

PROJECT SUMMARY

Identifying Molecular Cloud Formation in the Galaxy

What is the intellectual merit of the proposed activity?

The **origin of Galactic molecular clouds** ranks among the most poorly understood aspects of the interstellar life cycle, star formation and galactic evolution – to date, the formation of a molecular cloud has never been positively identified! However, the combination of publically available Galactic Plane infrared imaging surveys (e.g. IRAS, GLIMPSE and 2MASS), millimeter-wave CO surveys (e.g. FCRAO's Galactic Ring and Outer Galaxy Surveys), and HI radio surveys (e.g. the VLA/Canadian/Southern Galactic Plane Surveys) now allow for the comprehensive **identification of regions in the Galaxy where molecular cloud formation may be occurring**. Such "proto-molecular clouds", where the hydrogenic gas may be fully molecular (H_2), but not yet observable in CO line emission, may be an important and unrealized component of the cold ISM. Understanding where and how molecular clouds form in the Galaxy will constrain theoretical models of this pivotal component of galaxy evolution and provide a better understanding of the **life cycle of the interstellar medium**.

Innovative new astronomical instrumentation developed (in part) by this team at infrared and submillimeter wavelengths will allow these identified regions to be characterized in detail. These new data products are carefully chosen either to "glue" disparate archival survey data together (ex. infrared absorption line spectroscopy will directly connect dust extinction to the abundance of CO and H_2) or to improve the interpretation of the existing survey data (ex. submillimeter, multi-line carbon and CO maps of subarcminute resolution). In total, this study will provide a **pathfinding finderchart for far-infrared observations** for future ground, stratospheric, and space-based observatories.

What are the broader impacts of the proposed activity?

All comprehensive science products from this study will be made available to the astronomical community via the Web. These survey products will include (1) extinction maps over much of the Galactic Plane derived from 2MASS and GLIMPSE as related to the atomic and molecular gas content derived from radio surveys, (2) measurement of the H_2 and CO abundance in relation to extinction throughout the Galaxy, and (3) identification of regions predicted (or observed) to be sites of molecular cloud formation.

The broadest impact however may be drawn from the use of these surveys as educational and outreach tools. The visage of the dusty lanes of the Milky Way has inspired artistic and scientific imaginations for generations. This inherent fascination is a powerful tool to attract "students" of all ages and callings to a better, more literate appreciation of the sciences. Thus, spreading enthusiasm for science and training the next generation of scientists is a significant component of this research program. Specifically, this proposal will target (1) web-based and local (ex. grade school) public outreach, (2) guiding and training undergraduate and graduate students, and (3) presentation of research results to the general public and astronomical community.