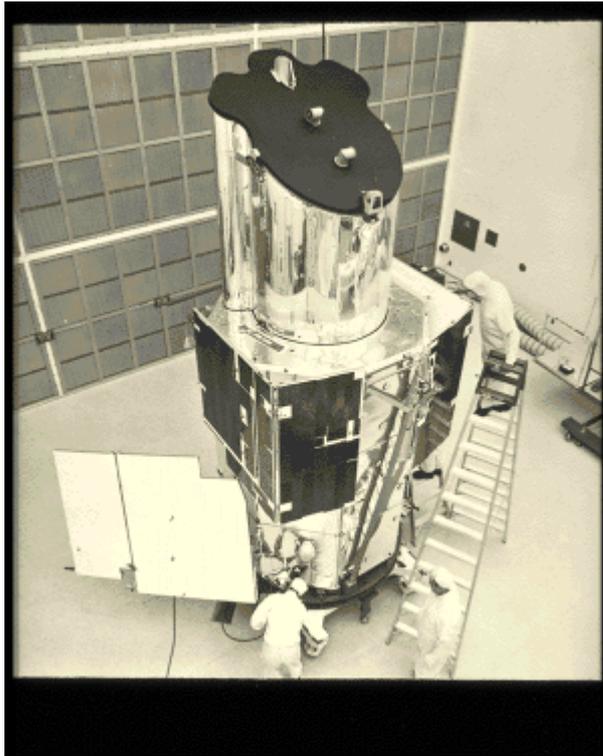


Abundancia de CO en Nubes Interstelares

Faviola Molina

- El CO es la molécula pesada más abundante y extendida del medio interestelar.
- La escala del espectro rotacional del CO es tal que la energía de separación de los niveles corresponde a las temperaturas de las nubes interestelares ($B=2,766$ K).
- Las líneas de absorción en el UV fueron detectadas en la dirección de ζ Oph por Smith & Stecher (1971), y luego en direcciones a otras estrellas por Jenkins, Drake, et al. (1973) con el satélite *Copernicus*
- Los resultados presentados corresponden a datos obtenidos de un sondeo UV tomados con el mismo satélite. Específicamente, en las longitudes de onda $\lambda=1088$ A y $\lambda=1076$ A, que corresponden a las transiciones fuertes ($v'=0 \rightarrow v=0$) $C1\Sigma^+ - X1\Sigma^+$ y $E1\Pi - X1\Sigma^+$ respectivamente



$$N(CO) = 1.07 [W_{1088} / mA] [f / 0.089]^{-1} \times 10^{12} \text{ cm}^{-2}$$

$$N(CO) = 0.813 [W_{1076} / mA] [f / 0.12]^{-1} \times 10^{12} \text{ cm}^{-2}$$

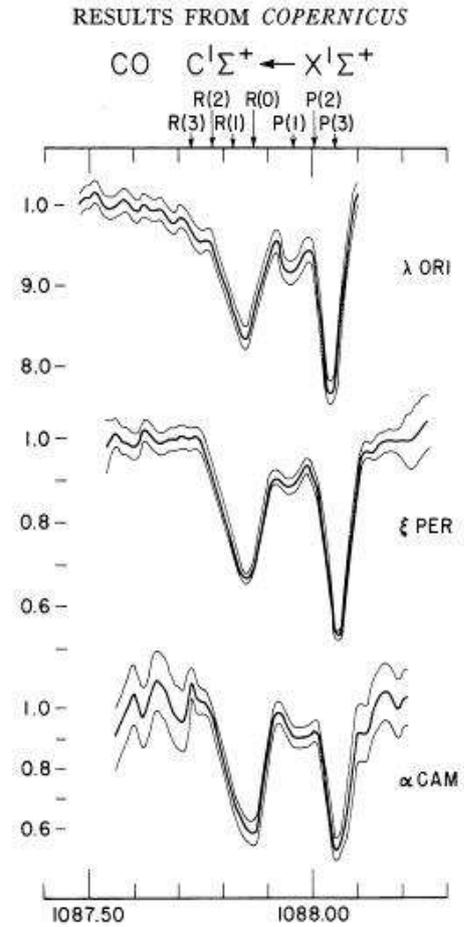


FIG. 1.—Composite profiles recorded for the 0-0 absorption to the $C^1\Sigma^+$ state of interstellar carbon monoxide in the spectra of λ Ori, ξ Per, and α Cam. The expected positions of several rotation components are shown at the top, with a wavelength scale at the bottom. The thin lines on either side of the main curve represent the $\pm 2\sigma$ error limits from the net counting statistics. The scales to the left of the profiles indicate the relative intensities.

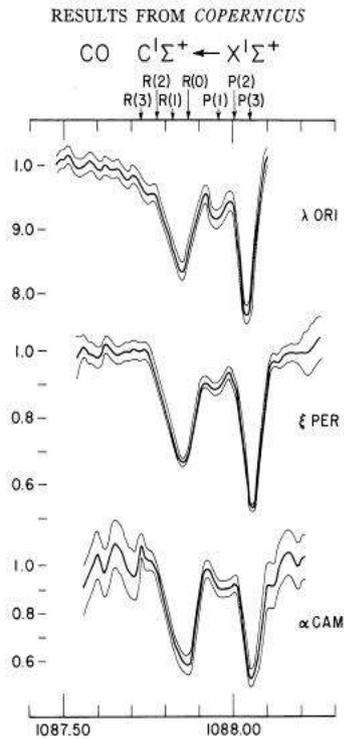


FIG. 1.—Composite profiles recorded for the 0-0 absorption to the $C^1\Sigma^+$ state of interstellar carbon monoxide in the spectra of λ Ori, ξ Per, and α Cam. The expected positions of several rotation components are shown at the top, with a wavelength scale at the bottom. The thin lines on either side of the main curve represent the $\pm 2\sigma$ error limits from the net counting statistics. The scales to the left of the profiles indicate the relative intensities.

N(CO) aumenta rápidamente con N(H₂)
aproximadamente como la segunda potencia

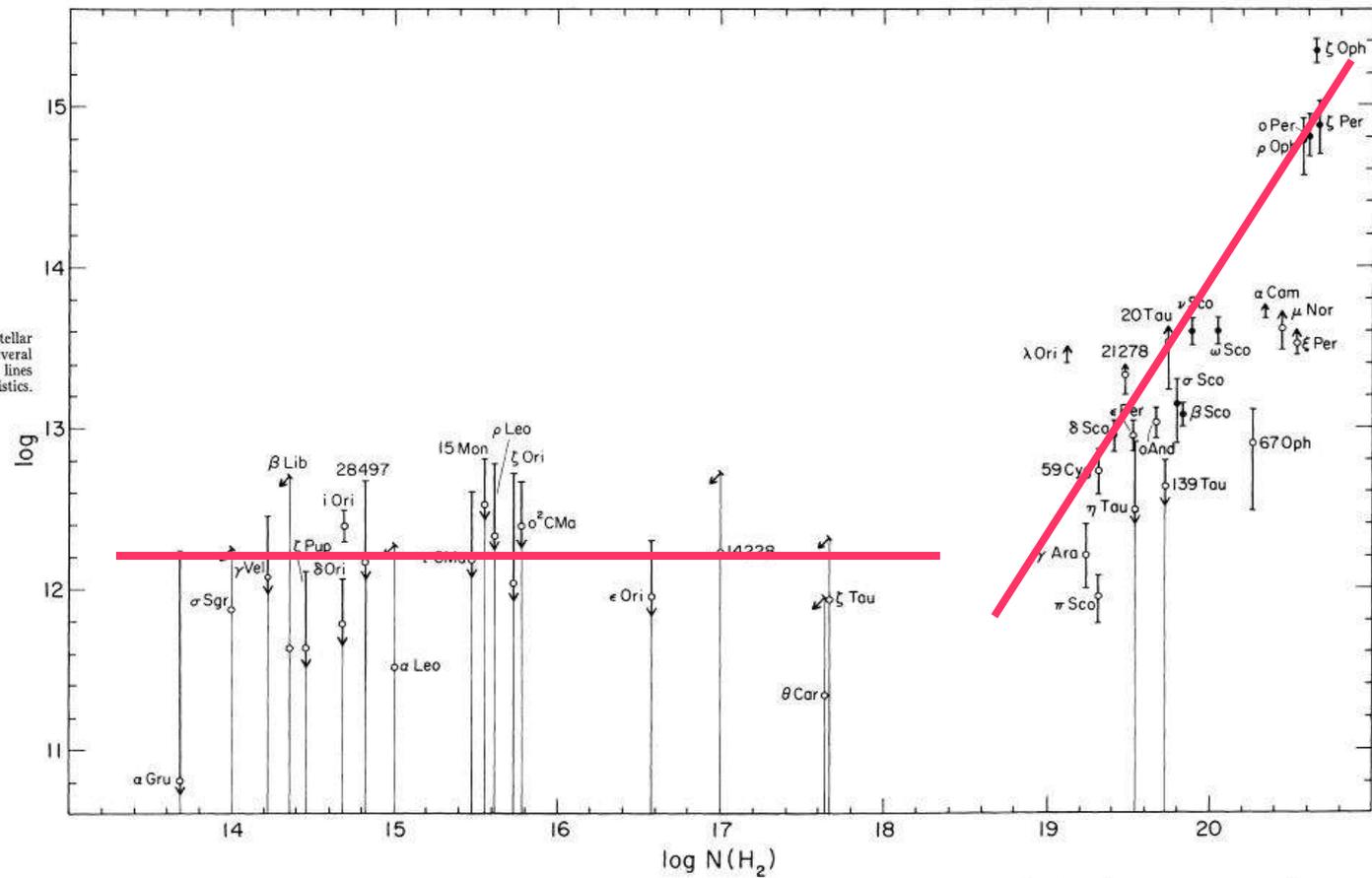


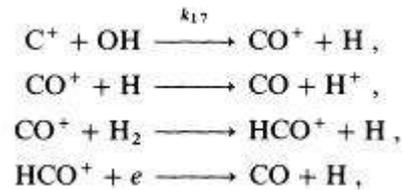
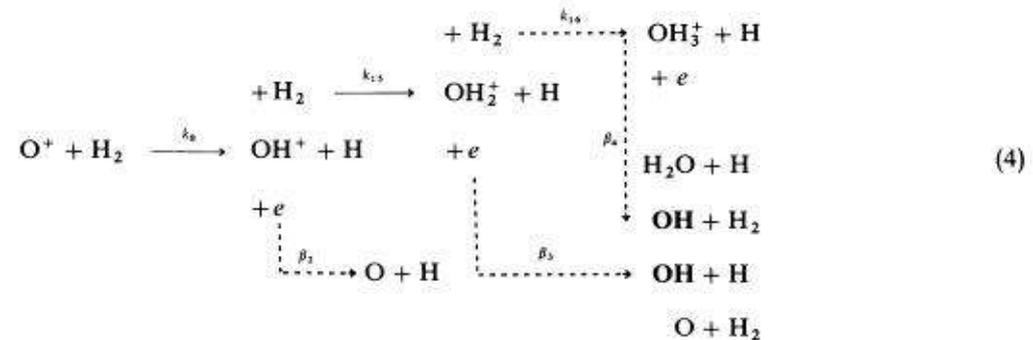
FIG. 1.—CO vs. H₂ column densities. The open circles refer to the strong $C-X$ and $E-X$ transitions used in this survey, supplemented by a few earlier measurements as described in the text. The filled circles are measurements obtained by other workers from the weaker $B-X$ and, for ζ Oph only, $A-X$ transitions. The error bars represent \pm one standard deviation. Upper and lower limits are indicated by arrows, and the formal value of the column density is given by the open circle. Slant arrows have been used in those cases where only upper limits to the column density of molecular hydrogen are available.

CO es detectado donde se observan cantidades sustanciales de H₂

El proceso más importante en la síntesis de CO es la *química de intercambio de carga del Oxígeno*



which is endothermic by 232 K. The radical OH is produced by the following sequence:



CO ABUNDANCE IN INTERSTELLAR CLOUDS

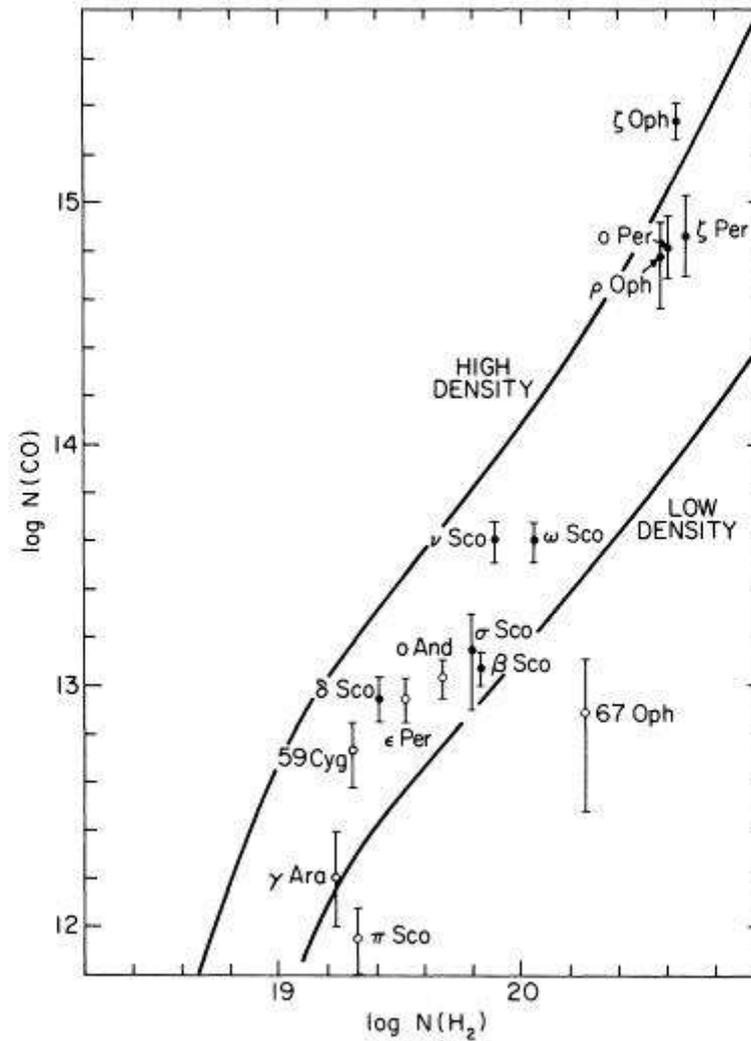


FIG. 2.—CO vs. H₂ column density measurements for $10^{19} \text{ cm}^{-2} \lesssim N(\text{H}_2) \lesssim 10^{21} \text{ cm}^{-2}$. Solid lines, theoretical calculations discussed in § IIIb of the text for the parameter sets in Table 3.

CO e Hidrógeno total

La densidad de H₂ es un mejor indicador de las diferencias de los distintos grupos de densidad columnar que la densidad total de Hidrógeno

A medida que N se incrementa el crecimiento de la tasa de formación de CO decrece debido a la saturación gradual de H₂ y debido a la ignorancia de la localización de HI

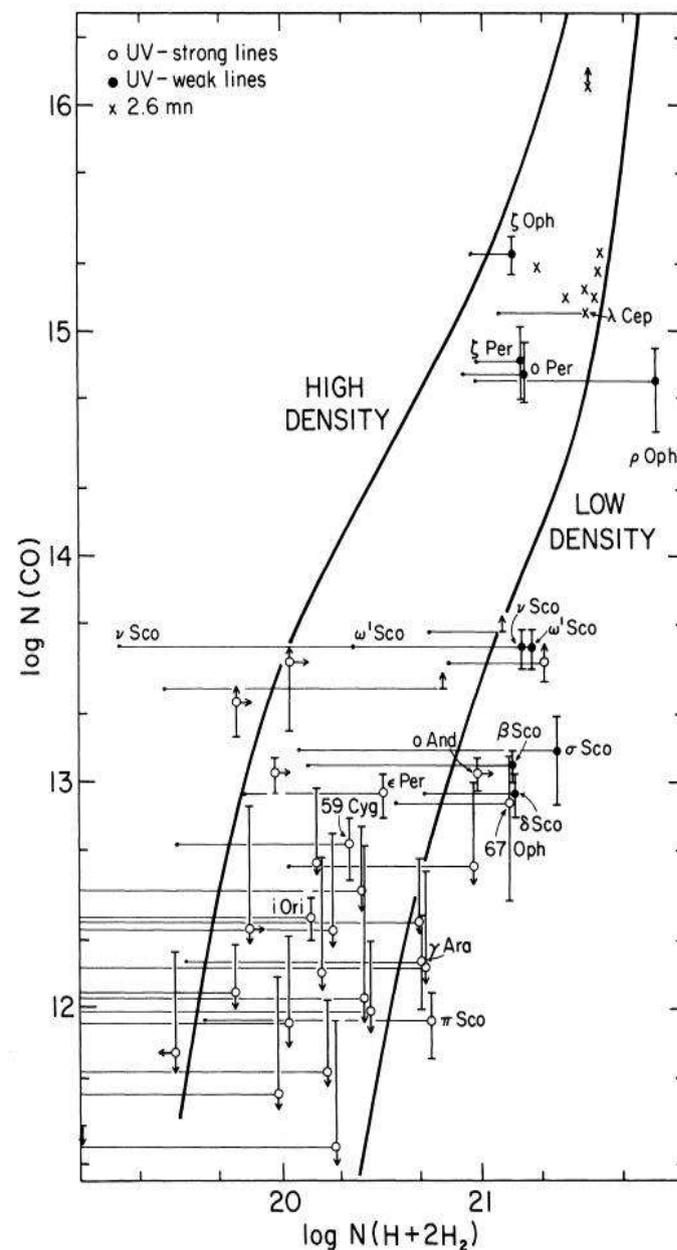


FIG. 3.—CO vs. total hydrogen column density $N = N(\text{H} + 2\text{H}_2) = N(\text{H}) + 2N(\text{H}_2)$. The representation is essentially the same as in Fig. 1. The dots at the end of the light horizontal line are where $N = 2N(\text{H}_2)$. Crosses, the radio observations of Knapp and Jura (1976). An upper limit for ρ Oph could not be plotted because it would coincide with the detection for ν Sco. In order to reduce crowding, only the names of stars for which detections have been made are included. Solid lines, theoretical calculations described in § IIIb of the text.

CO en nubes difusas y oscuras



$$N(\text{CO}) = 6,30 \times 10^{13} \text{ cm}^{-2} [N(\text{H}_2) / 10^{20} \text{ cm}^{-2}]^2$$

TABLE 3
FRACTIONATION OF ^{13}CO *

A_v	$N(^{12}\text{CO})/N(^{13}\text{CO})$	
	Low Density	High Density
0.5	80	34
1.0	75	28
1.5	60	20
2.0	46	10
2.5	34	
3.0	24	

* Terrestrial value for $^{12}\text{C}/^{13}\text{C} = 89$.
 $A_v = N(2 \times 10^{21} \text{ cm}^{-2})^{-1} \text{ mag.}$

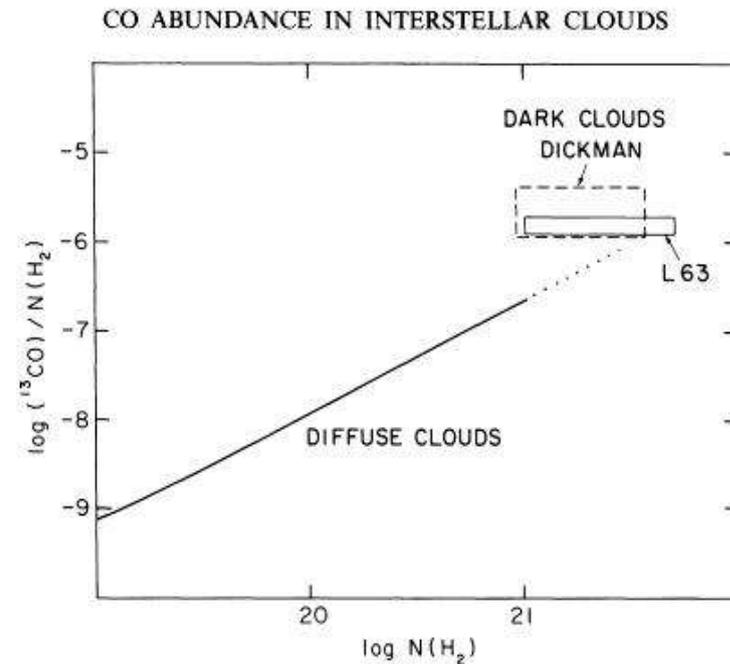


FIG. 5.—Comparison of ^{13}CO in diffuse clouds (solid line) and dark clouds (boxes). The solid line is a fit to the results of this paper corrected for fractionation.

La densidad columnar de CO observada se encuentra en el rango 10^{12} - 10^{15} cm^{-2} para nubes con $N(\text{H}_2)$ en el rango de 10^{19} – 10^{21} cm^{-2} .

El CO y la densidad columnar de H_2 están empíricamente relacionados por aproximadamente una ley cuadrática.

Todas las tendencias de la densidad columnar de CO pueden ser reproducidas por un modelo para densidades bajas y altas del medio interestelar