



Yalçın Kalkan
yalcinkalkan@gmail.com

WHAT ARE THE SIGNAL IONS IN GAS DETECTORS ?

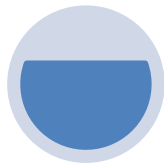
Ionization Process in the Gas



Avalanche

t=0 ns

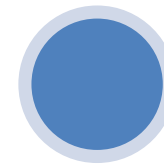
Ar⁺ ions are more abundant than CO₂⁺



Charge exchange

t=1 ns

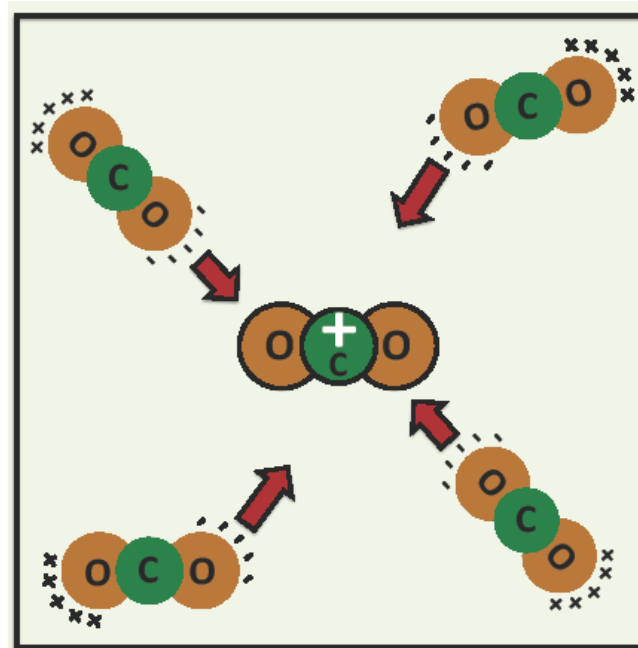
Charge is transfer from Ar⁺ to CO₂⁺.



Clustering

t=10 ns

Only CO₂⁺ • (CO₂)_n clusters left !



Cluster formation by induced dipole

Mobility & Mass

- Mobility decrease with mass.
- Heavy molecules accept the elastic limit of Langevin.

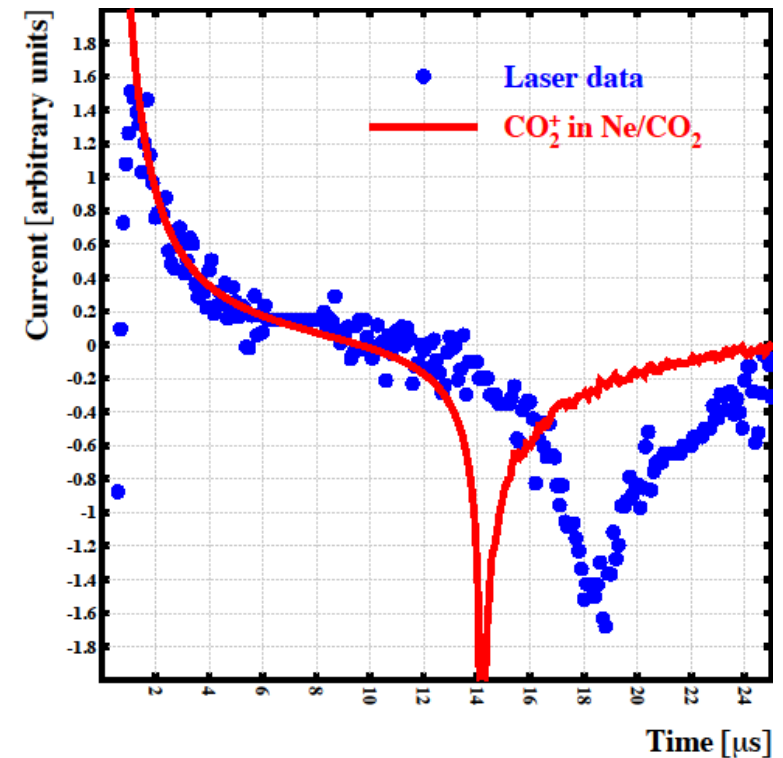
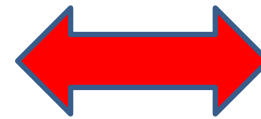
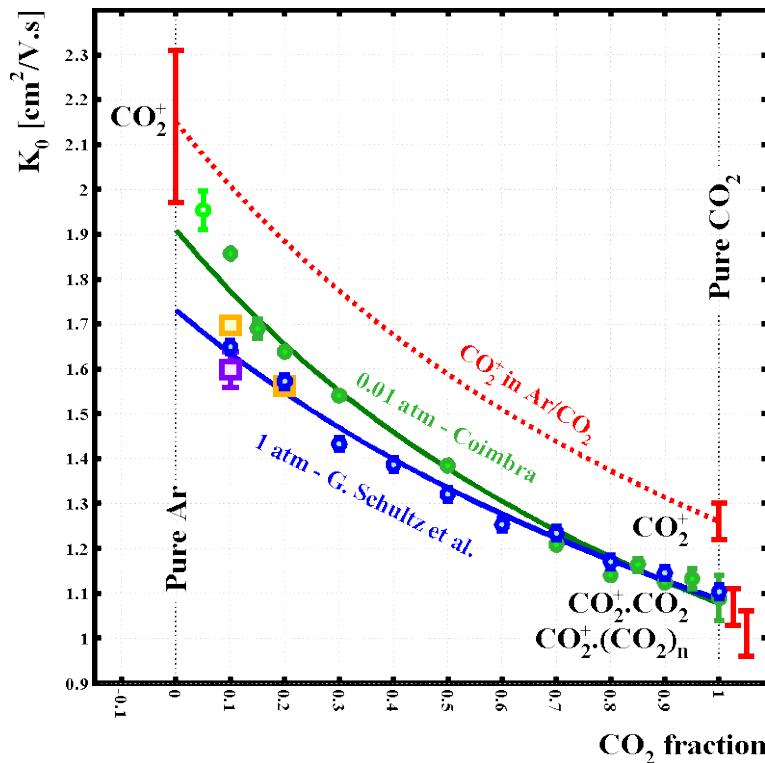
Blanc's Law

$$\frac{1}{K_{\text{mix}}} = \frac{f_1}{K_1} + \frac{f_2}{K_2}$$

Ion Mobility in Mixture

Common assumption: CO_2^+ is drifting in mixtures --> **not true !**

Proof : ALICE and NA49 data.



Conclusion : Signal ions are cluster ions in the gas detectors !