2. ROTATION

Next we determine the components of smaller magnitude \((B_r, B_\theta, v, w)\) by using \((B_\phi, u, \rho)\) in the previous section. Substituting equations (4) through (7) into the MHD equations and neglecting the higher order terms of \((B_r, B_\theta, v, w)\), we have

\[
\begin{align*}
\rho u - \frac{B_\phi B_\theta}{4\pi \rho u} &= \text{constant } (\equiv \ell \phi), \quad (12) \\
B_\phi(r, \theta) &= B_\phi(r_0) \cdot \left(\frac{r_0}{r}\right)^2 \cdot \frac{1}{4\pi r \rho \theta}, \quad (13) \\
v &= 0, \quad (14) \quad B_\theta = 0, \quad (15)
\end{align*}
\]

where \(r_0\) is an arbitrary constant with the same dimension as \(r\). The gas is rotated by the magnetic torque [equation (11)].

3. CORE JET

The cold magnetic jet has intrinsically a slender gaseous core along the symmetry axis as suggested by equations (4) and (5). This core gas is assumed to have no magnetic field in it, and to be hot enough to balance laterally the outside magnetic pressure due to \(B\), i.e.

\[
P_c(r) = \frac{1}{8\pi} B_{\phi}^2(r, \theta_c).
\]

The spatial gradient of \(P_c\) accelerates the core gas like the "melon seed" effect. Numerical computations show that this core jet has a larger velocity than the cold magnetic one has and it is accelerated as \(\log r\). See the detailed discussions and conclusions in the reference.

REFERENCE


COLLIMATION OF STELLAR WINDS BY THE MAGNETIC FIELD

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The pinching effect of the magnetic field is studied as a possible mechanism for collimating stellar winds into bipolar flows in star-forming regions. Axisymmetric, steady, polytropic stellar wind models...