

Opportunity Title: Tracing the H₂ molecular gas in the Galaxy
Opportunity Reference Code: 0097-NPP-NOV23-JPL-Astrophys

Organization National Aeronautics and Space Administration (NASA)

Reference Code 0097-NPP-NOV23-JPL-Astrophys

Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description Star formation rates in galaxies depend on how much molecular H₂ gas is present in dense cloud regions in which new stars form. Under most interstellar environments molecular H₂ gas is not directly observed. CO line emission is used as proxy to trace the H₂ gas in molecular clouds. However, there is a large uncertainty relating the observed CO line intensity to the underlying H₂ column density. The presence of a significant fraction H₂ molecular gas missed by CO as tracer, referred to as “CO-dark H₂ gas”, has been inferred from a variety of probes including dust emission, gamma rays, and 158 micron CII fine structure line emission. (c.f. Velusamy et al. 2010, A&A 521, L18; Langer et al. 2010, A&A 521, L17). The dust continuum emission in IR, far-IR, and submm traces the high H₂ molecular column densities. CII and CI fine structure lines trace the high H₂ molecular column densities in the C+/C0/CO transition layers in molecular clouds which are missed by CO emission. The goal of this project is to investigate the distribution of the “CO-dark H₂ gas” across the Galaxy combining the CII, CI maps observed by Herschel HIFI (GOTC+ survey and follow up projects), with the dust emissions observed by Spitzer IRAC & MIPS, Herschel PACS & SPIRE, and submm maps by SCUBA & LABOCA. The results will be used to constraint the X_{co} factor (CO-H₂ conversion factor defined the ratio of H₂ column density to CO line intensity) which is widely used, but poorly constrained, and critical to our understanding of the star formation in galaxies and thus the galaxy evolution in the universe.

Location:

Jet Propulsion Laboratory
Pasadena, California

Field of Science: Astrophysics

Advisors:

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: <https://www.nasa.gov/oiir/export-control>.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of



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application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Eligibility Requirements

- **Degree:** Doctoral Degree.