Hydrogen and galaxies (10 points)

Part A - Introduction

Bohr model

A.1 (0.2pt)

$v =$

A.2 (0.5pt)

Expression : $r_1 =$

Numerical value : $r_1 =$

$v_1 =$

A.3 (0.5pt)

$E_n =$

$E_1 =$

Numerical value : $E_1 =$

Hydrogen fine and hyperfine structure

A.4 (0.5pt)

$B_1 =$

A.5 (0.5pt)

$\Delta E_{\mathrm{F}} =$

Expression of $\lambda_{\mathrm{HF}} =$

Value of $\lambda_{\mathrm{HF}} =$

Part B - Rotation curves of galaxies

B.1 (0.2pt)

$v_c =$

B.2 (0.5pt)

$M_b =$

B.3 (1.8pt)

$k_1 =$

$k_2 =$

$v_{c,m}(r \ll r_m) \simeq$

$v_{c,m}(r \gg r_m) \simeq$

$M_m(r \gg r_m) \simeq$

$M_{\text{in the figure}} =$

Part C - Mass distribution in our galaxy

C.1 (0.5pt)

Vertical motion equation :

$\omega_0 =$

C.2 (0.6pt)

$\varphi_0 =$

$v_c(r) =$

C.3 (0.7pt)

$v_{rE/S} =$

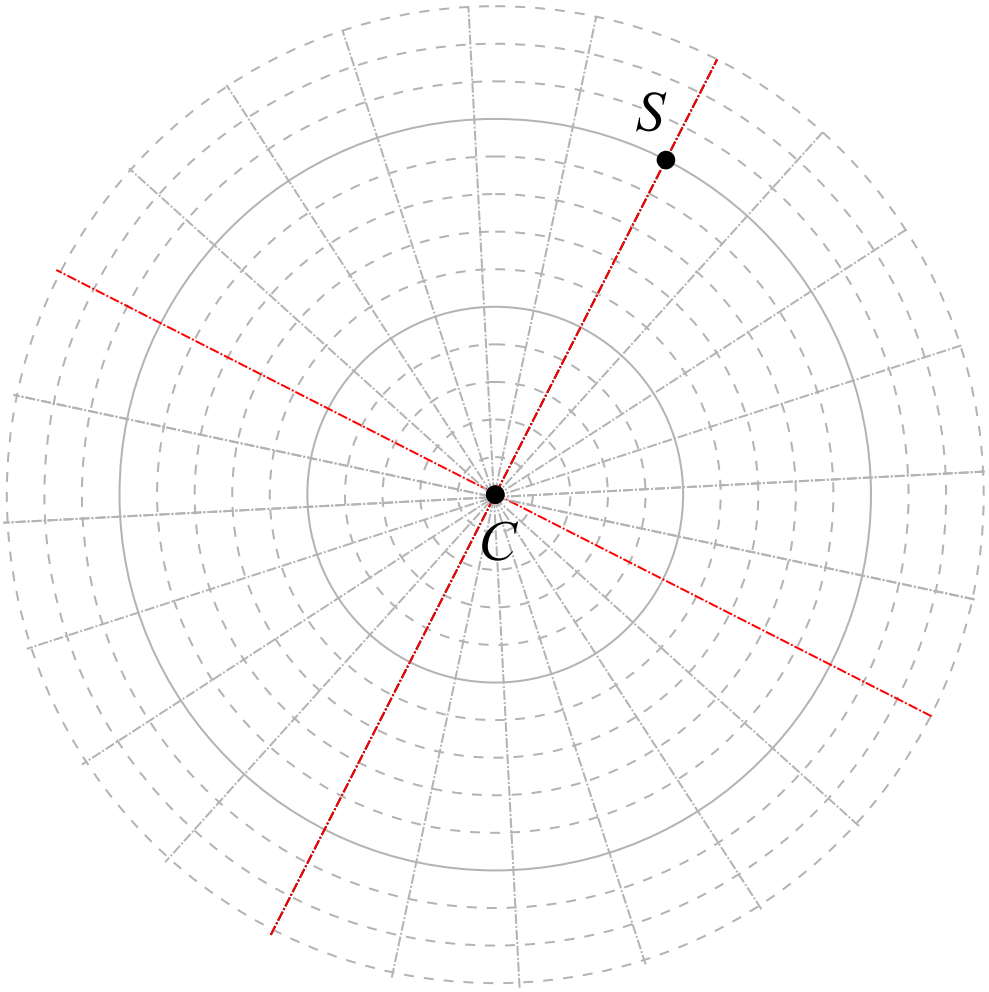
$R =$

C.4 (0.6pt)

$v_{r,1} =$ $v_{r,2} =$ $v_{r,3} =$

$R_1 =$ $R_2 =$ $R_3 =$

C.5 (0.6pt)



Deduction :

Part D - Tully-Fisher relation and Mond theory

D.1 (0.4pt)

η =

γ =

γ_{TF} =

D.2 (0.2pt)

$a_m =$

D.3 (0.8pt)

if $a \ll a_0$ then $\gamma_{\text{Mond}} =$

$a_0 =$

D.4 (0.9pt)

$v_c(r) =$

$v_c(r) =$