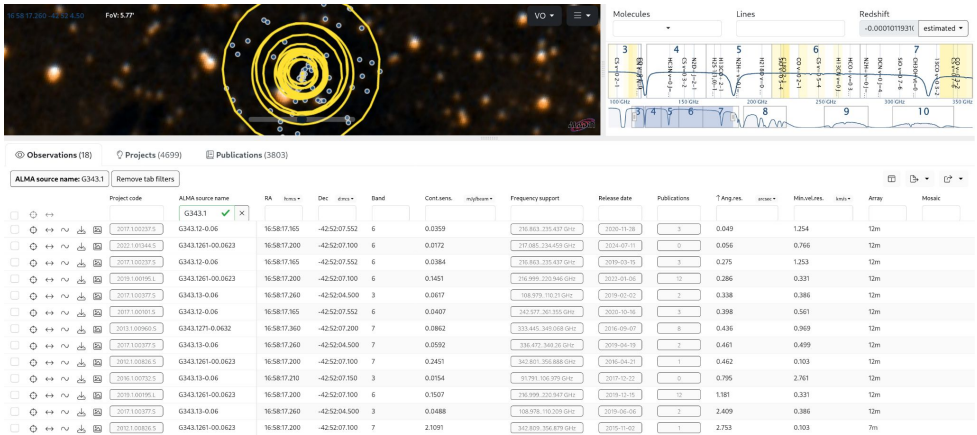
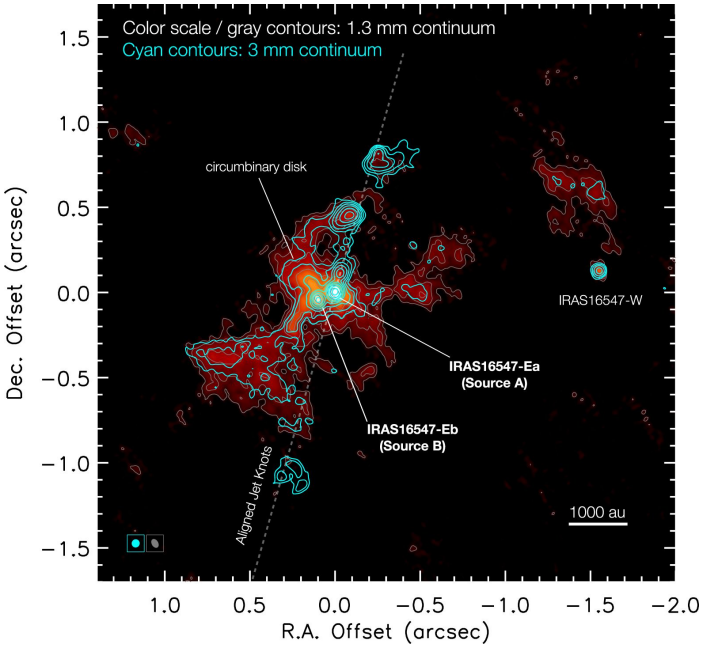
Multi-band

G343.12-0.06 (IRAS 16547-4247)

High-mass star forming region at 2.9 kpc





Tanaka et al. (2020)

Physical quantities

Grey body (e.g. Morales et al. 2009): $F_\nu^{\rm c} = \Omega_{\rm c} B_\nu(T_{\rm c})(1 - e^{-(\nu/\nu_0)^\beta}),$

Rayleigh-Jeans limit: $B_\nu(T) = \dfrac{2\nu^2 k_{\rm B} T}{c^2}.$

Spectral index: $\log(F_{\nu 1}/F_{\nu 2}) = \alpha \log(\nu_1/\nu_2)$ with $\alpha=\beta+2$

Column density: $N_{\rm H_2} = \dfrac{I_\nu R_{\rm gd}}{B_\nu(T_d)\kappa_\nu \mu_{\rm H_2} m_{\rm H}}$

Dust mass: $M_d = \dfrac{F_\nu d^2 R_{\rm gd}}{\kappa_\nu B_\nu(T_d)}$ $M_{\rm gas} = \mu m_{\rm H} d^2\, \delta x\, \delta y \sum N_{\rm H_2},$

Previous single dish studies

From Garay et al. (2007)

SIMBA Source	D (kpc)	T_d (K)	Radius (pc)	Mass ($M_\odot$)	$n(H_2)$ (cm^{-3})	$N(H_2)$ (cm^{-2})	$\tau_{1.2\ mm}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
16547−4247	2.9	31.0	0.20	1.9×10^3	9.3×10^5	7.7×10^{23}	0.0305

Dust + free-free

equation (5). In the interstellar medium, the average dust opacity index, β, is $\beta = 1.8 \pm 0.2$, while in protoplanetary discs, where grain agglomeration leads to increased dust grain sizes, this value can fall to $\beta \approx 1$ (Draine 2006) or even less if observing an optically thick, hot accretion disc. Typically, for MYSOs the value for β falls in the range $1 \leq \beta \leq 2$ (e.g. $\beta = 1$, $\beta = 1.3$, and $\beta = 1.5$ for Zhang et al. 2007, Galván-Madrid et al. 2010, Chen et al. 2016, respectively).

$$S_\nu^{\rm dust} \propto \nu^{\beta+2}, \tag{4}$$

$$S_\nu = c_1 \nu^\alpha + c_2 \nu^{\beta+2}, \tag{5}$$

where $c_1 = S_0^{\rm jet} \nu_0^{-\alpha}$, $c_2 = S_0^{\rm dust} \nu_0^{-\beta-2}$, and $S_0^{\rm jet}$ and $S_0^{\rm dust}$ are the flux contributions at some reference frequency, ν_0, from the ionized and dust components, respectively.

Purser et al. (2021)