R11a   The Cold AGN Outflow in NGC 1068 Characterized by Dissociation Sensitive Molecules using Two-dimensional PCA

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Recent developments in (sub-)millimeter facilities have dramatically changed the amount of information obtained by extragalactic spectral scans. Here we present feature extraction technique using two-dimensional principal component analysis (2DPCA) applied to the high-resolution spectral scan datasets toward the nearby type-2 Seyfert galaxy NGC 1068 using ALMA Band 3. We apply 2DPCA to 16 well-detected molecular line intensity maps convolved to a common 150 pc resolution, as well as [SIII]/[SII] line ratio and [CI] $^3P_1$-$^3P_0$ intensity maps, both of which clearly show a kpc-scale biconical outflow from the central AGN. We identify two prominent features: (1) a central concentration at the circumnuclear disk (CND) and (2) two peaks across the center which coincide with the biconical outflow. Molecular lines concentrated in the CND are mostly higher critical density tracers (e.g., $H^{13}CN$, HC_3N, and HCN). The emission lines from CN, C_2H, HNC, and possibly HCN, show a similar concentration but also with extended components along the bicone, likely implying that dissociative processes are the dominant chemistry in the cold molecular outflow in this galaxy. This is consistent with the faintness or absence of the emission lines from CO isotopologues, CH_3OH and N_2H^+, in the outflow, that are easily destroyed by dissociating photons and electrons.