in case of $\varkappa = 1$. The wave function might be written as

$$u^{c,m,s}_{\varkappa,n^*,l} = A\, R_{n^*,l}(r)\, Y_l^m(\vartheta,\varphi)\, \chi_s(\pm 1/2)\, \Gamma_c[\pm(\varkappa - 1/2)] \quad (19)$$

where $A$ is a normalization factor, $Y_l^m$ are spherical harmonics, $\chi_s$ and $\Gamma_c$ are spin and quasi spin functions where the latter reduces to a constant in the case $\varkappa = 1/2$. The well known spin function requires the inclusion of relativistic effects; the physical basis for $\Gamma_c$ has still to be found.

### *4.4. Transformation of Spectra*

It is known that highly ionized [2] atoms form a periodic system which coresponds to the hydrogen spectrum. This implies that there should exist a transformation which transforms the PSE-spectrum gradually into the hydrogen spectrum if the strength of the Coulomb potential is changed while the number of electrons is kept constant.

We consider a triangular quantum number lattice with a fixed direction being the direction of increasing $\lambda$ (Fig. 6). Both the hydrogen spectrum and the PSE-spectrum occupy certain lattice points in this lattice. It is evident from Fig. 6 that the required transformation is a rotation of the spectra in the fixed lattice space by an angle $\delta$ which is related to the parameter $\varkappa$ of the Schrödinger equation treatment by

$$\cos\delta = \varkappa\,. \quad (20)$$

For $\delta = 0$ we have the PSE spectrum with $\varkappa = 1$ and $\lambda(1) = 2, 4, 6, \ldots$; for $\delta = \pi/3$ we have the hydrogen spectrum with $\varkappa = 1/2$ and $\lambda(1/2) = 1, 2, 3, \ldots$. The discussion of the additional four characteristic angles produced by the sixfold symmetry of the lattice shall be omitted here.

Physically, $\varkappa$ might be interpreted as a measure for the effective potential in the following sense. We write Eq. (2 c) in the form $\lambda = 2\,\mu\, Z^*\, e^2/\hbar^2\, k$ with

$$Z^* = \varkappa\, Z\,. \quad (21)$$

If $Z$ is the nuclear charge, then $Z^*$ is the effective nuclear charge which shall be defined to be equal to the number of electrons which can be bound by the potential. For $\varkappa = 1$, the number of bound electrons is equal to the nuclear charge as it is the case in the PSE. If $\varkappa = 1/2$, the number of bound electrons is equal to half the nuclear charge. In order to get from the atoms of the PSE a periodic system which corresponds to the hydrogen spectrum, for each constant number of electrons in the shell one should by this interpretation increase the nuclear charge by a factor two. – In fact, the binding power per unit nuclear charge is much weaker in case of the hydrogen spectrum than in case of the PSE. It may be reasoned by very general arguments that therefore the hydrogen spectrum is not realized as a periodic system under normal conditions on earth but only in highly excited plasmas.

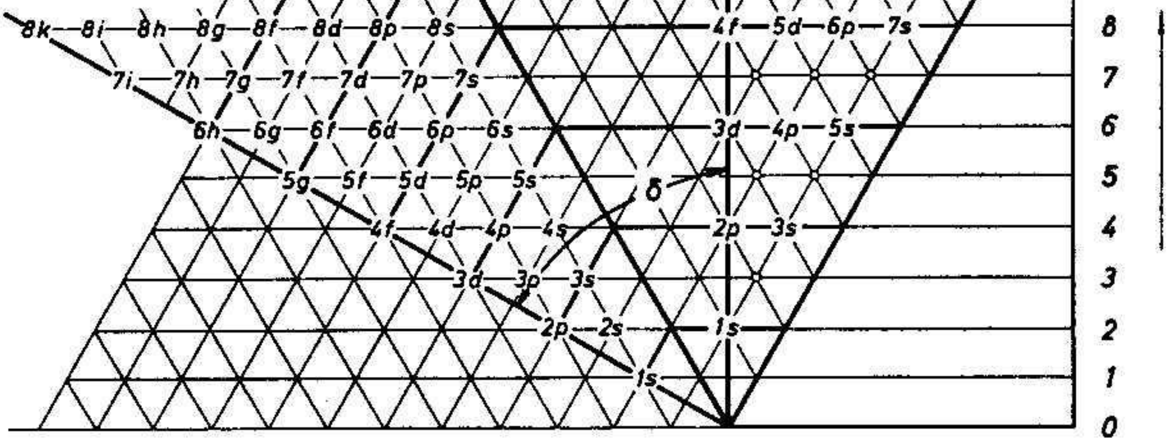


Fig. 6. PSE- and hydrogen-spectrum embedded in a triangular quantum number lattice in the conventional classification. For the PSE, the correct classification may be obtained by using Fig. 5.