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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.

Konyves V., Andre P., Men'shchikov A., Palmeirim P., Arzoumanian D., Schneider N., Roy A., Didelon P., Maury A., Shimajiri Y., Di Francesco J., Bontemps S., Peretto N., Benedettini M., Bernard J.-P., Elia D., Griffin M.J., Hill T., Kirk J., Ladjelate B., Marsh K., Martin P.G., Motte F., Nguyen Luong Q., Pezzuto S., Roussel H., Rygl K.L.J., Sadavoy S.I., Schisano E., Spinoglio L., Ward-Thompson D., White G.J.
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ADC_Keywords: YSOs ; Regional catalog ; Infrared sources ; Interstellar medium ; Combined data ; Photometry, millimetric/submm
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 $\sim 11 \text{deg}^2$ area of the Aquila molecular cloud complex at $d \sim 260 \text{pc}$, 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, $\sim 60\% \pm 10\%$ 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 $\sim 40\%$ 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 $\sim 1 \text{Myr}$, 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 $A_V \sim 7$, and $\sim 75\%$ of them lie within filamentary structures with supercritical masses per unit length $\geq 16 M_\odot/\text{pc}$. 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"
 $\text{SFR}/M_{\text{dense}} \sim 5 \pm 2 \times 10^{-8} \text{yr}^{-1}$ 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
<code>fits/*</code>	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_
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 34	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 H2 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	RA s	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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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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