KAP 8: Hamiltons ligninger

- $\underbrace{H = p_i \dot{q}_i - L}_{\text{Legendretransformasjon}}$; $H = H(q, p, t)$ mens $L = L(q, \dot{q}, t)$

  Legendretransformasjon $\Rightarrow$ variabelskifte, fra $(q, \dot{q}, t)$ til (q, p, t)

- Hamiltons ligninger: $\dot{q}_i = \dfrac{\partial H}{\partial p_i}$ $\quad \dot{p}_i = -\dfrac{\partial H}{\partial q_i}$ $\quad \left(-\dfrac{\partial L}{\partial t} = \dfrac{\partial H}{\partial t}\right)$

- Sentralfelt: $H(q, p) = \frac{1}{2m}\left(p_r^2 + p_\theta^2/r^2 + p_\varphi^2/r^2\sin^2\theta\right) + V(r)$
- E.m. felt: $H(x_i, p_i, t) = \frac{1}{2m}(\vec{p} - q\vec{A})^2 + q\phi$

KAP 3: Sentralfelt; 2-Legemeproblemet

- 2 legemer + sentralfelt $V(r)$ $\longrightarrow$ ekvivalent 1-legemeproblem:

  $L = T - V = \frac{1}{2}\mu\dot{\vec{r}}^2 - V(r)$

  red. masse (μ) ; relativkoord. ($\vec{r}$)

  $\vec{L}$ bevart $\Rightarrow$ plan bevegelse: $\vec{r} \to (r, \theta)$

  $r(t)$ gitt ved $\quad t = \displaystyle\int_{r_0}^{r} \frac{dr}{\sqrt{\frac{2}{m}(E - V - \ell^2/2mr^2)}}$

  $r(\theta)$ —"— $\quad \theta = \theta_0 + \displaystyle\int_{r_0}^{r} \frac{dr}{r^2\sqrt{\frac{2mE}{\ell^2} - \frac{2mV}{\ell^2} - \frac{1}{r^2}}}$

- Kepler-problemet: $V = -k/r \Rightarrow r = \dfrac{p}{1 + \varepsilon\cos\theta}$ (kjeglesnitt)

- Spredning i sentralfelt: $\sigma(\theta) \sim 1/\sin^4\theta/2$ (Rutherford)

- Spredningstverrsnitt:

  $\sigma(\Omega)\,d\Omega$ = antall partikler spredt inn i $d\Omega$ pr tidsenhet / innfallende intensitet

  $\sigma = \int \sigma(\Omega)\,d\Omega$ = totalt spr.tr.snitt