1

1,2

3

4

$$w_i = \Delta t \Delta \nu / T_{\rm sys}^2$$

x

$HPBW$

2

v_i

r_i

N

$$S = \sum r_i$$

$N = 7$

$S = 27$

i

$$\tau_i(v) = \tau_i \cdot \exp\left[-4\ln 2\left(\frac{v - v_{0,i}}{p_3}\right)^2\right]$$

p_3

$$v_{0,i} = v_i + p_2$$

$v_i = 0$

$$\tau(v) = p_4 \sum_{i=1}^{N} r_i \cdot \exp\left[-4 \ln 2 \left(\frac{v - v_i - p_2}{p_3}\right)^2\right]$$

$$T_{\mathrm{ant}}(v) = \frac{p_1}{p_4}\left(1 - e^{-\tau(v)}\right)$$

$$
\begin{aligned}
\tau(v_i + p_2) &= p_4 \cdot r_i \qquad \text{(assumption A4)} \\
\sum_i \tau_i &= p_4 \cdot S \\
T_{\text{ant}}(v_i + p_2) &= \frac{p_1}{p_4}\left(1 - e^{-p_4 r_i}\right) \\
T_{\text{ant}}(v_i + p_2) &\approx p_1 \cdot r_i
\end{aligned}
$$

p_4

S

$S = 1$

p_1

$\lambda < 3$

$$T_{\rm ant}(v) = T_A^*(v) = \frac{B_{\rm eff}}{F_{\rm eff}}[T_{\rm ex} - T_{\rm bg}](1 - e^{-\tau(v)})$$

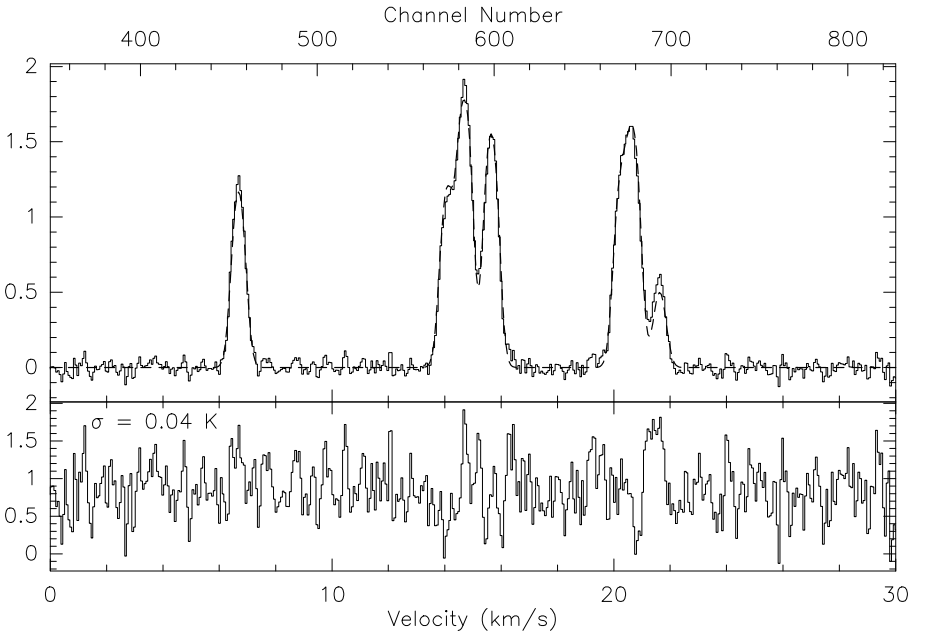
$$T_{\mathrm{ex}} = T_{\mathrm{bg}} + \frac{F_{\mathrm{eff}}}{B_{\mathrm{eff}}} \frac{p_1}{p_4}$$

$0.1 - 30$

$\exp(-\tau) \ll 1$

19; 5 TOTO N2H+(1−0) IRAM−30M−B41 +0 +0 Eq 3069. 0

1 0.570 (0.011) 14.692 (0.002) 0.513 (0.004) 0.274 (0.010)



10^6

< 30

< 40

$$f(\nu) = \frac{\mathcal{A}}{\Delta\nu} \frac{1 + 4H\left[(\nu - \nu_0)/\Delta\nu\right]^2}{1 + H/3}$$

ν_0

$$f(\nu_0) = \frac{\mathcal{A}}{\Delta\nu}\frac{1}{1+H/3}$$

$$f(\nu_0 + \Delta\nu/2) = \frac{\mathcal{A}}{\Delta\nu} \frac{1+H}{1+H/3}$$

$$\frac{f(\Delta\nu/2)}{f(0)} = 1 + H$$

$$v_{\mathrm{exp}} = c\,\frac{\Delta\nu/2}{\nu_0}$$

$\mathcal{A} = 5$

$\Delta\nu = 3.83$

$v_{\text{exp}} = 2.49$

-1

$H = 5$

$H = -1$

$v_{\text{exp}} = 2.49$

$= 5$

$= 3$

-1