R13a Pc-scale ALMA observations of the circumnuclear molecular disk of Centaurus A

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We present the distribution and kinematics of the molecular gas in the circumnuclear disk (CND, 400×200 pc) of Centaurus A with resolutions of 5 pc (0.3 arcsec) using CO(3–2), HCO^+(4–3), HCN(4–3), and CO(6–5) observations obtained with ALMA. Multiple filaments of 10-100 pc scale exist within the CND, which form a ring-like structure with an unprojected diameter of 170×110 pc. Inside the nuclear ring, there are two leading and straight filamentary structures with lengths of about 30–60 pc at $PA \simeq 120$deg on opposite sides of the AGN, with 180deg rotational symmetry and steeper position-velocity diagrams, which are interpreted as nuclear shocks due to non-circular motions. Along the filaments, and unlike other nearby AGNs, several dense molecular clumps present low HCN/HCO^+(4–3) ratios ($\lesssim 0.5$). The filaments abruptly end in the probed transitions at $r \simeq 20$ pc from the AGN, but near-IR H_2 maps show that they continue in an even warmer gas phase (T∼1000 K), winding up in the form of nuclear spirals, and forming an inner ring structure with another set of symmetric filaments along the N–S direction and within $r \simeq 10$ pc. The gas is governed primarily by non-circular motions, being the successive shock fronts at different scales where loss of angular momentum occurs, a mechanism which may feed efficiently powerful radio galaxies down to parsec scales.