

Herschel observations of EXtra-Ordinary Sources (HEXOS) Key Program Release Note

The data provided include five fully reduced single sideband (SSB) HIFI spectral scans toward the Orion Kleinmann-Low nebula (Orion KL), Orion South (Orion S), the Orion Bar, Sagittarius B2(N) [SgrB2(N)], and Sagittarius B2(M) [SgrB2(M)]. We also provide model spectra for each detected molecular species for Orion KL. Additionally, HIFI maps of water and OH transitions as well as deep integrations toward Sagittarius B2(S) [SgrB2(S)] are included. These user provided data products are described in more detail below.

1. Orion KL

These data were processed using the standard HIPE pipeline (version 10.3, build 2843). Molecular models were fit to data reduced using an older version of HIPE (5.0, build 1648). We fit models to the H/V averaged spectra with the continuum subtracted out. More details regarding the data reduction and analysis are given in Crockett et al. (2014a,b).

The data and models are provided in the following formats: CLASS, HIPE readable FITS, and ASCII. All data and models are shifted to a V_{lsr} of 9 km/s so that emission lines appear at or closer to their rest frequencies.

1.1 Data

CLASS - band<xx>_orionkl_<nc or c>.<tap or tmb>.ahv.hifi

<xx> indicates the band number (i.e 1a, 1b, ...). Separate pointings for the hot core and compact ridge were obtained for bands 6 and 7, which are indicated with 'hc' or 'cr' labels, respectively.

Files with "_nc" (indicating "no continuum") have been baseline subtracted, while files with a "_c" label (indicating "continuum") have continuum emission. There are three spectra in each file, which are: (1) average of the H/V polarization, (2) H polarization, and (3) V polarization. The labels "tap" or "tmb" indicate the spectra have been corrected with the aperture or main beam efficiencies, respectively. We used the aperture efficiency for bands 1-5 and the main beam efficiency for bands 6-7.

HIPE - band<xx>_orionkl_<nc or c>.<tap or tmb>.a.fits

H/V averaged spectra. Naming conventions are the same as the CLASS format.

ASCII - band<xx>_orionkl_<nc or c>.<tap or tmb>.a.dat

H/V averaged spectra. Naming conventions are the same as the CLASS format.

1.2 Models

CLASS - band<xx>_orionkl_mods.hifi

This file is organized such that the first spectrum is the H/V averaged continuum subtracted data (reduced in HIPE 10.3), the second is the same data reduced with HIPE 5.0 (the version to which we fit models), and the third is the total "full band" fit (sum of XCLASS + empirical models, see text below). All subsequent spectra are individual molecular fits.

The molecule name for each fit is given in the header variable SOURCE. Typing the LIST command in CLASS will thus give a summary of all molecules in the full band fit. If a molecule ID has an "M," prefix, it means that this species was fit using the MADEX non-LTE code. If a molecule ID has an "E," prefix, it means that the model is an "empirical model", i.e. the result of fitting gaussians to the observed profiles. All of these fits are explained in Crockett et al. (2014a). If a molecule ID has no prefix, it means that the emission was fit using XCLASS. All species except those with empirical fits were modeled with XCLASS. A subset of molecules was fit using MADEX. All MADEX fits therefore have a corresponding XCLASS fit.

HIPE - orionkl.<id>_<xx>.fits

Each molecular fit is given in a different FITS file. The molecule id is given in the filename as <id>. As before, <xx> indicates the band number. The "M," and "E," molecule label prefix conventions described in the CLASS format section are also followed here. The file with <id>="allmols" is the sum of the XCLASS + empirical models (same as spectrum 3 in the CLASS model file).

ASCII - orionkl.<id>_<xx>.dat

Same conventions as the HIPE format

2. Orion S

Data with and without the continuum are provided. Main beam efficiencies were applied to the spectra. More details regarding the data reduction and analysis are given in Tahani (2013).

CLASS - band<xx>_orions_<nc or c>.tmb.ahv.hifi

Conventions are the same as Orion KL.

HIPE - band<xx>_orions_<nc or c>.tmb.a.fits

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

ASCII - band<xx>_orions_<nc or c>.tmb.a.dat

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

3. Orion Bar

No significant continuum was measured in the HIFI data, so only baseline subtracted ("_nc" or "no continuum") data are included. Aperture efficiencies were applied to the spectra. More details regarding the data reduction and analysis are given in Nagy et al. (2013).

CLASS - band<xx>_orionbar_nc.tap.ahv.hifi

Conventions are the same as Orion KL.

HIPE - band<xx>_orionbar_nc.tap.a.fits

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

ASCII - band<xx>_orionbar_nc.tap.a.dat

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

4. SgrB2(N)

Data with and without the continuum are provided. Aperture efficiencies were applied to the spectra. The spectra are shifted to a V_{lsr} of 64 km/s so that emission lines appear at or closer to their rest frequencies. More details regarding the data reduction and analysis are given in Neill et al. (2014).

CLASS - band<xx>_sgrb2n_<nc or c>.tap.ahv.hifi

Conventions are the same as Orion KL.

HIPE - band<xx>_sgrb2n_<nc or c>.tap.a.fits

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

ASCII - band<xx>_sgrb2n_<nc or c>.tap.a.dat

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

5. SgrB2(M)

Only spectra that include the continuum are provided. Main beam efficiencies were applied to the data.

CLASS - band<xx>_sgrb2m_c.tmb.ahv.hifi

Conventions are the same as Orion KL.

HIPE - band<xx>_sgrb2m_c.tmb.a.fits

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

ASCII - band<xx>_sgrb2m_c.tmb.a.dat

Conventions are the same as Orion KL. H/V averaged spectra are provided for each band.

6. Orion KL Maps

Orion KL maps of targeted transitions of water and OH are provided in CLASS and HIPE readable FITS format. Each file contains multiple spectra corresponding to a different position in the map. Because the bandwidth of these data is 2 x 4 GHz (upper and lower sidebands) in bands 1-5 and 2 x 2.4 GHz in bands 6-7, additional transitions from other species are detected in these maps.

CLASS - <molecule><qn_up>_<qn_low>_<freq>_orionkl.tmb.<pol><sb>.hifi

<molecule>, <qn_up>, <qn_low>, and <freq> indicate the targeted molecule, upper state quantum numbers, lower state quantum numbers, and transition frequency, respectively. <pol> and <sb> indicate the polarization and sideband frequency scale, respectively. For example, the file h2o312_303_1097_orionkl.tmb.vu.hifi is a map of the V polarization emission of the $3_{1,2} - 3_{0,3}$ transition of water at 1097 GHz using the upper sideband frequency scale.

HIPE - <molecule><qn_up>_<qn_low>_<freq>_orionkl.tmb.<pol><sb>.fits

Naming conventions are the same as the CLASS format files.

6. SgrB2(S)

Deep integrations of targeted transitions toward SgrB2(S) are supplied in HIPE readable FITS format.

7. References

- Crockett, N. R., Bergin, E. A., Neill, J. L., et al. 2014a, ApJ, 787, 112
Crockett, N. R., Bergin, E. A., Neill, J. L., et al. 2014b, ApJ, 781, 114
Nagy, Z., Van der Tak, F. F. S, Ossenkopf, V. et al. 2013, ApJ, 550, 96
Neill, J. L., Bergin, E. A., Lis, D. C., et al. 2014, ApJ, 789, 8
Tahani, K. 2013, master's thesis, University of Calgary