CO(J=1-0) OBSERVATIONS OF M101

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ABSTRACT. We have mapped the central ≈8'x5' of the spiral galaxy M101 with full beam width spacing (30") in the CO(J=1-0) line using the Onsala 20m telescope. In total, observations were performed towards 153 positions, and 120 were definitely detected. We discuss briefly the distribution and kinematics of the CO gas.

1. Integrated CO(J=1-0) intensity distribution

The integrated CO antenna temperature, $I_{CO}=\int T_A^* dv$, decreases monotonically with distance from the nucleus, but the scatter around the mean is substantial, $I_{high}/I_{low}\approx 4$ at a given radius. This is partly due to the presence of spiral arm-like features in the CO distribution. The integrated intensity map shows a peak at the centre and two secondary maxima at the beginning of the spiral arms to the E and to the W of the nucleus. The inner portions of the spiral arms, as well as two branched arms to the SW and to the S of the nucleus, are traced out by the CO emission. In general, the CO emission tends to follow the radio continuum although their peaks do not necessarily coincide. For instance, 2' SW of the nucleus a peak in the radio continuum, Se2, is associated with a local dip in the CO emission and there is no strong CO emission associated with the HII-regions Se3 and H58.

2. Kinematics

An iso-velocity (intensity-weighted mean velocity) map of the CO emission suggests that the kinematics is reasonably ordered in the central region of the galaxy, but the are indications of perturbations associated with the principal and branched spiral arms. This is more apparent in a position-velocity diagram along the major axis (PA=40°), where there are velocity increases (in the tangential direction) associated with the crossing of principal and branched spiral arms. The shifts are of order 40 km/s if they occur in the plane of the galaxy (i=18°). It appears that the gas slows down before and after the velocity jump. Also, a cut in the direction of the minor axis shows two velocity components at the position of an arm. Finally, there seems to be an increased velocity dispersion to the E and to the W of the nucleus where the spiral arms start.

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