

P107b 44 GHz CH₃OH Maser Zeeman Observations and MageQ Project (1)

Fumitaka Nakamura (NAOJ), Yoshinori Yonekura (Ibaraki Univ.) and eQ team

Our eQ team is advancing the MageQ (Magnetic Field Measurements using the eQ receiver) project, which aims to measure magnetic field strengths in star-forming regions. The magnetic field in high-density regions where stars form plays a crucial role in gas accretion and the formation and evolution of outflows. Observationally constraining this field is therefore indispensable for understanding the star formation mechanism.

The project's objective is to measure the magnetic field strength via the Zeeman effect, using molecular emission lines such as CCS (33 GHz, 45 GHz) and SO (30 GHz) that trace dense cores, alongside methanol maser lines. The 44 GHz methanol maser is classified as a Class I maser, excited by collisions, and exhibits relatively strong intensity, making it an effective tracer for magnetic field measurements in high-mass star-forming regions. As the first phase of this project, we conducted polarization observations of the 44 GHz methanol maser sources OMC-2, S235, S255N, and NGC 2264, using the eQ receiver. The observations yielded high-quality data in a short integration time. The peak intensities were measured to be approximately 100 K for OMC-2, 18 K for S235, 100 K for S255N, and 29 K for NGC 2264. These intensities were confirmed to be consistent with the measurements by VLA.

These 44 GHz maser observations are positioned as a pilot experiment for conducting future Zeeman observations of spatially extended CCS and SO lines. Polarization analysis of these data is currently underway. We will report the overall plan of MageQ and the progress of the methanol maser polarization observations.