Wednesday, July 6, 2022

Erratum – Trinanjan Datta

Introductory Solid State Physics with MATLAB Applications, 1st Ed.

Javier Hasbun and Trinanjan Datta

Chapter 10

1. Page 332, the following line in the introduction "Shen Kuo, the polymathic Chinese scientist, was the first person to explicitly document the use of the compass as a tool for navigation purposes."

should be replaced with

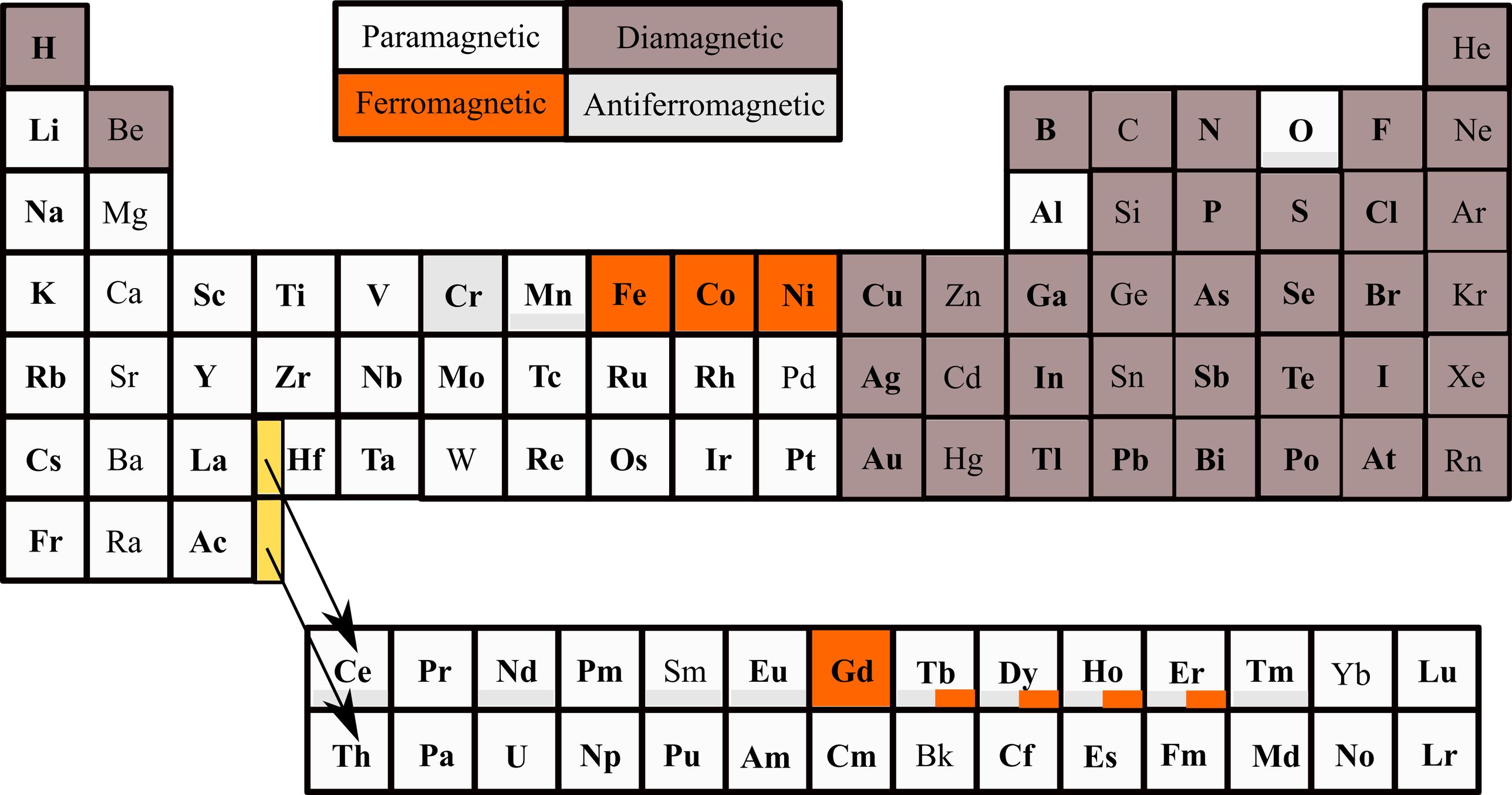
"Shen Kuo (1031 – 1095), the polymathic Chinese scientist of Northern Song Dynasty (960 – 1127), was the first to discover that the magnetic needle compass does not point directly north, but to the magnetic north pole."

2. Figure 10.8.22 updated with new figure caption. The updated figure is included as a PDF in this document. The new figure caption should read –

"Periodic table of magnetic elements. Bulk of the elements are either paramagnetic or diamagnetic. There are three elements (Fe, Co, Ni) which are ferromagnetic at room temperature. There is one (Gd) which is ferromagnetic near room temperature. Chromium is exclusively antiferromagnetic at room temperature. Note, there are some elements which show a combination of paramagnetism, antiferromagnetism and or ferromagnetism based on temperature. An element whose isolated atom possesses a magnetic moment is shown in bold face font. Synthetic elements 104 to 118 are not displayed in the periodic table."

New periodic table figure (next page)

3. Remove Gd from paramagnetic row in Table 10.3.1 to the ferromagnetic row. Replace Gd with W in the paramagnet row.


Paramagnetic
Diamagnetic
Ferromagnetic
Antiferromagnetic
H
He
Li
Be
B
C
N
O
F
Ne
Na
Mg
Al
Si
P
S
Cl
Ar
K
Ca
Sc
Ti
V
Cr
Mn
Fe
Co
Ni
Cu
Zn
Ga
Ge
As
Se
Br
Kr
Rb
Sr
Y
Zr
Nb
Mo
Tc
Ru
Rh
Pd
Ag
Cd
In
Sn
Sb
Te
I
Xe
Cs
Ba
La
Hf
Ta
W
Re
Os
Ir
Pt
Au
Hg
Tl
Pb
Bi
Po
At
Rn
Fr
Ra
Ac
Ce
Pr
Nd
Pm
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Th
Pa
U
Np
Pu
Am
Cm
Bk
Cf
Es
Fm
Md
No
Lr

Chapter 11

1. Page 382, Equation (11.26) should read

$$R_{nl}(r) = -\sqrt{\left(\frac{2\,Z}{n\,a_0}\right)^3 \frac{(n-l-1)!}{2n\,[(n+l)!]^3}}\; e^{-\frac{\rho}{2}}\rho^l L_{n+l}^{2l+1}(\rho)$$

The correct definitions are $\rho = \frac{2Zr}{n\,a_\mu}$ and $L_{n+l}^{2l+1}(\rho)$ is the associated Laguerre polynomial.

2. Page 382, Equation (11.27) should read

$$Y_l^m(\theta,\phi) = (-1)^{(m+|m|)/2}\sqrt{\frac{(2l+1)}{4\pi}\frac{(l-|m|)!}{(l+|m|)!}}\; P_l^m(cos\theta)e^{im\phi}$$

3. Page 382, Equation (11.28) should read

$$\psi_{nlm}(r) = -\sqrt{\left(\frac{2\,Z}{n\,a_0}\right)^3 \frac{(n-l-1)!}{2n\,[(n+l)!]^3}}\; e^{-\frac{\rho}{2}}\rho^l L_{n+l}^{2l+1}(\rho)Y_l^m(\theta,\phi)$$

4. Page 384, Equation (11.32). The formula for sine should be

$$\sin\theta = \frac{e^{i\theta} - e^{-i\theta}}{2i}$$

5. Page 385, Equation (11.33). The second line of this derivation is missing an "i". Also, the middle equation of Equation (11.34) should read as

$$d_{l=2}^{m=-2} = 2\sqrt{\frac{15}{16\pi}}\,\sin^2\theta\,\sin\phi\,\cos\phi$$

6. Page 385

Equation (11.37) should not have an "*i*". It should read

$$d_{l=2}^{m=1} = \frac{1}{\sqrt{2}}(Y_2^{-1} - Y_2^1)$$

7. Page 403, Eq. (11.88) first line of the derivation. The momentum should not be squared inside the bracket. There is only an overall square of the canonical momentum.

8. Page 423, Table 11.10.4. The following radial wave functions should be

$$R_{21}(r) = \frac{1}{\sqrt{3}}\left(\frac{Z}{2a_0}\right)^{\frac{3}{2}}\left(\frac{Zr}{a_0}\right)\exp\left(-{Zr}/{2a_0}\right)$$

$$R_{31}(r) = \frac{4\sqrt{2}}{9}\left(\frac{Z}{3a_0}\right)^{3/2}\left(\frac{Zr}{a_0}\right)\left(1 - \frac{Zr}{6a_0}\right)\exp\left(-{Zr}/{3a_0}\right)$$

9. Page 424, Table 11.10.5. The last line should have ± 4 .

10. Page 425, Figure 11.11.20 caption should read: Einstein-de Haas effect experimental set up.

11. Page 427, Exercise 11.11.10

A. The problem statement needs to be modified to the following where it says … "The original … characterized its structure." to

"The original sample was supplied to Gustav Rose by the Chief Mines Inspector August Alexander Kammerer of the Russian Empire. Subsequently, Rose determined its physical properties and chemical composition. On the Chief Mines Inspector's suggestion Rose name the mineral after the Russian politician and mineralogist Count Lev Alekseyevich Perovski".

[a]Perovskite: Name Puzzle and German-Russian Odyssey of Discovery, Eugene Katz, *Helv. Chim. Acta* 2020, 103, e2000061.

B. In the line "For this purpose … octahedron" we need to write "… where eZ is the effective ligand charge …".

12. Page 428, Exercise 11.11.11

In the line “In Figure 11.5.11(a) … charge” we need to write “… where eZ is the effective ligand charge …”

In Eq. (11.198) the pre-factor for the second term should be

$$\frac{7\sqrt{\pi}}{3}\frac{r^4}{a^4}$$

13. Page 429, Exercise 11.11.12

The “a” should not be there in the denominator of the overall pre-factor.

14. Page 429, Exercise 11.11.13

In the problem statement it should say

“Since the crystal field splitting is an energy difference, we will compute the expectation value of the crystal field Hamiltonian (energy), in the complex basis. Beginning with Equation 11.198, derived in Exercise 11.11.11,”

The integral should be defined as

$$H_{m,m'} = \int d\vec{r}\, \psi^*_{nlm}(\vec{r})(eV^{oct}_{cf})\psi_{nlm}$$

In part (a) right after the matrix we should write, where $D = \frac{35e}{4a^5}$ and $q = \frac{2Ze}{105}\langle R_{32}|r^4|R_{32}\rangle$.

Chapter 12

1. Page 434, Table 12.2.2. The following chemical compounds should be written as

Lanthanum Barium Copper Oxide $La_{2-x}Ba_xCuO_4$ (LBCO)

Lanthanum Strontium Copper Oxide $La_{2-x}Sr_xCuO_4$ (LSCO)

Bismuth strontium calcium copper oxide $Bi_2Sr_2CaCu_2O_{8+x}$ (BSCCO)

2. Page 451, Table 12.8.5. The following chemical compounds should be written as

$La_{2-x}Sr_xCuO_4$

$Bi_2Sr_2CaCu_2O_{8+x}$