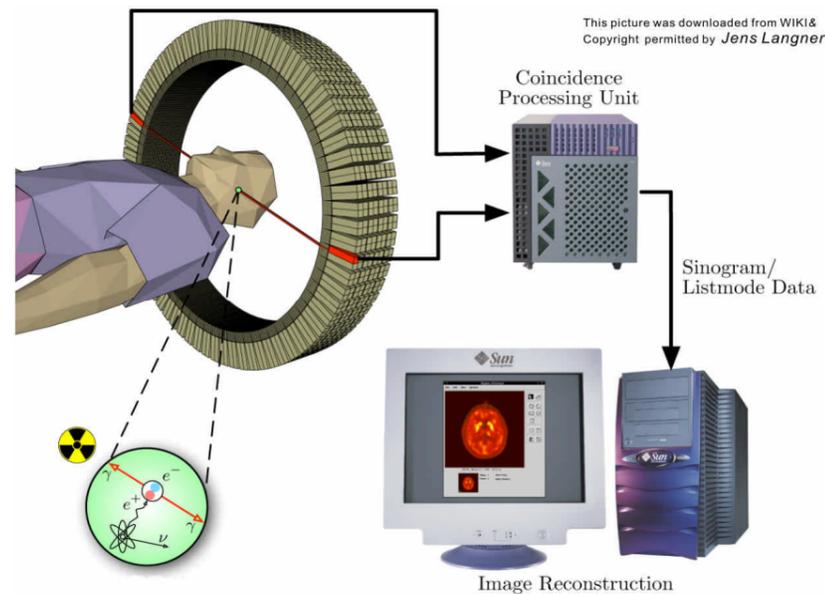


# 國立嘉義大學 99 學年度

## 電子物理學系碩士班 (甲組) 招生考試試題

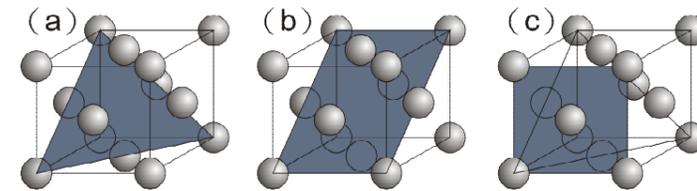
### 科目：近代物理

1. How can you distinguish Compton scattering, Rayleigh scattering, and Raman scattering? Please draw a schematic picture to explain the reason of the peak observed in the corresponding spectroscopy? (20%)
2. Please explain what is positron emission tomography (PET) 「正子斷層掃描術」 in the following schematic diagram? Please try to explain the physics of technique from the picture. (20%)



(Hint: the accelerated positron, radioisotope, and scintillator with photomultiplier )

3. The following pictures show a cubic metallic material with periodic face-centered-cubic (fcc) structure. A professor asked one of undergraduate students to use the X-ray diffraction (XRD) for determining the structural property of the unknown polycrystalline powder. Please answer the following questions: (20%)
  - (1) What is the main physics equation for the measurement? Please draw a simple picture to explain the principle.
  - (2) If the peak positions  $2\theta$  in XRD are located at around  $24.6^\circ$ ,  $35.1^\circ$ ,  $43.4^\circ$  and  $95.3^\circ$ , can you recognize the peak originated from which face labeled in Miller indices ( $hkl$ ): (a) (left figure), (b) (middle figure) or (c) (right figure)? Give your reasons. Further, what is the lattice constant of the material (the side length of the lattice)? (The wavelength of  $\text{Cu } K_\alpha$  radiation used in XRD is about  $1.54 \text{ \AA}$ )



4. Suppose that in a Franck-Hertz experiment, you use electrons of energy  $13.0 \text{ eV}$  to excite hydrogen atoms. What spectral lines will the hydrogen atoms emit under these conditions? (20%)
5. A particle moves in a potential well given by  $V(x, y, z) = 0$  for  $0 < x < L$ ,  $0 < y < L$ , and  $0 < z < L$  and  $V = \infty$  outside these ranges. Find (a) the eigenfunction and (b) the energy for the ground state. (20%)