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The molecular gas kinematics in the host galaxy of non-repeating FRB 180924B

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Fast radio bursts (FRBs) are millisecond-duration transients with large dispersion measures. The origin of FRBs is still mysterious. One of the methods to comprehend FRB origin is to probe the physical environments of FRB host galaxies. Mapping molecular-gas kinematics in FRB host galaxies is critical because it results in star formation that is likely connected to the birth of FRB progenitors. However, most previous works of FRB host galaxies have focused on its stellar component. Therefore, we, for the first time, report the molecular gas kinematics in the host galaxy of the non-repeating FRB 180924B at $z = 0.3216$. Two velocity components of the CO (3-2) emission line are detected in its host galaxy with the Atacama Large Millimeter/submillimeter Array (ALMA): the peak of one component (-155.40 km s^{-1}) is near the centre of the host galaxy, and another (-7.76 km s^{-1}) is near the FRB position. The CO (3-2) spectrum shows asymmetric profiles with $A_{peak} = 2.03 \pm 0.39$, where A_{peak} is the peak flux density ratio between the two velocity components. The CO (3-2) velocity map also indicates an asymmetric velocity gradient from -180 km s^{-1} to 8 km s^{-1}. These results indicate a disturbed kinetic structure of molecular gas in the host galaxy. Such disturbed kinetic structures are reported for repeating FRB host galaxies using HI emission lines in previous works. Our finding indicates that non-repeating and repeating FRBs could commonly appear in disturbed kinetic environments, suggesting a possible link between the gas kinematics and FRB progenitors.

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