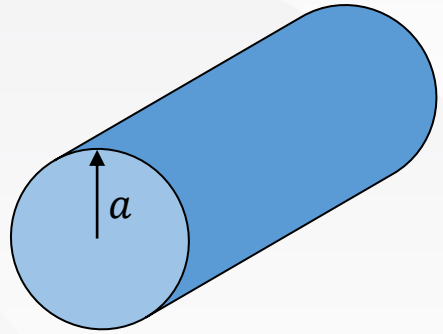
- **作业**
  - 写出光滑圆柱形波导中TM_{01}与TM_{11}模式的各场分量表达式
  - 考虑两个模式对沿轴线通过的、长度远小于波长的电子束团的可能作用（提示：纵向加速与横向偏转）

➢ 在微波结构中传播的电磁波

❖ TM模式

- $E_\rho = -j\beta T U_0 J_n'(T\rho)\cos n\phi\, e^{-j\beta z}$
- $E_\phi = \frac{j\beta n}{\rho} U_0 J_n(T\rho)\sin n\phi\, e^{-j\beta z}$
- $E_z = T^2 U_0 J_n(T\rho)\cos n\phi\, e^{-j\beta z}$
- $H_\rho = -\frac{j\omega\varepsilon n}{\rho} U_0 J_n(T\rho)\sin n\phi\, e^{-j\beta z}$
- $H_\phi = -j\omega\varepsilon T U_0 J_n'(T\rho)\cos n\phi\, e^{-j\beta z}$
- $H_z = 0$



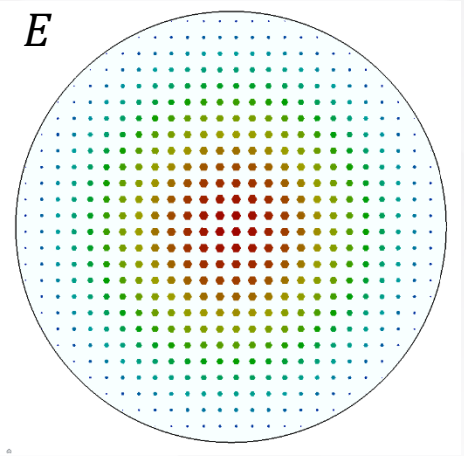
➢ 在微波结构中传播的电磁波

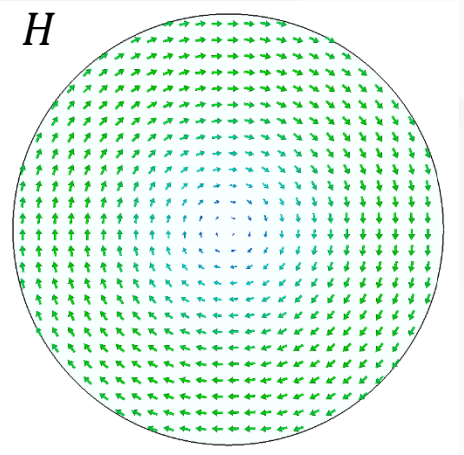
❖ TM_{01}模式

- $E_\rho = -j\beta T U_0 J_0'(T\rho)\, e^{-j\beta z}$
- $E_\phi = 0$
- $E_z = T^2 U_0 J_0(T\rho) e^{-j\beta z}$
- $H_\rho = 0$
- $H_\phi = -j\omega\varepsilon T U_0 J_0'(T\rho)\, e^{-j\beta z}$
- $H_z = 0$

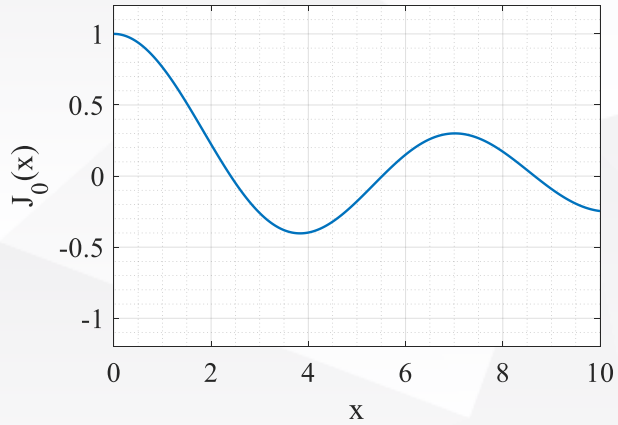
❖ TM_{01}模式轴线场分布

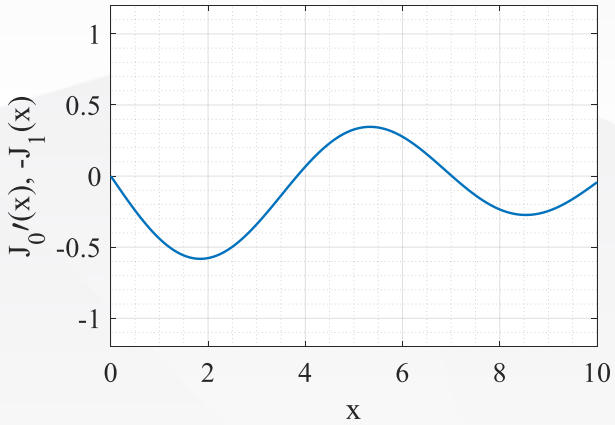
- $E_\rho = 0$
- $E_\phi = 0$
- $E_z = T^2 U_0 J_0(T\rho) e^{-j\beta z}$
- $H_\rho = 0$
- $H_\phi = 0$
- $H_z = 0$





- $T = \frac{x_{01}}{a} = \frac{2.405}{a}$

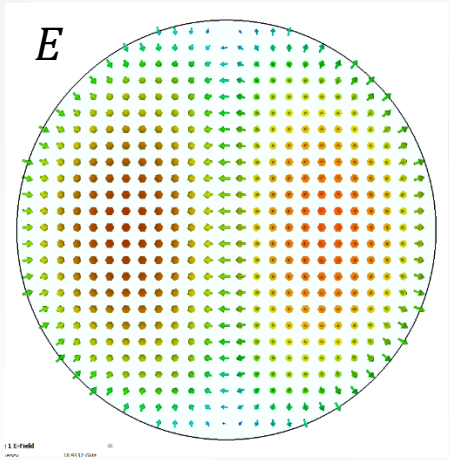


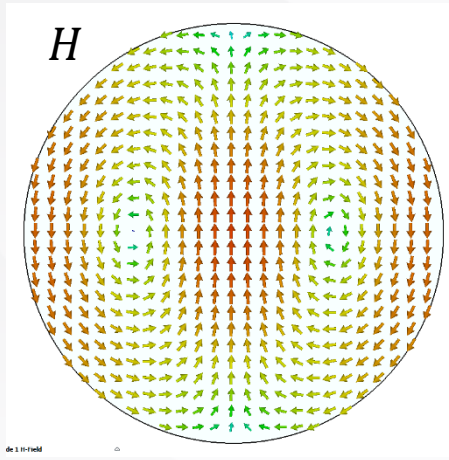


➢ 在微波结构中传播的电磁波

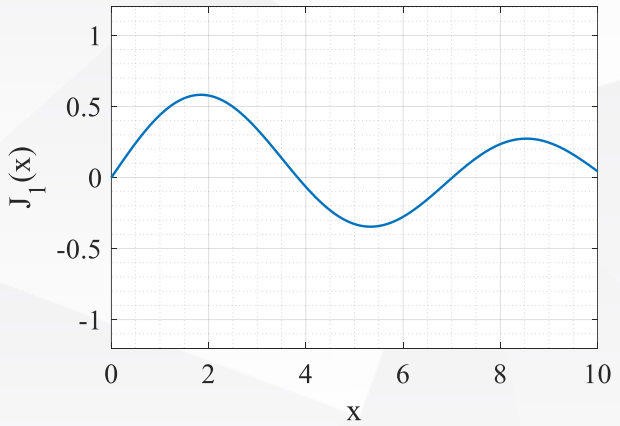
❖ TM_{11}模式

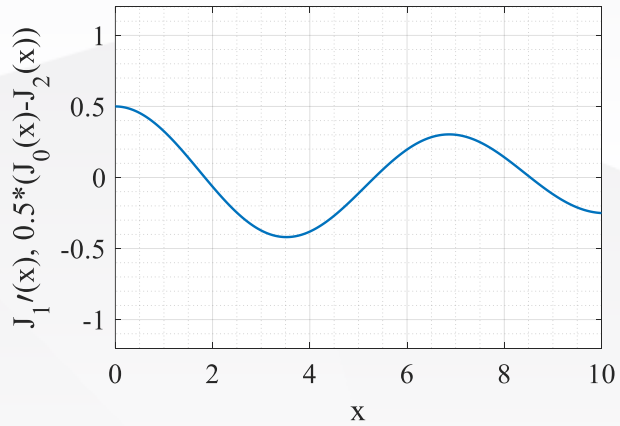
- $E_\rho = -j\beta T U_0 J_1'(T\rho)\cos\phi\, e^{-j\beta z}$
- $E_\phi = \frac{j\beta}{\rho} U_0 J_1(T\rho)\sin\phi\, e^{-j\beta z}$
- $E_z = T^2 U_0 J_1(T\rho)\cos\phi\, e^{-j\beta z}$
- $H_\rho = -\frac{j\omega\varepsilon}{\rho} U_0 J_1(T\rho)\sin\phi\, e^{-j\beta z}$
- $H_\phi = -j\omega\varepsilon T U_0 J_1'(T\rho)\cos\phi\, e^{-j\beta z}$
- $H_z = 0$





- $T = \frac{x_{11}}{a} = \frac{3.832}{a}$

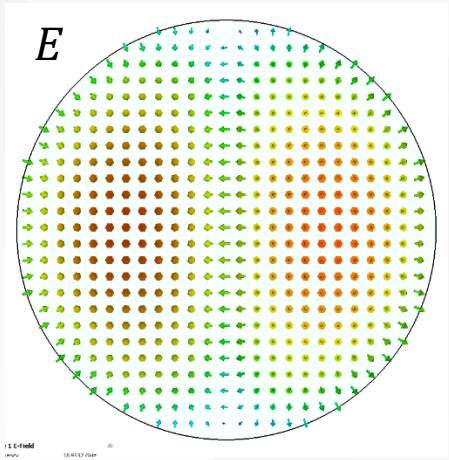


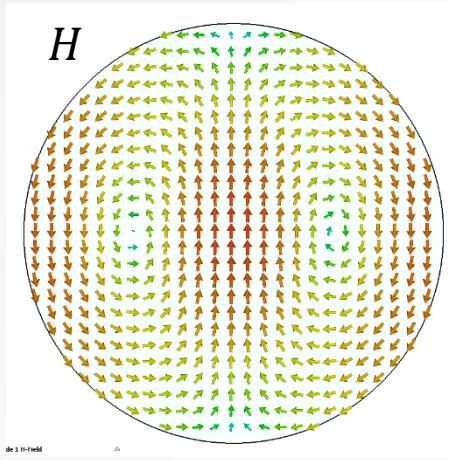


➢ 在微波结构中传播的电磁波

❖ TM_{11}模式轴线场分布

- $E_\rho = -\frac{j\beta T U_0}{2}\cos\phi\, e^{-j\beta z}$
- $E_\phi = \frac{j\beta T U_0}{2}\sin\phi\, e^{-j\beta z}$
- $E_z = 0$
- $H_\rho = -\frac{j\omega\varepsilon T U_0}{2}\sin\phi\, e^{-j\beta z}$
- $H_\phi = -\frac{j\omega\varepsilon T U_0}{2}\cos\phi\, e^{-j\beta z}$
- $H_z = 0$





- $T = \frac{x_{11}}{a} = \frac{3.832}{a}$

❖ 坐标变换

- $E_x = E_\rho\cos\phi - E_\phi\sin\phi = -\frac{j\beta T U_0}{2}e^{-j\beta z}$
- $E_y = E_\rho\sin\phi + E_\phi\cos\phi = 0$
- $E_z = 0$
- $H_x = H_\rho\cos\phi - H_\phi\sin\phi = 0$
- $H_y = H_\rho\sin\phi + H_\phi\cos\phi = -\frac{j\omega\varepsilon T U_0}{2}e^{-j\beta z}$
- $H_z = 0$