The Galactic Center: Feeding and Feedback in a Normal Galactic Nucleus
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Oxygen isotope ratio studies in the Galactic center region

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Abstract. Using the Delingha 13.7 m telescope with a 9-beam SIS superconducting receiver installed, we carried out mapping of $C^{18}O$ and $C^{17}O$ $J = (1-0)$ toward molecular clouds in the central molecular zone (CMZ) and in the halo of our galaxy. From the integrated intensity ratio of $C^{18}O$ to $C^{17}O$, the isotope ratio $^{18}O/^{17}O$ ratio can be estimated, which is considered to be one of the most useful tracers of nuclear processing and metal enrichment. Here preliminary results are presented toward Sgr A, Sgr B2, Sgr C, Sgr D, and the 1°.3 complex in the CMZ and M+5.3−0.3 in the halo.

Keywords. Isotope, ratio, Oxygen

1. Introduction

The central region of our Galaxy exhibits huge amounts of gas with violent motion and gas accretion toward the central region can be well modeled (e.g., Fukui *et al.* 2006; Binney *et al.* 1991). Isotope ratios are considered to be good tools to discriminate gas flowing towards the disk and gas already residing in the disk of the central Galactic plane (Riquelme *et al.* 2010). The ^{18}O to ^{17}O isotope ratio is a particularly useful tracer of nuclear processing and metal enrichment (e.g., Henkel & Mauersberger 1993) and it can be readily determined from $C^{18}O/C^{17}O$ line intensity ratio (without significant effect from the opacity, fractionation etc., e.g., Wouterloot *et al.* 2008, Langer *et al.* 1984, Zhang *et al.* 2007). We are performing a systematic study on the ratio of oxygen isotopes of ^{18}O to ^{17}O in our Galaxy. Our motivation includes: 1) to check different gas properties in the disk of the central Galactic plane and the halo, to and further understand Galactic center (GC) kinematics, 2) combine with observations of clouds at different galactocentric distances, to check the existence of $^{18}O/^{17}O$ gradient at large scale. Here we present preliminary results toward the molecular clouds in the GC region.

2. Observations and results

We selected the $C^{18}O$ and $C^{17}O$ molecules as our probes and their $J = (1-0)$ lines were mapped for molecular clouds in the central molecular zone (CMZ; Sgr A, B 2, C, D, 1°.3 complex) and in the halo (M+5.3−0.3). The observations were made in 2011 January and 2012 May.

Integrated intensity ratios are derived for those positions when both lines have: 1) the same velocity component for both lines; 2) high signal-to-noise ratios (SNR $\geqslant$ 5). The detailed results are presented in Table 1. It shows: 1) the results for Sgr A, Sgr B2 are consistent with previous work (Penzias 1981, Wouterloot *et al.* 2008), 2) the $^{18}O/^{17}O$ values are determined for Sgr C, Sgr D, the 1°.3 complex and M+5.3−0.3 for the first

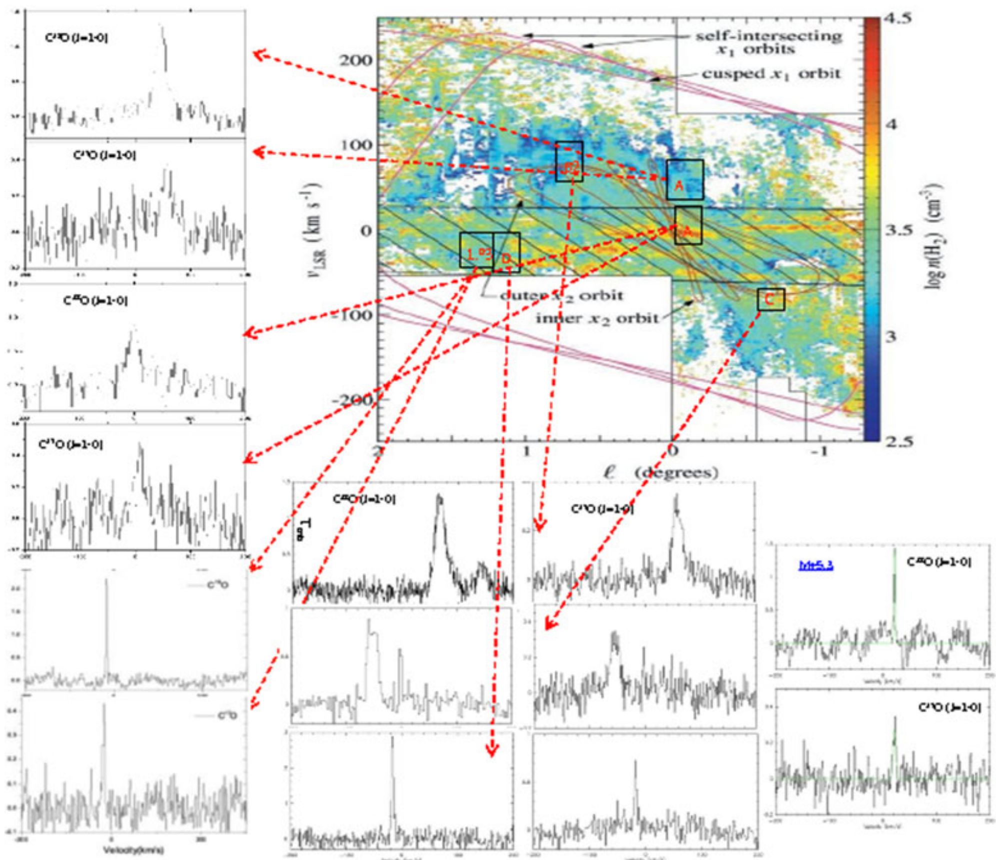

Figure 1. $C^{18}O$ and $C^{17}O$ $J = (1-0)$ spectra of main velocity components in CMZ molecular clouds (Sgr A, B 2, C, D, 1.°3 complex) and M+5.3−0.3 in the halo. Density of x_1 and x_2 orbits in the inner Milky Way was superimposed on the l-v diagram (Stark *et al.* 2004). [A color version is available online.]

Table 1. Measured values of $^{18}O/^{17}O$

Source	$l°$	$b°$	V-peak$^{a)}$	$^{18}O/^{17}O^{b)}$
Sgr A	−0.052	−0.075	∼0	2.86 ± 0.05
	−0.011	−0.066	∼50	3.72 ± 0.19
Sgr B2	0.68	−0.06	∼62	3.26 ± 0.10
Sgr C	−0.554	−0.124	∼ −56	3.53 ± 0.09
Sgr D	1.131	−0.107	∼ −20	4.18 ± 0.13
1.°3	1.28	0.07	∼ −17	4.44 ± 0.15
M+5.3−0.3	5.50	−0.234	∼23	3.21 ± 0.13

a) Line center velocity of main components in km s^{-1}
b) From frequency-corrected ratio of $C^{18}O/C^{17}O$.

time, 3) no significant difference on the ratio can be found in the disk and in the halo. However, toward Sgr D and the 1.°3 complex, the main known components (at ∼100 km s^{-1}) were not detected due to high noise and the slightly bigger ratio resulted from strong emission (much narrower, relative to Sgr A, B2 and C), possibly from local gas.

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