Composite ^{12}CO ^{13}CO $C^{18}O$ image across the η Car GMC, from DR4.

Data Release User's Guide

CHaMP is a multi-faceted survey of molecular clouds and star formation in the direction of the Carina Arm of the Milky Way ($300° > l > 280°$, $-4° < b < +2°$). The Data Releases are all available at the CHaMP DR Bank. The primary references for the DRs, including observational and analytical details, are given below. If you find these data useful for your research, please cite the appropriate paper as listed, available from the CHaMP Bibliography or standard ADS queries. If your work makes *significant* use of these data, **CHaMP policy** is to include at least one of our PI or Co-Is as collaborators or co-authors (contact email below).

The data tables are supplied in IPAC Table Format, as space-delimited ASCII files available for download or rendered with IRSA-based tools. The 2D+3D FITS files can be previewed within the IRSA pages, and downloaded & viewed with a wide range of software packages. We recommend *kvis*, part of the Karma package (Gooch R.E. 1996, "Karma: a Visualisation Test-Bed," in *Astronomical Data Analysis Software and Systems V*, ASP Conf. Series **101**, ed. G.H. Jacoby & J. Barnes, ASP, San Francisco, pp80-83, ISSN 1080-7926), for its (l,b,V_{LSR})-friendly display tools.

A note on the IRSA preview of the 3D cubes: these default to the central channel in each cube, which doesn't necessarily correspond to the brightest (or any!) emission. The 2D moments *are* centred on each cloud's bright emission, but to see the full 3D emission patterns, one should view the appropriate channels. The CHaMP cubes cover a velocity range -60 km/s $< V_{LSR} < +40$ km/s across ~1000 spectral channels (i.e., ~0.1 km/s per channel), with the spectral line emission typically peaking between -40 and 0 km/s (or somewhere between channels 200 and 600), depending on the individual cloud. Again, *kvis* makes it easy to view such cubes.

DR1: Nanten Master Catalogue and Mopra HCO⁺ Results

Reference: Barnes, Yonekura, Fukui, et al 2011, *ApJS*, **196**, 12.

Table 1 contains the central coordinates (l,b,V_{LSR}) and brightnesses (T_A^*) of the 209 parsec-scale BYF clouds identified in the Nanten telescope's ^{12}CO, ^{13}CO, $C^{18}O$, & HCO⁺ (3mm) mapping surveys of the Carina Arm (Yonekura et al 2005, *ApJ*, **634**, 476). It also lists the CHaMP Regions containing those clouds, grouped together for later mapping convenience.

Table 4 contains the observed HCO⁺ J=1–0 (89 GHz) emission parameters of 303 sub-pc clumps identified in Phase I of mapping with the ATNF-Mopra 22m antenna, which included data in 16 molecular spectral lines observed at 85–93 GHz in the MOPS spectrometer.

Table 5 contains the physical parameters of the same HCO⁺ clumps, derived as described in Barnes et al 2011.

DR2: Mopra N₂H⁺ and AAT Near-IR Results

Reference: Barnes, Ryder, O'Dougherty, et al 2013, *MNRAS*, **432**, 2231.

Table 2 contains the observed N_2H^+ J=1–0 (93 GHz) emission parameters of a subset of 69 Mopra clumps, also from the first phase of Mopra mapping as in DR1.

Table 3 contains the observed near-IR nebular emission parameters of the same 69 clumps, obtained from imaging with the Anglo-Australian Telescope's 3.9m IRIS2 camera in the 4 narrowband filters K-cont, Brackett-γ, H_2 v=1–0 $S(1)$, and H_2 v=2–1 $S(1)$.

DR3: Mopra ^{12}CO Results

Reference: Barnes, Hernandez, O'Dougherty, et al 2016, *ApJ*, **831**, 67.

Table B1 contains the observed ^{12}CO J=1–0 (115 GHz) emission parameters of all 303 clumps in DR1, but from Phase II mapping with the ATNF-Mopra 22m antenna and MOPS spectrometer, covering a different set 16 molecular spectral lines at 107–115 GHz.

Table B3 contains the physical parameters for 272 out of the 303 ^{12}CO clumps, derived as described in Barnes et al 2016.

DR4: Mopra iso-CO (^{12}CO, ^{13}CO, $C^{18}O$) Data

Reference: Barnes, Hernandez, Muller, et al 2018, *ApJ*, **866**, 19.

Data Cubes: For 28 spatial Regions plus the isolated clumps, we provide full (l, b, V_{LSR}) data cubes in each of the 3 CO-isotopologue lines for all 303 clumps from DR3, totalling 84 data cubes. Some areas have clumps at more than 1 velocity, so there are effectively maps of 34 distinct complexes in the 28 areas. They are all provided as standard FITS cubes.

Moment Maps: For each complex/line combination with usable emission, we constructed several 2D moment maps using the SAM algorithm. These include the integrated intensity I (zeroth moment) and its error map, the intensity-weighted mean velocity (first moment) and velocity dispersion (second moment) with their velocity-error map, and the peak brightness map on the T_r^* scale with its rms map, for a total of 655 standard FITS maps.

DR5: Results of Dust-SED Fitting to Far-IR Data

References: Pitts, Barnes, & Varosi 2019, *MNRAS*, **484**, 305 and Pitts & Barnes 2021, *ApJS*, **256**, 3.

Maps of each Region and isolated clump covered by ATLASGAL (Schuller, Menten, Contreras, et al 2009, *A&A*, **504**, 415) and *Herschel* Hi-GAL (Molinari, Swinyard, Bally, et al 2010, *A&A*, **518**, 100) data, of the fitted dust temperature T_d, inferred H_2 column density N_{H2}, and their error maps. The maps are organised into somewhat larger areas than the spectral-line Regions: there are 15 sets of the four 2D maps (60 standard FITS files) which cover 24 of the 28 spatial areas (30/34 complexes).

Future Data Releases

More data cubes and moment maps, such as each molecular species' excitation temperature, opacity, column density, and gas-phase abundance, are planned for future releases. If researchers wish to obtain pre-release access to these data products for their own projects, or suggest others for future development, they may be available by collaborative arrangement. Please contact the PI of CHaMP, Peter Barnes (pbarnes@spacescience.org) to inquire.