S18a Rotating Ionized Gas Ring around the Galactic Center IRS13E3

Masato Tsuboi, Yoshimi Kitamura (ISAS), Makoto Miyosi (NAOJ), Takahiro Tsutsumi (NRAO), Ryosuke Miyawaki (J.F. Oberlin Univ.), Atsushi Miyazaki (Japan Space Forum)

We detected a compact ionized gas associated physically with IRS13E3, an Intermediate Mass Black Hole (IMBH) candidate in the Galactic Center, in the continuum emission at 232 GHz and H30α recombination line using ALMA Cy.5 observation (2017.1.00503.S, P.I. M.Tsuboi). The resultant angular resolutions of the observations are both 0.037" $\times$ 0.024", $PA = 87^\circ$ using "natural weighting". The continuum emission image shows that IRS13E3 is surrounded by an oval-like structure. The oval-like structure is seen as an inclined linear feature in the H30α position-velocity diagram, which is usually a defining characteristic of a rotating gas ring around a large mass. The gas ring has a rotating velocity of $V_{\rm rot} \sim 150$ km s^{-1} and an orbit radius of $r \sim 7 \times 10^{15}$ cm. From these orbit parameters, the enclosed mass is estimated to be $M_{\rm IMBH} \sim 1.2 \times 10^4\ M_\odot$. The large enclosed mass would be a supporting evidence of that IRS13E3 is an IMBH. Because the orbital period is estimated to be as short as $T = 2\pi r/V \sim 100$ yr, the morphology of the observed ionized gas ring is expected to be changed in the next several decades. The mean electron temperature and density of the ionized gas are $\bar{T}_{\rm e} = 6800 \pm 700$ K and $\bar{n}_{\rm e} = 6 \times 10^5$ cm^{-3}, respectively. Then the mass of the ionized gas is estimated to be $M_{\rm gas} = 4 \times 10^{-4} M_\odot$. We will present the details of our ALMA observation and analysis with the data.