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Development and Practice of AI Agents and Framework for Scientific Data Processing

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2025 is widely recognized as the Year of the AI Agent. Large language models have moved beyond conversational interfaces to become callable tools that boost productivity—evident in the rapid adoption of systems like Manus, Claude-Code, and Cursor. AI Agent technologies are also increasingly being applied in scientific research to assist in data analysis and literature exploration, as demonstrated by systems such as SciMaster, FutureHouse, Machine Chemist, and SciToolAgent.
The Computing Center of the Institute of High Energy Physics (IHEP) initiated research on scientific AI Agents in 2023 and developed Dr.Sai, an intelligent agent for BESIII (Beijing Spectrometer) physics analysis. Building upon this experience, we present OpenDrSai—a scientific AI agent framework designed to accelerate the development and deployment of AI agents for scientific data processing.

OpenDrSai integrates core capabilities including self-learning and reflection, real-time human–agent interaction, long task management, and multi-agent collaboration. The framework offers modular components for multimodal scientific data perception, knowledge and memory management, scientific tool orchestration, and complex workflow execution. It also features a flexible multi-agent architecture, a scalable backend system, an interactive human–machine interface, and standardized APIs. These features address key challenges in scientific AI development, such as integrating complex tools, managing long-running tasks, and handling domain-specific data and knowledge.

OpenDrSai is already deployed or planned for use in several large-scale scientific experiments, including the China Spallation Neutron Source, Beijing Synchrotron Radiation Facility, Large High Altitude Air Shower Observatory (LHAASO), JUNO Neutrino Experiment, and the Deep-Sea Neutrino Telescope. Some specialized agents—such as DataAgent, RongZai Agent, and BOSS8 Assistant—have been developed to support tasks including neutron diffraction and PDF refinement, as well as data processing for large-scale experimental facilities.

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