?
?
$\int dy\Psi^{\dagger}(y) H\Psi(y)\Psi =$
$(\psi)_{\uparrow}$
$\psi_{\downarrow}$
$\psi_{\downarrow}^{\dagger}$
$-$
$\psi_{\uparrow}^{\dagger}$
$H =$
$\left(\frac{p^2}{2m} - \mu_0\right)\tau_z +$
$up\sigma_z\tau_z +$
$B\sigma_x +$
$\Delta\tau_{\phi}$
σ_i
τ_i
$\tau_{\phi} =$
$\tau_x \cos\phi -$
$\tau_y \sin\phi$
ϕ
μ_0
B
Δ
U
$U(y)$
??
$U(y)\tau_z$
??
??
$\mu(y) =$
$\mu_0 -$
$U(y)$
??
$\mu(y)$
ϕ
ϕ_L
ϕ_R
ϕ_L
ϕ_R
$\mu(y) \gg$
Δ
$_and_extpotentials(a)y - profileofexternalelectricalfield.(b)y - profileofeffectivechemicalpotential$

$$H = \left(\frac{p^2}{2m} - \mu(y)\right)\tau_z + up\sigma_z\tau_z + B\sigma_x + \Delta\tau_{\phi(y)} \tag{1}$$

$$\mu(y) = \{\mu_L, -\frac{L}{2} < y\mu_b, -\frac{L}{2} < y < \frac{L}{2}\mu_R, \frac{L}{2} < y\phi(y) = \{\phi_L, -\frac{L}{2} < y\phi_R\frac{\frac{L}{2}+y}{L} + \phi_L\frac{\frac{L}{2}-y}{L}, -\frac{L}{2} < y < \frac{L}{2}\phi_R, \frac{L}{2} < y \tag{2}$$

L
B
U
Δ
μ
?
Spatially varying μ
$\mu(y)$
?
$B -$
$\sqrt{\mu^2 + \Delta^2}$
$\mu(y)$
$B >$
$|\Delta|$
μ_L
μ_R
$_realPossibleexperimentalrealizationofthesystem.Theredisametallicorsemiconductingwire,theyellowarethegatesandt$
??
?
??
??
$H =$
$\frac{p^2}{2m} -$
μ
??
$up\sigma_z$
??
$B\sigma_x$
??
τ_z
$H =$
$\left(\frac{p^2}{2m} - \mu_0\right)\tau_z +$
$up\sigma_z\tau_z +$
$B\sigma_x$
E
$-E$