

Human–AI Collaboration-Driven Cosmology Research

Saturday, 7 November 2026 16:30 (30)

In modern cosmological research, using cosmological numerical simulations to study the evolution of the large-scale structure of the Universe has proven to be a highly effective technique. However, cosmological numerical simulations beyond the standard cosmological model require numerous modifications to existing cosmological simulation frameworks. They are technically complex and have a high entry barrier, so a large number of non-standard cosmological models cannot be effectively validated. In recent years, the development of artificial intelligence technologies represented by large language models has brought profound changes to scientific research; for example, large language models such as DeepSeek have rapidly spread across various areas of life. Based on the DeepSeek large language model, we developed an agent for cosmological numerical simulations. This agent uses multi-agent collaboration technology and integrates functions such as literature review, code analysis, and report generation, allowing users to generate complex cosmological numerical simulation software with a single sentence. After evaluation, we found that the agent can effectively avoid generating hallucinations and produce work guides with real productive capacity. Using these work guides, we automatically developed cosmological numerical simulation software for models including SIDM and WDM. In terms of development efficiency, compared with experienced developers, the agent is two orders of magnitude more efficient. The application of this agent will bring about a major revolution in numerical-simulation-based cosmology research. Hundreds or thousands of models that previously could not be tested by simulations will become testable, and the most time- and expertise-consuming part of this field has been overcome. We believe that the human–AI collaboration method developed in this study can be extended to a broader range of research fields and may bring about a profound transformation of research paradigms.

Primary author(s) : ZHANG, Jiajun (Shanghai Astronomical Observatory)

Presenter(s) : ZHANG, Jiajun (Shanghai Astronomical Observatory)

Session Classification : Parallel-Cosmology