Abstract

Star formation is ubiquitous in the Galaxy, but the physical and chemical conditions in star-forming sites might differ due to environment. For example, due to the negative metallicity gradient, abundances of molecules and dust are expected to decrease with the distance from the Galactic Center, and subsequently influence the cooling budget and efficiency of star formation. Magnetic fields (B-fields) are also believed to regulate the formation of stars, and their impact shall be quantified individually for each cloud.

This thesis aims to investigate the role of B-fields and metallicity in molecular clouds, where new stars are born in our Galaxy. Firstly, we characterize the morphology and strengths of B-fields in the densest part of a nearby molecular cloud Oph A, and discuss the role of B-fields and radiation from a nearby star in regulating star formation and shaping the cloud. Secondly, we investigate the role of metallicity on far-infrared (far-IR) line cooling in the embedded cluster Gy 3–7 located in the CMa-ℓ224 region in the outer Galaxy. We obtain gas physical conditions (temperatures, densities) across the cluster, identify the presence of shocks irradiated by ultraviolet radiation, and characterize the population of young stars. Even though the metallicity of Gy 3–7 is expected to be intermediate between the Large Magellanic Cloud and the Solar neighborhood, we do not find the impact of low metallicity on star formation in this cluster. Similar conclusions are reached in our final investigation of mass accretion rates of low- and intermediate-mass young stellar objects (YSOs) in the CMa-ℓ224 region. We calculate the spectral types of those young stars and extinction, as well as the excess continuum emission due to accretion. Mass accretion rates are in good agreement with those found for YSOs in the nearby star-forming regions. We conclude that a systematic, multi-wavelength study of the outer Galaxy, covering a broad range of metallicities, is necessary to confidently identify the impact of environment on star formation.