J/A+A/584/A91 Catalog of dense cores in Aquila from Herschel (Konyves+, 2015)

A census of dense cores in the Aquila cloud complex: SPIRE/PACS observations from the Herschel Gould Belt survey.

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Keywords: ISM: individual objects: Aquila Rift complex - stars: formation - ISM: clouds - ISM: structure - submillimeter: ISM

Abstract:

We present and discuss the results of the Herschel Gould Belt survey (HGBS) observations in an ~11deg^2 area of the Aquila molecular cloud complex at d~260pc, imaged with the SPIRE and PACS photometric cameras in parallel mode from 70-micron to 500-micron. Using the multi-scale, multi-wavelength source extraction algorithm getsources, we identify a complete sample of starless dense cores and embedded (Class 0-I) protostars in this region, and analyze their global properties and spatial distributions. We find a total of 651 starless cores, ~60% ±10% of which are gravitationally bound prestellar cores, and they will likely form stars in the future. We also detect 58 protostellar cores. The core mass function (CMF) derived for the large population of prestellar cores is very similar in shape to the stellar initial mass function (IMF), confirming earlier findings on a much stronger statistical basis and supporting the view that there is a close physical link between the stellar IMF and the prestellar CMF. The global shift in mass scale observed between the CMF and the IMF is consistent with a typical star formation efficiency of ~40% at the level of an individual core. By comparing the numbers of starless cores in various density bins to the number of young stellar objects (YSOs), we estimate that the lifetime of prestellar cores is ~1Myr, which is typically ~4 times longer than the core free-fall time, and that it decreases with average core density. We find a strong correlation between the spatial distribution of prestellar cores and the densest filaments observed in the Aquila complex. About 90% of the Herschel-identified prestellar cores are located above a background column density corresponding to A_V~7, and ~75% of them lie within filamentary structures with supercritical masses per unit length $\gtrsim$16$M_\odot$/pc. These findings support a picture wherein the cores making up the peak of the CMF (and probably responsible for the base of the IMF) result primarily from the gravitational fragmentation of marginally supercritical filaments. Given that filaments appear to dominate the mass budget of dense gas at A_V>7, our findings also suggest that the physics of prestellar core formation within filaments is responsible for a characteristic "efficiency" SFR/M_{dense}~5±2x10^{-8}yr^{-1} for the star formation process in dense gas.

Description:

Based on Herschel Gould Belt survey (Andre et al., 2010A&A...518L.102A) observations of the Aquila cloud complex, and using the multi-scale, multi-wavelength source extraction algorithm getsources (Men'shchikov et al., 2012A&A...542A..81M), we identified a total of 749 dense cores, including 685 starless cores and 64 protostellar cores.

The observed properties of all dense cores are given in tablea1.dat, and their derived properties are listed in tablea2.dat.

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
tablea1.dat	519	749	Observed properties of dense cores in Aquila
tablea2.dat	178	749	Derived properties of dense cores in Aquila
list.dat	100	2	List of fits images
fits/*	0	2	Individual fits files

See also:

J/MNRAS/421/3257 : MHO catalogue for Serpens and Aquila (Ioannidis+, 2012)
J/ApJ/723/915 : BLAST view of Aquila SFR (Rivera-Ingraham+, 2013)

Byte-by-byte Description of file: tablea1.dat

```
   Bytes Format Units     Label        Explanations

   1-  3  I3    ---       Seq          Core running number
   5- 19  A15   ---       Name         Core name, HHMMSS.s+DDMMSS, to be added
                                        after HGBS_J
  21- 22  I2    h         RAh          Right ascension (J2000)
  24- 25  I2    min       RAm          Right ascension (J2000)
  27- 31  F5.2  s         RAs          Right ascension (J2000)
      33  A1    ---       DE-          Declination sign (J2000)
  34- 35  I2    deg       DEd          Declination (J2000)
  37- 38  I2    arcmin    DEm          Declination (J2000)
  40- 43  F4.1  arcsec    DEs          Declination (J2000)
  45- 50  F6.1  ---       Signi070     Detection significance at 70um (1)
  52- 60  E9.3  Jy        Sp070        Peak flux density at 70um (in Jy/beam)
  62- 68  E7.2  Jy        e_Sp070      Error on peak flux density at 70um
                                        (in Jy/beam)
  70- 75  F6.2  ---      Sp070/Sbg070  Contrast over local background at 70um
  77- 85  E9.3  Jy        Sconv070     Smoothed peak flux density at 70um
                                        (in Jy/beam500) (2)
  87- 95  E9.3  Jy        Stot070      Integrated flux density at 70um
  97-103  E7.2  Jy        e_Stot070    Error on integrated flux density at 70um
 105-107  I3    arcsec    FWHMa070     ?=-1 Major FWHM diameter at 70um (3)
 109-111  I3    arcsec    FWHMb070     ?=-1 Minor FWHM diameter at 70um (3)
 113-115  I3    deg       PA070        ?=-1 Position angle at 70um (3)(4)
 117-122  F6.1  ---       Signi160     Detection significance at 160um (1)
 124-132  E9.3  Jy        Sp160        Peak flux density at 160um (in Jy/beam)
 134-140  E7.2  Jy        e_Sp160      Error on peak flux density at 160um
                                        (in Jy/beam)
 142-147  F6.2  ---      Sp160/Sbg160  Contrast over local background at 160um
 149-157  E9.3  Jy        Sconv160     Smoothed peak flux density at 160um
                                        (in Jy/beam500) (2)
 159-167  E9.3  Jy        Stot160      Integrated flux density at 160um
 169-175  E7.2  Jy        e_Stot160    Error on integrated flux density at 160um
 177-179  I3    arcsec    FWHMa160     ?=-1 Major FWHM diameter at 160um (3)
 181-183  I3    arcsec    FWHMb160     ?=-1 Minor FWHM diameter at 160um (3)
 185-187  I3    deg       PA160        ?=-1 Position angle at 160um (3)(4)
 189-194  F6.1  ---       Signi250     Detection significance at 250um (1)
 196-204  E9.3  Jy        Sp250        Peak flux density at 250um (in Jy/beam)
 206-212  E7.2  Jy        e_Sp250      Error on peak flux density at 250um
                                        (in Jy/beam)
 214-219  F6.2  ---      Sp250/Sbg250  Contrast over local background at 250um
 221-229  E9.3  Jy        Sconv250     Smoothed peak flux density at 250um
                                        (in Jy/beam500) (2)
 231-239  E9.3  Jy        Stot250      Integrated flux density at 250um
 241-247  E7.2  Jy        e_Stot250    Error on integrated flux density at 250um
 249-251  I3    arcsec    FWHMa250     ?=-1 Major FWHM diameter at 250um (3)
 253-255  I3    arcsec    FWHMb250     ?=-1 Minor FWHM diameter at 250um (3)
 257-259  I3    deg       PA250        ?=-1 Position angle at 250um (3)(4)
 261-266  F6.1  ---       Signi350     Detection significance at 350um (1)
 268-276  E9.3  Jy        Sp350        Peak flux density at 350um (in Jy/beam)
 278-284  E7.2  Jy        e_Sp350      Error on peak flux density at 350um
                                        (in Jy/beam)
 286-291  F6.2  ---      Sp350/Sbg350  Contrast over local background at 350um
 293-301  E9.3  Jy        Sconv350     Smoothed peak flux density at 350um
                                        (in Jy/beam500) (2)
 303-311  E9.3  Jy        Stot350      Integrated flux density at 350um
 313-319  E7.2  Jy        e_Stot350    Error on integrated flux density at 350um
 321-323  I3    arcsec    FWHMa350     Major FWHM diameter of core at 350um
 325-326  I2    arcsec    FWHMb350     Minor FWHM diameter of core at 350um
 328-330  I3    deg       PA350        Position angle of core at 350um (4)
 332-337  F6.1  ---       Signi500     Detection significance at 500um (1)
 339-347  E9.3  Jy        Sp500        Peak flux density at 500um (in Jy/beam)
 349-355  E7.2  Jy        e_Sp500      Error on peak flux density at 500um
                                        (in Jy/beam)
 357-362  F6.2  ---      Sp500/Sbg500  Contrast over local background at 500um
 364-372  E9.3  Jy        Stot500      Integrated flux density at 500um
 374-380  E7.2  Jy        e_Stot500    Error on integrated flux density at 500um
 382-384  I3    arcsec    FWHMa500     Major FWHM diameter of core at 500um
 386-387  I2    arcsec    FWHMb500     Minor FWHM diameter of core at 500um
 389-391  I3    deg       PA500        Position angle of core at 500um (4)
 393-398  F6.1  ---       SigniNH2     Detection significance at column density
 400-404  E5.1 10+21cm-2  NpH2         Peak H2 column density at 18.2" resolution
 406-409  F4.2  ---       NpH2/Nbg     Contrast over local background at
                                        column density
 411-414  E4.1 10+21cm-2  NconvH2      Peak H2 column density at 36.3" resolution
 416-419  E4.1 10+21cm-2  NbgH2        Local background H_2 column density
 421-423  I3    arcsec    FWHMaNH2     Major FWHM diameter of core at N_H2
 425-427  I3    arcsec    FWHMbNH2     Minor FWHM diameter of core at N_H2
 429-431  I3    deg       PANH2        Position angle of core at N_H2 (4)
     433  I1    ---       NSED         [1/5] Number of significant Herschel bands
     435  A1    ---       CSARflag     [012] Associations with CSAR-found
                                              cores (5)
 437-448  A12   ---       Coretype     Core type (6)
 450-482  A33   ---       NSIMBAD      Closest counterpart found in SIMBAD
 484-505  A22   ---       NSPITZER     Closest SPITZER c2d association (7)
 507-519  A13   ---       Com          Comments
```

Note (1): Detection significance, derived by getsources (Men'shchikov et al., 2012A&A...542A..81M), is 0.0 if the core is not visible in clean single scales.
Note (2): Peak flux density at the specified wavelength, measured after smoothing the data to a 36.3" beam.
Note (3): A special value of -1 is given when no size measurement was possible.

Note (4): Position angle of the core major axis, measured east of north.

Note (5): CSAR-flag: 2 if the getsources core has a counterpart detected by CSAR (Kirk, J.M. et al., 2013MNRAS.432.1424K) within 6 arcsec of its peak position, 1 if no close CSAR counterpart was found but the peak position of a CSAR source lies within the FWHM contour of the getsources core in the high-resolution column density map, 0 otherwise.
Note (6): Core type: starless, prestellar, protostellar.

Note (7): Closest Spitzer-identified YSO from the c2d survey (Dunham et al., 2013AJ....145...94D, Allen et al., in prep.) within 6-arcsec of the Herschel peak position, if any.

Byte-by-byte Description of file: tablea2.dat

Bytes	Format	Units	Label	Explanations
1- 3	I3	---	Seq	Core running number
5- 19	A15	---	Name	Core name, HHMMSS.s+DDMMSS, to be added after HGBS_J*
21- 22	I2	h	RAh	Right ascension (J2000)
24- 25	I2	min	RAm	Right ascension (J2000)
27- 31	F5.2	s	RAs	Right ascension (J2000)
33	A1	---	DE-	Declination sign (J2000)
34- 35	I2	deg	DEd	Declination (J2000)
37- 38	I2	arcmin	DEm	Declination (J2000)
40- 43	F4.1	arcsec	DEs	Declination (J2000)
45- 51	E7.2	pc	Rd	Deconvolved core radius (1)
53- 59	E7.2	pc	Robs	Observed core radius (2)
61- 65	F5.2	Msun	Mcore	Estimated core mass
67- 70	F4.2	Msun	e_Mcore	Uncertainty in the core mass
72- 75	F4.1	K	Tdust	Dust temperature from SED fitting
77- 79	F3.1	K	e_Tdust	Uncertainty in the dust temperature
81- 85	F5.1	10+21cm-2	NH2peak	Peak H2 column density at 36.3" resolution
87- 91	F5.1	10+21cm-2	NH2av	Average N_{H2} derived with Robs
93- 97	F5.1	10+21cm-2	NH2avd	Average N_{H2} derived with Rd
99-103	F5.1	10+4cm-3	nH2peak	Beam-averaged peak volume density
105-109	F5.1	10+4cm-3	nH2av	Average core volume density from Robs
111-115	F5.1	10+4cm-3	nH2avd	Average volume density from Rd
117-120	F4.1	---	alphaBE	Bonnor-Ebert mass ratio
122-133	A12	---	Coretype	Core type (3)
135-178	A44	---	Com	Comments (4)

Note (1): Geometrical average between the major and minor FWHM sizes of the core [pc], measured in the high-resolution column density map after deconvolution from the 18.2-arcsec HPBW resolution of the map.
Note (2): Same as (1) before deconvolution.

Note (3): Core type: starless, prestellar, protostellar.

Note (4): Comments may be "no SED fit", "tentative bound", or "CO high-V_LSR", see Sect. 4 of the paper for details.

Byte-by-byte Description of file: list.dat

Bytes	Format	Units	Label	Explanations
1- 9	F9.5	deg	RAdeg	Right ascension of image center (J2000)
10- 18	F9.5	deg	DEdeg	Declination of image center (J2000)
20	I1	arcsec/pix	Scale	[3] Scale of the image
22- 25	I4	---	Nx	[5233] Number of pixels along X-axis
27- 30	I4	---	Ny	[5657] Number of pixels along Y-axis
32- 37	I6	Kibyte	size	[115642] Size of the fits file
39- 77	A39	---	FileName	Name of the fits file in subdirectory fits
79-100	A22	---	Title	Title of the fits file

Acknowledgements:
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Philippe Andre, pandre(at)cea.fr

References:
Andre et al., 2010A&A...518L.102A

Dunham et al., 2013AJ....145...94D
Kirk, J.M. et al., 2013MNRAS.432.1424K
Men'shchikov et al., 2012A&A...542A..81M

(End) Vera Konyves [CEA/Saclay, France], Patricia Vannier [CDS] 29-Jul-2015

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