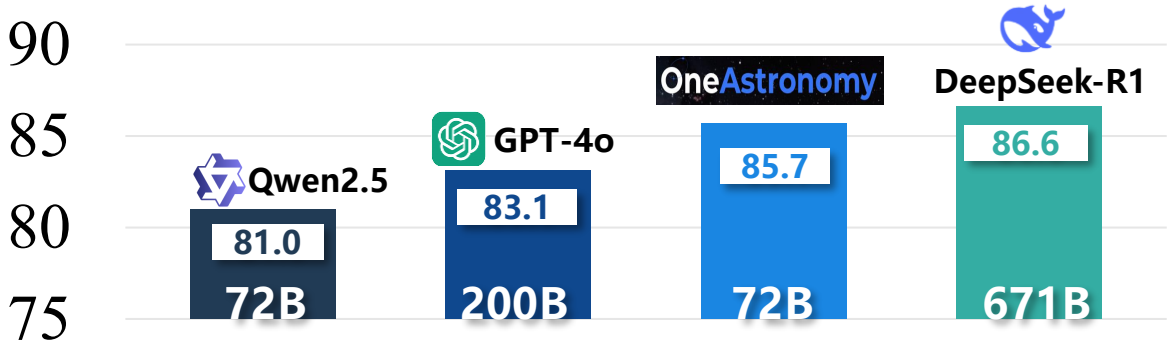
GPQA-astro

Astronomical reasoning evaluation set with 42 questions



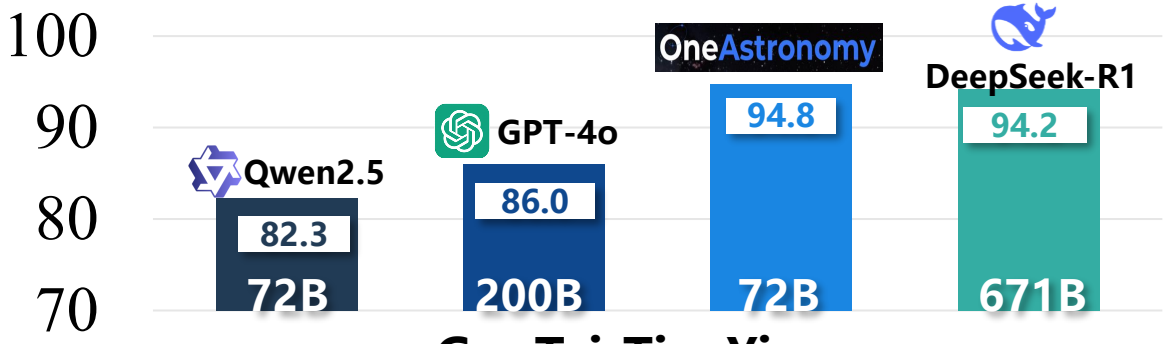
SuperGPQA-astro

Astronomical reasoning evaluation set with 405 questions



Astrobench-mcq

Astronomical knowledge evaluation set with 3,846 questions



GuoTai-TianYi

Astronomical knowledge evaluation set with 458 questions

Part B： OneAstronomy for Astronomer

OneAstronomy——Serve astronomers

Precise answers to astronomical questions

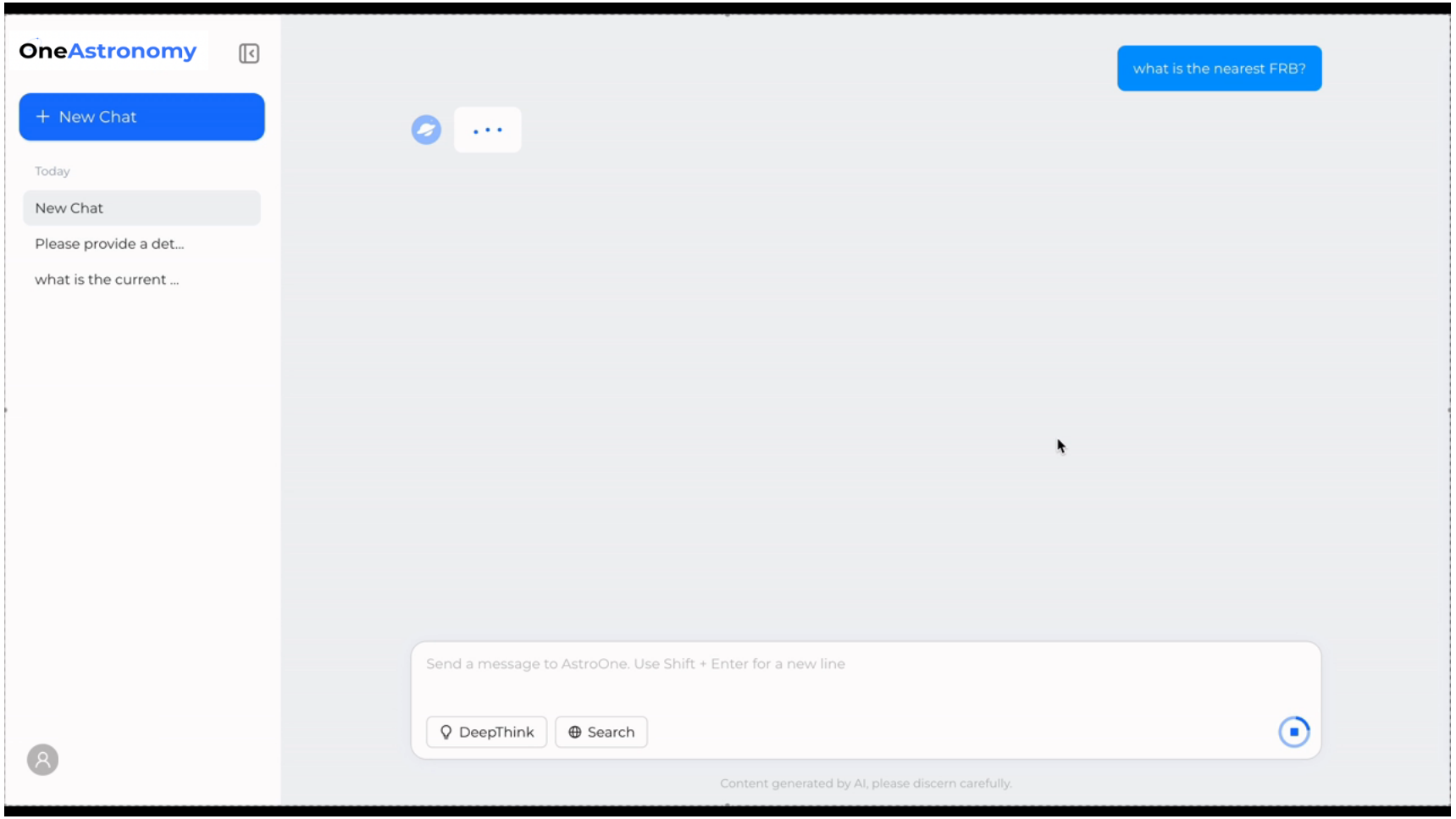
Reasoning over complex astronomy questions

Access the latest astronomical knowledge

Collaborative analysis with astronomical science models

OneAstronomy—Precise answers to astronomical questions

Send: What is the nearest FRB?

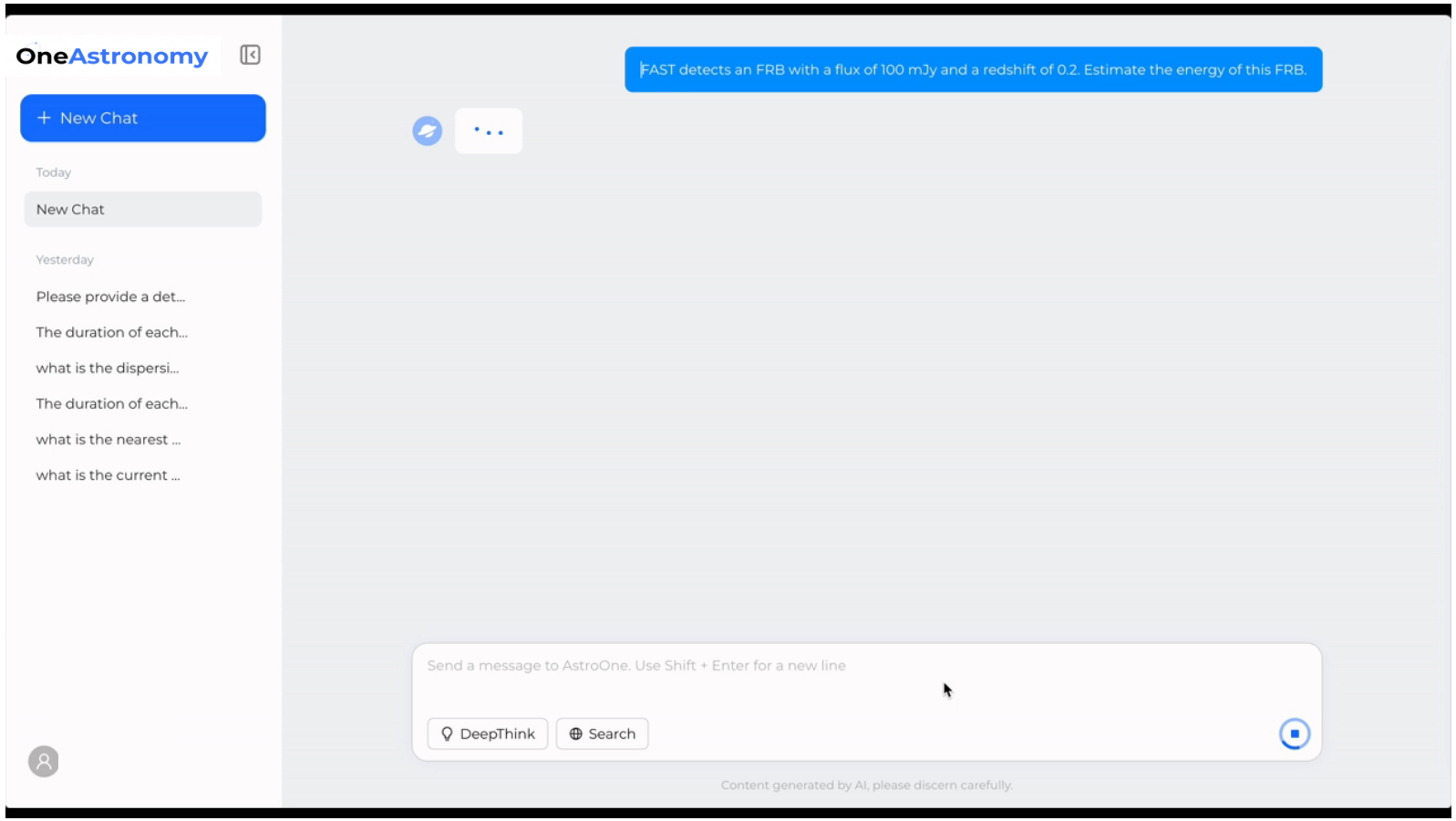


OneAstronomy can precisely identify the key knowledge points scientists need from a vast pool of astronomical data, enabling instant and accurate responses to astronomy-related queries.

OneAstronomy—Reasoning based on pre-trained knowledge

Send: FAST detects FRB with a flux of 100 mJy and a redshift of 0.2

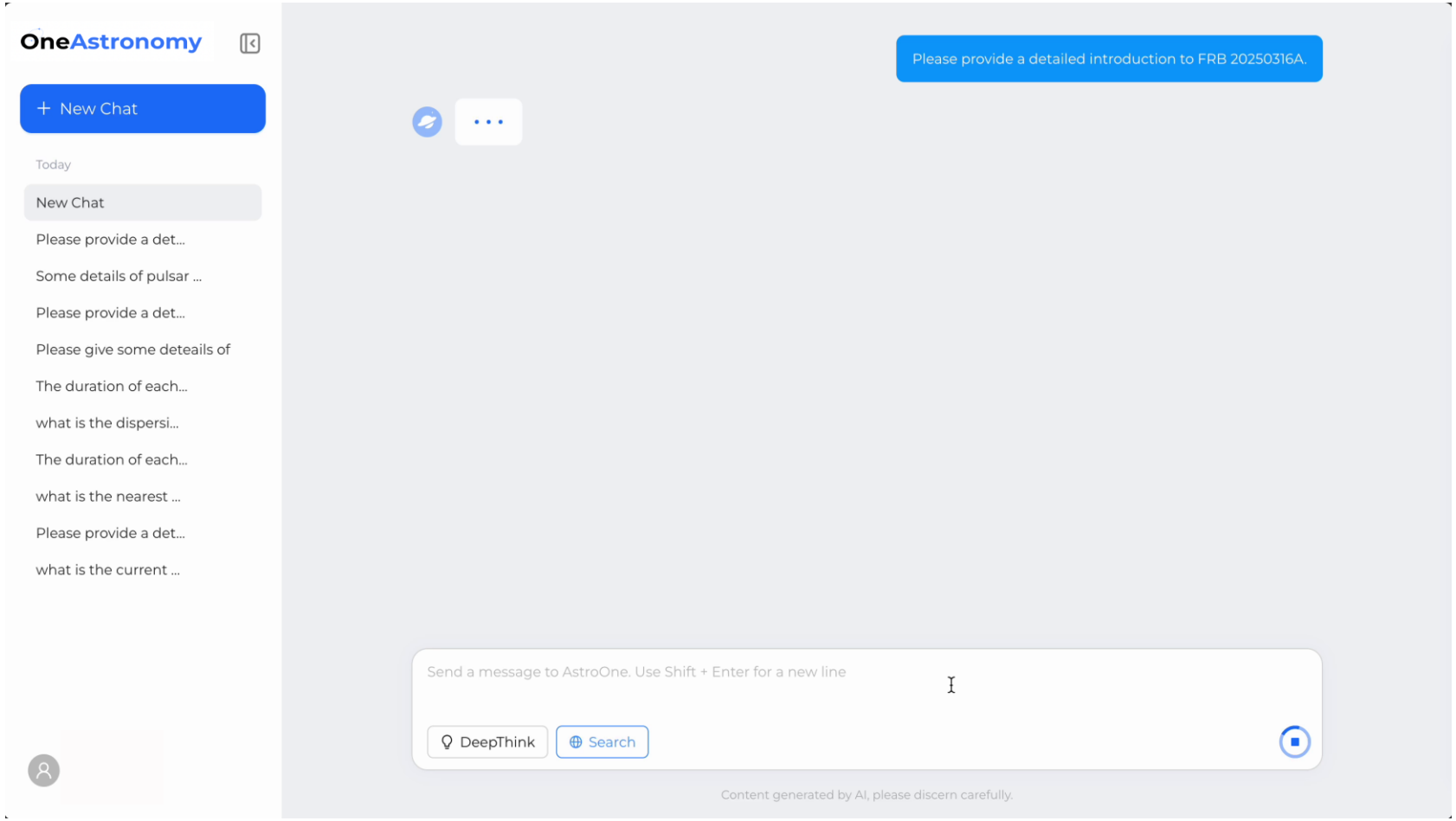
Estimate the energy of this FRB.



OneAstronomy is equipped with advanced astronomical reasoning capabilities, supporting astronomers in analyzing and solving complex astronomical problems.

OneAstronomy—Connect to the latest knowledge

Send: please provide a detailed introduction to FRB 20250316A



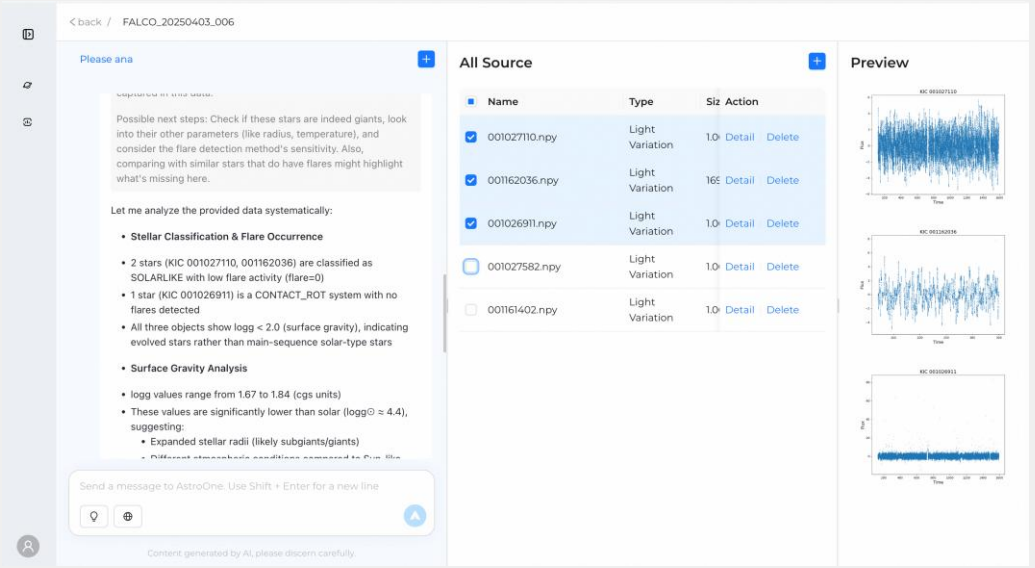
OneAstronomy leverages search to access the latest web content, scientific literature, and other resources, integrating them with its pre-trained knowledge for comprehensive analysis and reasoning.

OneAstronomy—Collaborate with computational models

FALCO

Analyze the light variation characteristics of objects to track their patterns of change, promptly capture anomalous astronomical events, and detect new object or astronomical phenomena.

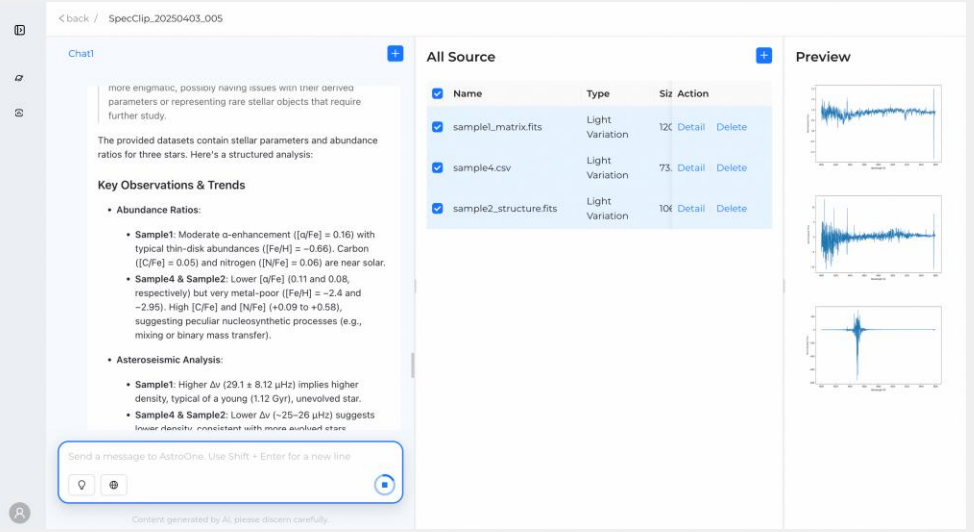
Send: please analyze these KIC files



SpecCLIP

Analyzing spectral data across different wavelengths helps researchers identify the physical and chemical properties of objects, as well as their velocity information. This model will play a key role in exploring cosmic evolution, star formation, and galactic dynamics.

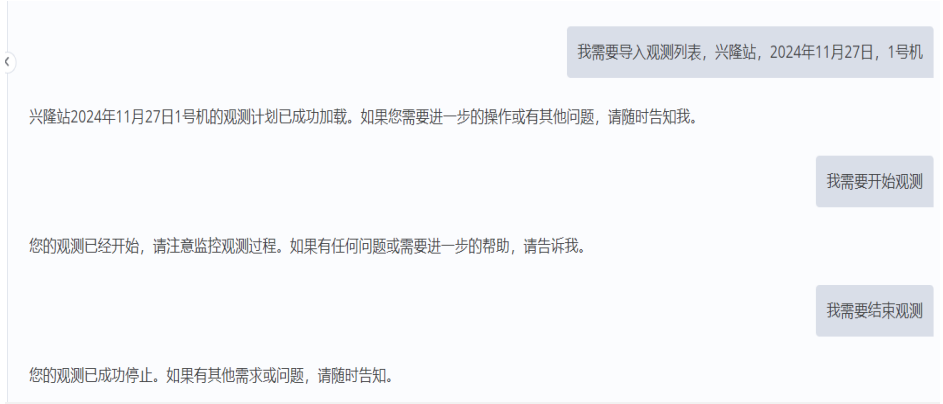
Send: please analyze these Fit files



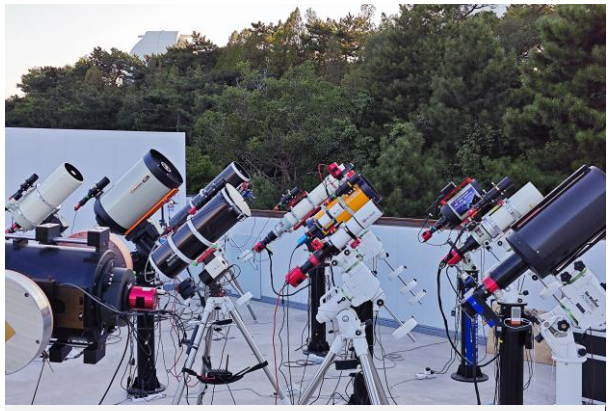
Part C： OneAstronomy for Embodied AI

OneAstronomy for Embodied telescope

Drive the generation of observation plans, instruction control, observation data processing, and analysis of observation results through natural language, achieving a fully automated and closed-loop telescope observation workflow.



natural language-driven

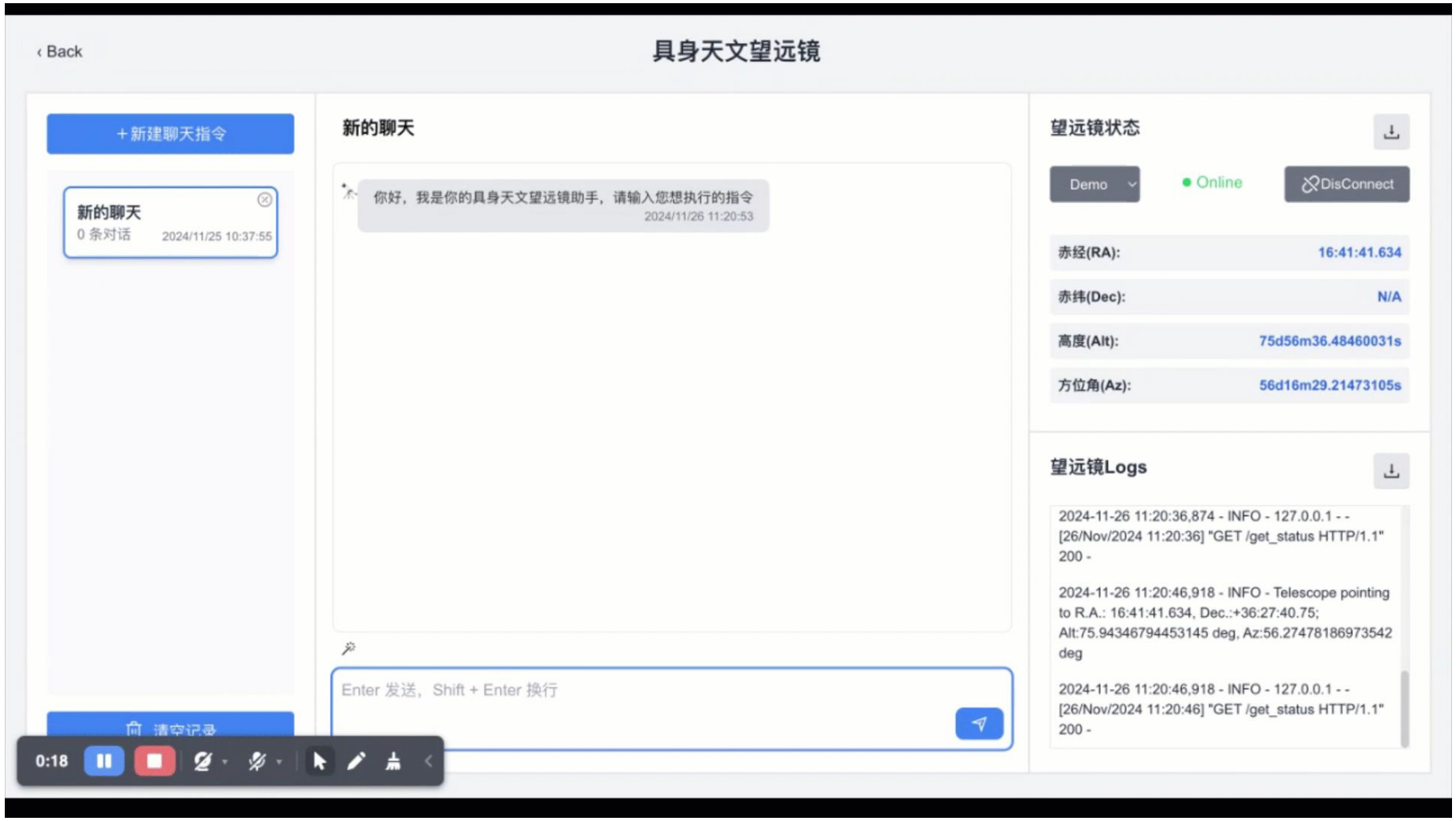


Nearby Galaxy Survey Telescope Array

Exploration of Mini SiTian

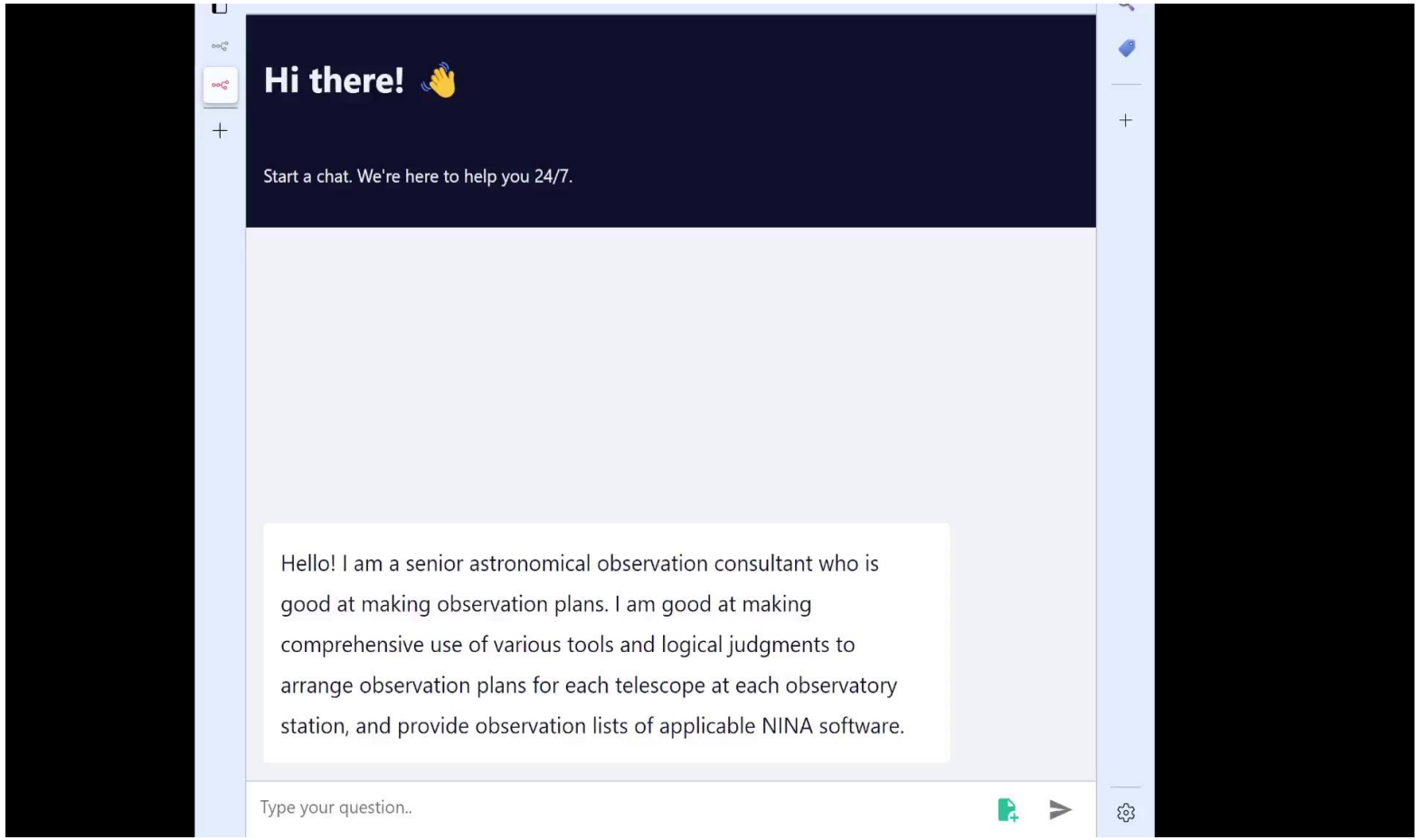
OneAstronomy for Embodied telescope

Send: I would like to observe Polaris.



OneAstronomy for Embodied telescope

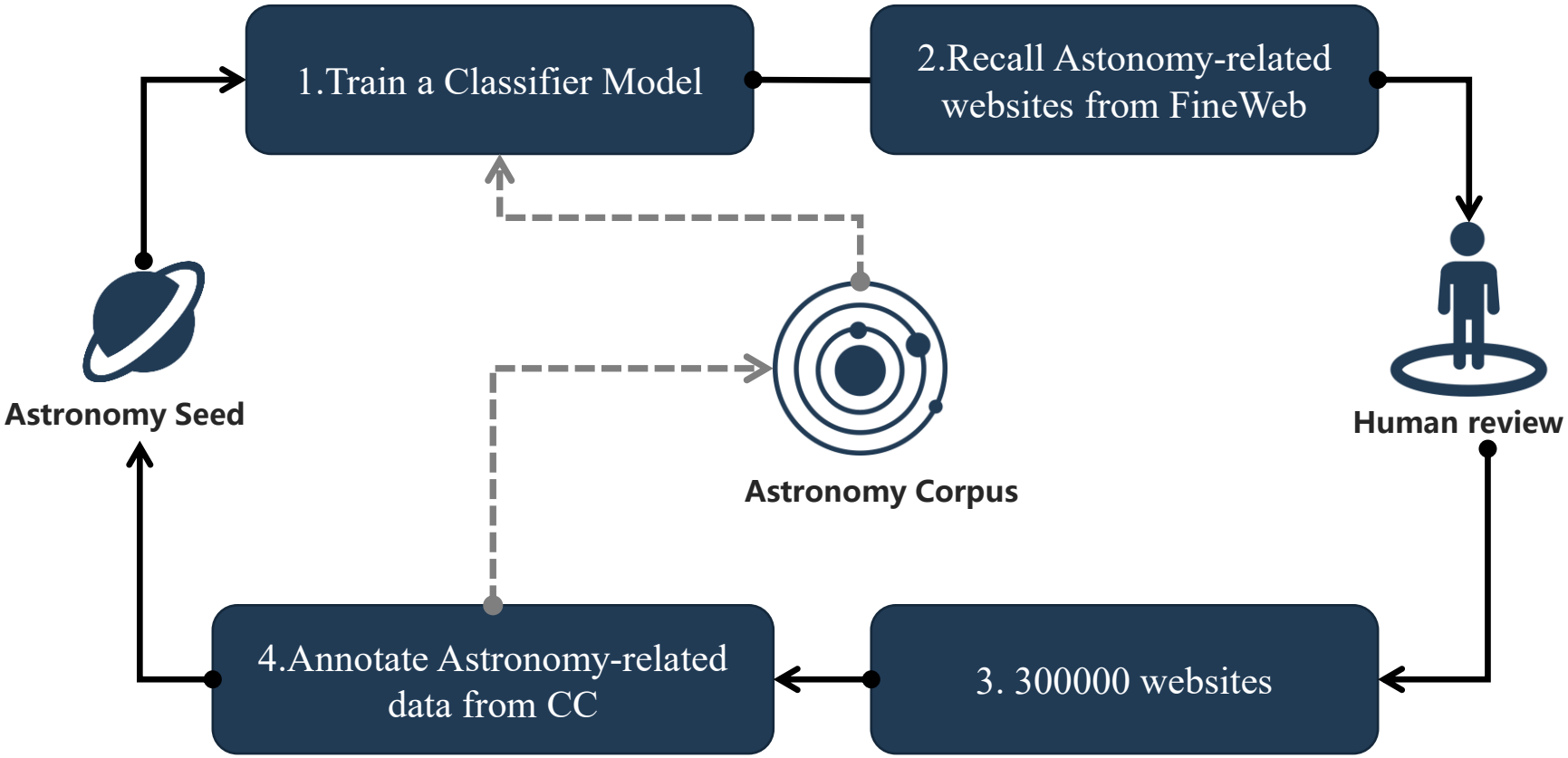
Send: generation of observation plans, analysis of observation data through natural language



Part D：How we built OneAstronomy

OneAstronomy LLM——Data

A joint team of 90 data scientists and astronomers



- **Astronomical data** 32B tokens
- **General data** 4.3B tokens
- **Instruction data** 3.41M tokens
- **Mathematical reasoning** 257.6K tokens
- **Code reasoning** 74.7K tokens
- **Long-form reasoning** 40K tokens

OneAstronomy LLM——training

Enhancing the model’ s astronomical capabilities without compromising its general performance.

Guide the model to better understand and process astronomical data, enhancing its applicability in the field of astronomy.

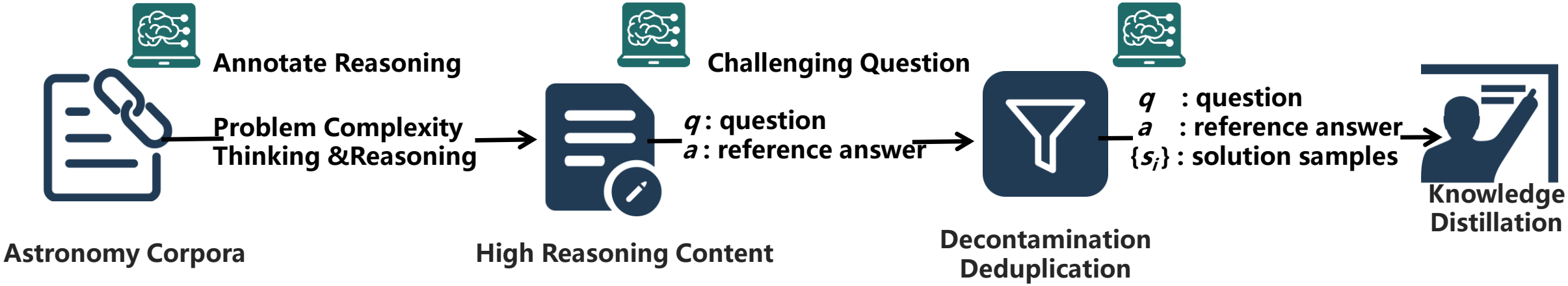
Make the model learn the widest possible range of astronomical knowledge.

Align with the preferences of astronomical users to improve the model’ s practicality in astronomical applications.

OneAstronomy LLM——Model reasoning ability training

Activate OneAstronomy’ s reasoning ability over vast astronomical knowledge through training.

OneAstronomy utilized 40,000 long-form astronomical reasoning samples, each 12K tokens in length, and validated that using long-sequence astronomical reasoning data can effectively enhance the model’ s astronomical reasoning capabilities.



OneAstronomy – AI + Astronomy

Scientific Problems

- Cosmology
- Galaxy Clusters
- Galaxies
- The Origin and Evolution of the Milky Way
- Star Clusters
- Stellar Physics
- Exoplanets

Application Systems

- AI Scientist
- Embodied Intelligence

Foundation Models

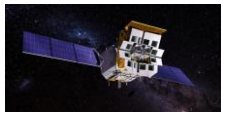
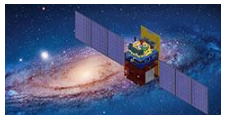
- Astronomical Foundation Models + Scientific Computing Models for Astronomy

Observational Data

- **Image** (Light Distribution in Space)
- **Spectroscopy** (Light Distribution in Frequency)
- **Time-Domain** (Light Variation Over Time)

Observational Facilities

Low Frequency, Low Energy → High Frequency, High Energy

Wavelength	Radio	Millimeter	Optical	X-Ray	γ-Ray	Cosmic Ray
Facilities	FAST SKA	ALMA	CSST LAMOST	 Einstein Probe  HXMT	GLAST HEBS	LHAASO

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Thank you!