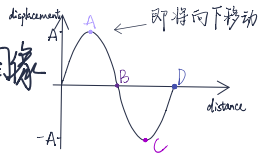
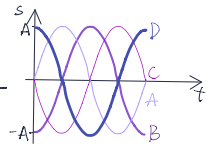
wave basis

- 呈现样式
  - wave front ⊥ ray — equivalent 运动状态相同
- 波的分类
  - ①方向
    - transverse — def. 振动方向⊥传播方向 — ep. water wave & light
    - longitudinal — def. 振动方向//传播方向 — ep. sound
  - ②维度
    - 一维
    - 二维
    - 三维
  - ③产生方式
    - progressive 行波
    - stationary 驻波 两个波干涉形成
  - ④介质
    - electromagnetic 无介质
    - mechanic 要介质
- 运动
  - partical — osciallation
    - s-d图像



    - 定义
      - amplitude(A) 振幅
      - frequency(f)=1/T
      - period(T) 周期
  - motion — propagation
    - s-t图像



      - 可以先确定点
      - 线上每点的amplitude和period保持一致
      - out of phase (ep. A&C) 两个粒子完全运动相反
      - in phase 运动方式完全相同. (波完全重叠)
    - 定义
      - period
      - amplitude
      - frequency — source
      - wave speed(v) = λf — medium
      - wave length(λ) — source & medium一旦确定

pause-echo detection

- 实验
  - what
    - Pause: reflected pulse
    - Echo: short wave (wave length~1λ)
    - Detection: the distance of the object
  - how (得到方法)
    - 测一次pulse的时间 (Δt)
    - distance = $\frac{\Delta t\, v}{2}$
  - notice (不用continuous wave)
    - ① 干涉, 只需要求一个波来回的时间
    - ② 很难确定一个连续波上用观察点

We need pause to come back before next pulse emitted.
So we can tell which reflected pulse originated with which emitted pulse.

  - range
- 图像 (如何根据PE detection得出图像)
  - 一变多 — Probe moved to different positions to get many distances of these positions
  - density — Echo spring not only distance but also density information of boundary
    - → reflection & penetration 反射和折射的能量分布

phase · $\frac{\text{path difference}}{\lambda} = \frac{\text{phase difference}}{2\pi}$

· { in phase PD $= n\lambda$
  antiphase PD $= (\frac{1}{2}+n)\lambda$

Behaviour.

- Superposition 干涉
  - cons interference: path · $d = n\lambda$ phase · $d = 0$ A_{max}
  - des interference: path · $d = (\frac{1}{2}+n)\lambda$ phase · $d = \pi$ A_{min}
- stationary ~ / standing ~ 驻波
  - 条件: coherent: 波长、振幅相同、方向相反
  - 计算
    - 两端node  $f_n = \frac{nV}{2L}$ (nth harmonic)
    - 两端antinode $L = \frac{n\lambda}{2}$
    - 一端node 一端antinode $L = \frac{(2n-1)\lambda}{4}$

  > $f_n = \frac{(2n-1)V}{4L}$
- diffraction 衍射