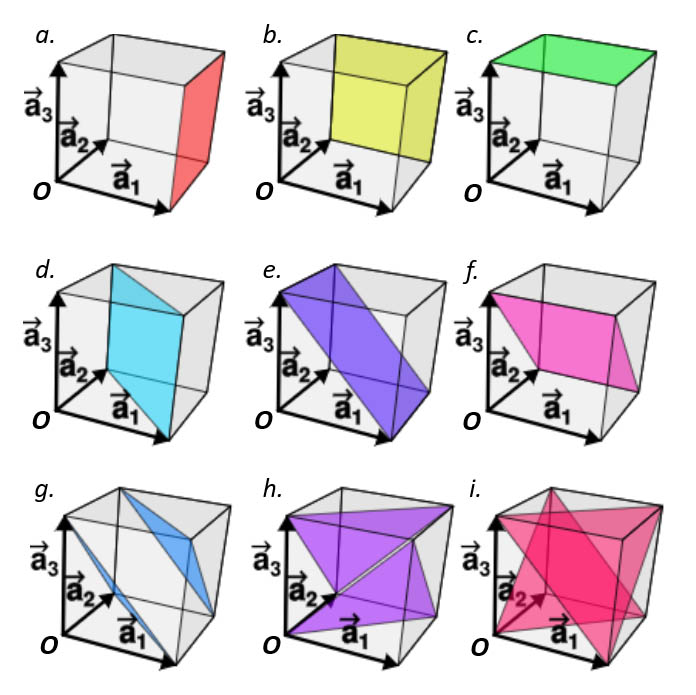
《量子信息基础》2022.3.15随堂作业：

1. (1) Write down the indices of the following 9 crystal planes in the cubic lattice system.



*a.* (1, 0, 0); *b.* (0, 1, 0); *c.* (0, 0, 1);

*d.* (1, 1, 0); *e.* (1, 0, 1); *f*. (0, 1, 1);

*g*. (1, 1, 1); *h.* (, 1, 1); *i.* (1, , 1).

以上每个写对给2分

(2) Write down the indices of the shortest lattice vector which starts from the point *O* and ends at the crystal planes with colors in the above figure.

*a.* (1, 0, 0); *b.* (0, 1, 0); *c.* (0, 0, 1);

*d.* (1, 1, 0); *e.* (1, 0, 1); *f*. (0, 1, 1);

*g*. (, , ); (, , ); *h.* (, , ); (0, 0, 0); *i.* (, , ); (0, 0, 0).

以上每个写对给2分

如果写成下面这样也算对

*g*. (1, 1, 1); *h.* (, 1, 1); *i.* (1, , 1).

1. (1) Write down the reciprocal vector of the 1D and 2D lattice of

在一维情况下，令，，

以上写对给10分

在二维情况下，令，，

以上写对给10分

(2) Prove that in the Bloch’s theorem, where is the 1D reciprocal vector.

Comparing to,

QED.

以上写对给10分

1. (Text book\* Problem 6.5)

Show that Equation 6.12 follows from Equation 6.11. Hint: First write , which is certainly true for some , and then show that is necessarily a periodic function of *x*.

从6.11式出发

我们发现波矢为的平面波 满足布洛赫定理:

写出平面波满足布洛赫定理给7分

我们还发现波矢为的平面波满足布洛赫定理，其中是一维周期性晶格的倒格矢

写出倒格矢周期性叠加的平面波满足布洛赫定理给10分

令布洛赫波 为平面波的线性叠加

写出关于u(x)的布洛赫定理给10分

其中

写出关于u(x)的表达式给7分

\* David J. Griffiths, and Darrell F. Schroeter, Introduction to Quantum Mechanics (3rd Edition), Cambridge University Press (2018).