"A15" Fullerene (Ba_3C_{60}) Structure: AB20_cP126_223_c_k2l-001

https://aflow.org/p/HV0S

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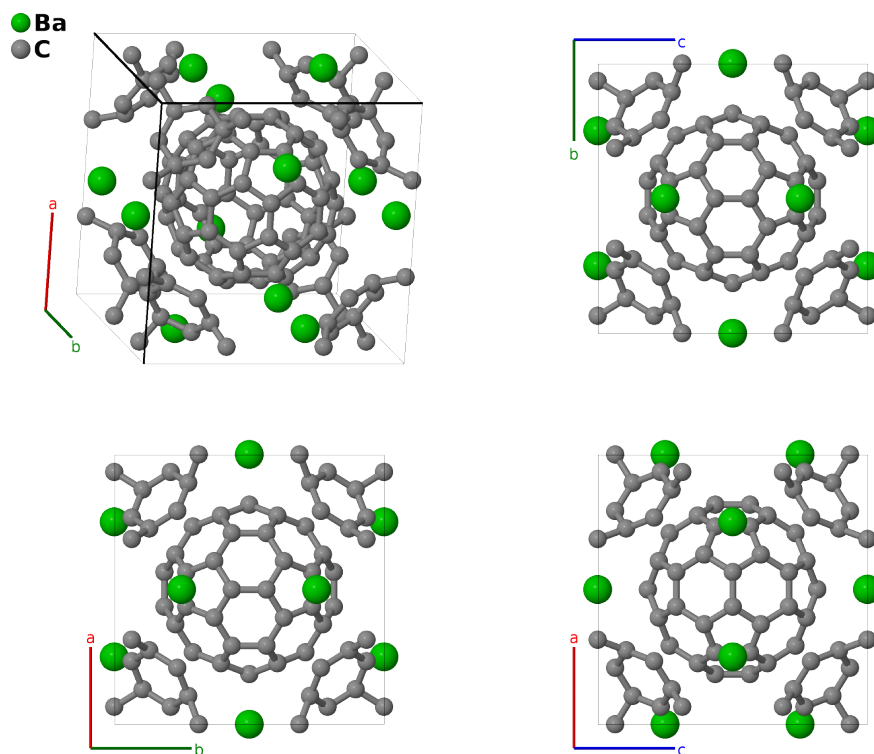
Prototype	Ba_3C_{60}
AFLOW prototype label	AB20_cP126_223_c_k2l-001
ICSD	70063
Pearson symbol	cP126
Space group number	223
Space group symbol	$Pm\bar{3}n$
AFLOW prototype command	aflow --proto=AB20_cP126_223_c_k2l-001 --params=$a, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4$

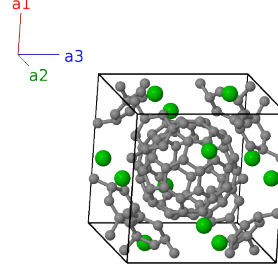**Other compounds with this structure**

Sr_3C_{60}

- The barium atoms are on the chromium sites in the $A15$ (Cr_3Si) structure, while the fullerene molecules are centered on the silicon site.

Simple Cubic primitive vectors

$$\mathbf{a_1} = a\,\hat{\mathbf{x}}$$
$$\mathbf{a_2} = a\,\hat{\mathbf{y}}$$
$$\mathbf{a_3} = a\,\hat{\mathbf{z}}$$

Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	$=$	$\frac{1}{4}\mathbf{a_1}+\frac{1}{2}\mathbf{a_3}$	$=$	$\frac{1}{4}a\,\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{z}}$	(6c)	Ba I
$\mathbf{B_2}$	$=$	$\frac{3}{4}\mathbf{a_1}+\frac{1}{2}\mathbf{a_3}$	$=$	$\frac{3}{4}a\,\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{z}}$	(6c)	Ba I
$\mathbf{B_3}$	$=$	$\frac{1}{2}\mathbf{a_1}+\frac{1}{4}\mathbf{a_2}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}+\frac{1}{4}a\,\hat{\mathbf{y}}$	(6c)	Ba I
$\mathbf{B_4}$	$=$	$\frac{1}{2}\mathbf{a_1}+\frac{3}{4}\mathbf{a_2}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}+\frac{3}{4}a\,\hat{\mathbf{y}}$	(6c)	Ba I
$\mathbf{B_5}$	$=$	$\frac{1}{2}\mathbf{a_2}+\frac{1}{4}\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{y}}+\frac{1}{4}a\,\hat{\mathbf{z}}$	(6c)	Ba I
$\mathbf{B_6}$	$=$	$\frac{1}{2}\mathbf{a_2}+\frac{3}{4}\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{y}}+\frac{3}{4}a\,\hat{\mathbf{z}}$	(6c)	Ba I
$\mathbf{B_7}$	$=$	$y_2\,\mathbf{a_2}+z_2\,\mathbf{a_3}$	$=$	$ay_2\,\hat{\mathbf{y}}+az_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_8}$	$=$	$-y_2\,\mathbf{a_2}+z_2\,\mathbf{a_3}$	$=$	$-ay_2\,\hat{\mathbf{y}}+az_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_9}$	$=$	$y_2\,\mathbf{a_2}-z_2\,\mathbf{a_3}$	$=$	$ay_2\,\hat{\mathbf{y}}-az_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{10}}$	$=$	$-y_2\,\mathbf{a_2}-z_2\,\mathbf{a_3}$	$=$	$-ay_2\,\hat{\mathbf{y}}-az_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{11}}$	$=$	$z_2\,\mathbf{a_1}+y_2\,\mathbf{a_3}$	$=$	$az_2\,\hat{\mathbf{x}}+ay_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{12}}$	$=$	$z_2\,\mathbf{a_1}-y_2\,\mathbf{a_3}$	$=$	$az_2\,\hat{\mathbf{x}}-ay_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{13}}$	$=$	$-z_2\,\mathbf{a_1}+y_2\,\mathbf{a_3}$	$=$	$-az_2\,\hat{\mathbf{x}}+ay_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{14}}$	$=$	$-z_2\,\mathbf{a_1}-y_2\,\mathbf{a_3}$	$=$	$-az_2\,\hat{\mathbf{x}}-ay_2\,\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{15}}$	$=$	$y_2\,\mathbf{a_1}+z_2\,\mathbf{a_2}$	$=$	$ay_2\,\hat{\mathbf{x}}+az_2\,\hat{\mathbf{y}}$	(24k)	C I
$\mathbf{B_{16}}$	$=$	$-y_2\,\mathbf{a_1}+z_2\,\mathbf{a_2}$	$=$	$-ay_2\,\hat{\mathbf{x}}+az_2\,\hat{\mathbf{y}}$	(24k)	C I
$\mathbf{B_{17}}$	$=$	$y_2\,\mathbf{a_1}-z_2\,\mathbf{a_2}$	$=$	$ay_2\,\hat{\mathbf{x}}-az_2\,\hat{\mathbf{y}}$	(24k)	C I
$\mathbf{B_{18}}$	$=$	$-y_2\,\mathbf{a_1}-z_2\,\mathbf{a_2}$	$=$	$-ay_2\,\hat{\mathbf{x}}-az_2\,\hat{\mathbf{y}}$	(24k)	C I
$\mathbf{B_{19}}$	$=$	$\left(y_2+\frac{1}{2}\right)\mathbf{a_1}+\frac{1}{2}\mathbf{a_2}-\left(z_2-\frac{1}{2}\right)\mathbf{a_3}$	$=$	$a\left(y_2+\frac{1}{2}\right)\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{y}}-a\left(z_2-\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{20}}$	$=$	$-\left(y_2-\frac{1}{2}\right)\mathbf{a_1}+\frac{1}{2}\mathbf{a_2}-\left(z_2-\frac{1}{2}\right)\mathbf{a_3}$	$=$	$-a\left(y_2-\frac{1}{2}\right)\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{y}}-a\left(z_2-\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{21}}$	$=$	$\left(y_2+\frac{1}{2}\right)\mathbf{a_1}+\frac{1}{2}\mathbf{a_2}+\left(z_2+\frac{1}{2}\right)\mathbf{a_3}$	$=$	$a\left(y_2+\frac{1}{2}\right)\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{y}}+a\left(z_2+\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{22}}$	$=$	$-\left(y_2-\frac{1}{2}\right)\mathbf{a_1}+\frac{1}{2}\mathbf{a_2}+\left(z_2+\frac{1}{2}\right)\mathbf{a_3}$	$=$	$-a\left(y_2-\frac{1}{2}\right)\hat{\mathbf{x}}+\frac{1}{2}a\,\hat{\mathbf{y}}+a\left(z_2+\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{23}}$	$=$	$\frac{1}{2}\mathbf{a_1}+\left(z_2+\frac{1}{2}\right)\mathbf{a_2}-\left(y_2-\frac{1}{2}\right)\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}+a\left(z_2+\frac{1}{2}\right)\hat{\mathbf{y}}-a\left(y_2-\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{24}}$	$=$	$\frac{1}{2}\mathbf{a_1}+\left(z_2+\frac{1}{2}\right)\mathbf{a_2}+\left(y_2+\frac{1}{2}\right)\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}+a\left(z_2+\frac{1}{2}\right)\hat{\mathbf{y}}+a\left(y_2+\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{25}}$	$=$	$\frac{1}{2}\mathbf{a_1}-\left(z_2-\frac{1}{2}\right)\mathbf{a_2}-\left(y_2-\frac{1}{2}\right)\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}-a\left(z_2-\frac{1}{2}\right)\hat{\mathbf{y}}-a\left(y_2-\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{26}}$	$=$	$\frac{1}{2}\mathbf{a_1}-\left(z_2-\frac{1}{2}\right)\mathbf{a_2}+\left(y_2+\frac{1}{2}\right)\mathbf{a_3}$	$=$	$\frac{1}{2}a\,\hat{\mathbf{x}}-a\left(z_2-\frac{1}{2}\right)\hat{\mathbf{y}}+a\left(y_2+\frac{1}{2}\right)\hat{\mathbf{z}}$	(24k)	C I
$\mathbf{B_{27}}$	$=$	$\left(z_2+\frac{1}{2}\right)\mathbf{a_1}+\left(y_2+\frac{1}{2}\right)\mathbf{a_2}+\frac{1}{2}\mathbf{a_3}$	$=$	$a\left(z_2+\frac{1}{2}\right)\hat{\mathbf{x}}+a\left(y_2+\frac{1}{2}\right)\hat{\mathbf{y}}+\frac{1}{2}a\,\hat{\mathbf{z}}$	(24k)	C I

$$\mathbf{B_{28}} = \left(z_2 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_2 - \tfrac{1}{2}\right)\mathbf{a}_2 + \tfrac{1}{2}\mathbf{a}_3 = a\left(z_2 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_2 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + \tfrac{1}{2}a\,\hat{\mathbf{z}} \quad (24\text{k}) \qquad \text{C I}$$

$$\mathbf{B_{29}} = -\left(z_2 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_2 + \tfrac{1}{2}\right)\mathbf{a}_2 + \tfrac{1}{2}\mathbf{a}_3 = -a\left(z_2 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_2 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + \tfrac{1}{2}a\,\hat{\mathbf{z}} \quad (24\text{k}) \qquad \text{C I}$$

$$\mathbf{B_{30}} = -\left(z_2 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_2 - \tfrac{1}{2}\right)\mathbf{a}_2 + \tfrac{1}{2}\mathbf{a}_3 = -a\left(z_2 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_2 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + \tfrac{1}{2}a\,\hat{\mathbf{z}} \quad (24\text{k}) \qquad \text{C I}$$

$$\mathbf{B_{31}} = x_3\,\mathbf{a}_1 + y_3\,\mathbf{a}_2 + z_3\,\mathbf{a}_3 = ax_3\,\hat{\mathbf{x}} + ay_3\,\hat{\mathbf{y}} + az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{32}} = -x_3\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 + z_3\,\mathbf{a}_3 = -ax_3\,\hat{\mathbf{x}} - ay_3\,\hat{\mathbf{y}} + az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{33}} = -x_3\,\mathbf{a}_1 + y_3\,\mathbf{a}_2 - z_3\,\mathbf{a}_3 = -ax_3\,\hat{\mathbf{x}} + ay_3\,\hat{\mathbf{y}} - az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{34}} = x_3\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 - z_3\,\mathbf{a}_3 = ax_3\,\hat{\mathbf{x}} - ay_3\,\hat{\mathbf{y}} - az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{35}} = z_3\,\mathbf{a}_1 + x_3\,\mathbf{a}_2 + y_3\,\mathbf{a}_3 = az_3\,\hat{\mathbf{x}} + ax_3\,\hat{\mathbf{y}} + ay_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{36}} = z_3\,\mathbf{a}_1 - x_3\,\mathbf{a}_2 - y_3\,\mathbf{a}_3 = az_3\,\hat{\mathbf{x}} - ax_3\,\hat{\mathbf{y}} - ay_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{37}} = -z_3\,\mathbf{a}_1 - x_3\,\mathbf{a}_2 + y_3\,\mathbf{a}_3 = -az_3\,\hat{\mathbf{x}} - ax_3\,\hat{\mathbf{y}} + ay_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{38}} = -z_3\,\mathbf{a}_1 + x_3\,\mathbf{a}_2 - y_3\,\mathbf{a}_3 = -az_3\,\hat{\mathbf{x}} + ax_3\,\hat{\mathbf{y}} - ay_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{39}} = y_3\,\mathbf{a}_1 + z_3\,\mathbf{a}_2 + x_3\,\mathbf{a}_3 = ay_3\,\hat{\mathbf{x}} + az_3\,\hat{\mathbf{y}} + ax_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{40}} = -y_3\,\mathbf{a}_1 + z_3\,\mathbf{a}_2 - x_3\,\mathbf{a}_3 = -ay_3\,\hat{\mathbf{x}} + az_3\,\hat{\mathbf{y}} - ax_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{41}} = y_3\,\mathbf{a}_1 - z_3\,\mathbf{a}_2 - x_3\,\mathbf{a}_3 = ay_3\,\hat{\mathbf{x}} - az_3\,\hat{\mathbf{y}} - ax_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{42}} = -y_3\,\mathbf{a}_1 - z_3\,\mathbf{a}_2 + x_3\,\mathbf{a}_3 = -ay_3\,\hat{\mathbf{x}} - az_3\,\hat{\mathbf{y}} + ax_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{43}} = \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{44}} = -\left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{45}} = \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{46}} = -\left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{47}} = \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{48}} = -\left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{49}} = -\left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{50}} = \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{51}} = \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{52}} = \left(z_3 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{53}} = -\left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{54}} = -\left(z_3 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{55}} = -x_3\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 - z_3\,\mathbf{a}_3 = -ax_3\,\hat{\mathbf{x}} - ay_3\,\hat{\mathbf{y}} - az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{56}} = x_3\,\mathbf{a}_1 + y_3\,\mathbf{a}_2 - z_3\,\mathbf{a}_3 = ax_3\,\hat{\mathbf{x}} + ay_3\,\hat{\mathbf{y}} - az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{57}} = x_3\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 + z_3\,\mathbf{a}_3 = ax_3\,\hat{\mathbf{x}} - ay_3\,\hat{\mathbf{y}} + az_3\,\hat{\mathbf{z}} \quad (48\text{l}) \qquad \text{C II}$$

$$\mathbf{B_{58}} = -x_3\,\mathbf{a_1} + y_3\,\mathbf{a_2} + z_3\,\mathbf{a_3} = -ax_3\,\hat{\mathbf{x}} + ay_3\,\hat{\mathbf{y}} + az_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{59}} = -z_3\,\mathbf{a_1} - x_3\,\mathbf{a_2} - y_3\,\mathbf{a_3} = -az_3\,\hat{\mathbf{x}} - ax_3\,\hat{\mathbf{y}} - ay_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{60}} = -z_3\,\mathbf{a_1} + x_3\,\mathbf{a_2} + y_3\,\mathbf{a_3} = -az_3\,\hat{\mathbf{x}} + ax_3\,\hat{\mathbf{y}} + ay_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{61}} = z_3\,\mathbf{a_1} + x_3\,\mathbf{a_2} - y_3\,\mathbf{a_3} = az_3\,\hat{\mathbf{x}} + ax_3\,\hat{\mathbf{y}} - ay_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{62}} = z_3\,\mathbf{a_1} - x_3\,\mathbf{a_2} + y_3\,\mathbf{a_3} = az_3\,\hat{\mathbf{x}} - ax_3\,\hat{\mathbf{y}} + ay_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{63}} = -y_3\,\mathbf{a_1} - z_3\,\mathbf{a_2} - x_3\,\mathbf{a_3} = -ay_3\,\hat{\mathbf{x}} - az_3\,\hat{\mathbf{y}} - ax_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{64}} = y_3\,\mathbf{a_1} - z_3\,\mathbf{a_2} + x_3\,\mathbf{a_3} = ay_3\,\hat{\mathbf{x}} - az_3\,\hat{\mathbf{y}} + ax_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{65}} = -y_3\,\mathbf{a_1} + z_3\,\mathbf{a_2} + x_3\,\mathbf{a_3} = -ay_3\,\hat{\mathbf{x}} + az_3\,\hat{\mathbf{y}} + ax_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{66}} = y_3\,\mathbf{a_1} + z_3\,\mathbf{a_2} - x_3\,\mathbf{a_3} = ay_3\,\hat{\mathbf{x}} + az_3\,\hat{\mathbf{y}} - ax_3\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{67}} = -\left(y_3 - \tfrac{1}{2}\right)\mathbf{a_1} - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a_2} + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{68}} = \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_1} + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_2} + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_3} = a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{69}} = -\left(y_3 - \tfrac{1}{2}\right)\mathbf{a_1} + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_2} - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{70}} = \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_1} - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a_2} - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a_3} = a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{71}} = -\left(x_3 - \tfrac{1}{2}\right)\mathbf{a_1} - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a_2} + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{72}} = \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_1} - \left(z_3 - \tfrac{1}{2}\right)\mathbf{a_2} - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a_3} = a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{73}} = \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_1} + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_2} + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_3} = a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{74}} = -\left(x_3 - \tfrac{1}{2}\right)\mathbf{a_1} + \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_2} - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{75}} = -\left(z_3 - \tfrac{1}{2}\right)\mathbf{a_1} - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a_2} + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{76}} = -\left(z_3 - \tfrac{1}{2}\right)\mathbf{a_1} + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_2} - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a_3} = -a\left(z_3 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{77}} = \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_1} - \left(y_3 - \tfrac{1}{2}\right)\mathbf{a_2} - \left(x_3 - \tfrac{1}{2}\right)\mathbf{a_3} = a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_3 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_3 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{78}} = \left(z_3 + \tfrac{1}{2}\right)\mathbf{a_1} + \left(y_3 + \tfrac{1}{2}\right)\mathbf{a_2} + \left(x_3 + \tfrac{1}{2}\right)\mathbf{a_3} = a\left(z_3 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_3 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_3 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C II}$$

$$\mathbf{B_{79}} = x_4\,\mathbf{a_1} + y_4\,\mathbf{a_2} + z_4\,\mathbf{a_3} = ax_4\,\hat{\mathbf{x}} + ay_4\,\hat{\mathbf{y}} + az_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{80}} = -x_4\,\mathbf{a_1} - y_4\,\mathbf{a_2} + z_4\,\mathbf{a_3} = -ax_4\,\hat{\mathbf{x}} - ay_4\,\hat{\mathbf{y}} + az_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{81}} = -x_4\,\mathbf{a_1} + y_4\,\mathbf{a_2} - z_4\,\mathbf{a_3} = -ax_4\,\hat{\mathbf{x}} + ay_4\,\hat{\mathbf{y}} - az_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{82}} = x_4\,\mathbf{a_1} - y_4\,\mathbf{a_2} - z_4\,\mathbf{a_3} = ax_4\,\hat{\mathbf{x}} - ay_4\,\hat{\mathbf{y}} - az_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{83}} = z_4\,\mathbf{a_1} + x_4\,\mathbf{a_2} + y_4\,\mathbf{a_3} = az_4\,\hat{\mathbf{x}} + ax_4\,\hat{\mathbf{y}} + ay_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{84}} = z_4\,\mathbf{a_1} - x_4\,\mathbf{a_2} - y_4\,\mathbf{a_3} = az_4\,\hat{\mathbf{x}} - ax_4\,\hat{\mathbf{y}} - ay_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{85}} = -z_4\,\mathbf{a_1} - x_4\,\mathbf{a_2} + y_4\,\mathbf{a_3} = -az_4\,\hat{\mathbf{x}} - ax_4\,\hat{\mathbf{y}} + ay_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{86}} = -z_4\,\mathbf{a_1} + x_4\,\mathbf{a_2} - y_4\,\mathbf{a_3} = -az_4\,\hat{\mathbf{x}} + ax_4\,\hat{\mathbf{y}} - ay_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{87}} = y_4\,\mathbf{a_1} + z_4\,\mathbf{a_2} + x_4\,\mathbf{a_3} = ay_4\,\hat{\mathbf{x}} + az_4\,\hat{\mathbf{y}} + ax_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{88}} = -y_4\,\mathbf{a_1} + z_4\,\mathbf{a_2} - x_4\,\mathbf{a_3} = -ay_4\,\hat{\mathbf{x}} + az_4\,\hat{\mathbf{y}} - ax_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{89}} = y_4\,\mathbf{a_1} - z_4\,\mathbf{a_2} - x_4\,\mathbf{a_3} = ay_4\,\hat{\mathbf{x}} - az_4\,\hat{\mathbf{y}} - ax_4\,\hat{\mathbf{z}} \quad (48\mathrm{l}) \quad \text{C III}$$

$$\mathbf{B_{90}} = -y_4\,\mathbf{a}_1 - z_4\,\mathbf{a}_2 + x_4\,\mathbf{a}_3 = -ay_4\,\hat{\mathbf{x}} - az_4\,\hat{\mathbf{y}} + ax_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{91}} = \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{92}} = -\left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{93}} = \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{94}} = -\left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{95}} = \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{96}} = -\left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{97}} = -\left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{98}} = \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{99}} = \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{100}} = \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{101}} = -\left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{102}} = -\left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{103}} = -x_4\,\mathbf{a}_1 - y_4\,\mathbf{a}_2 - z_4\,\mathbf{a}_3 = -ax_4\,\hat{\mathbf{x}} - ay_4\,\hat{\mathbf{y}} - az_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{104}} = x_4\,\mathbf{a}_1 + y_4\,\mathbf{a}_2 - z_4\,\mathbf{a}_3 = ax_4\,\hat{\mathbf{x}} + ay_4\,\hat{\mathbf{y}} - az_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{105}} = x_4\,\mathbf{a}_1 - y_4\,\mathbf{a}_2 + z_4\,\mathbf{a}_3 = ax_4\,\hat{\mathbf{x}} - ay_4\,\hat{\mathbf{y}} + az_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{106}} = -x_4\,\mathbf{a}_1 + y_4\,\mathbf{a}_2 + z_4\,\mathbf{a}_3 = -ax_4\,\hat{\mathbf{x}} + ay_4\,\hat{\mathbf{y}} + az_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{107}} = -z_4\,\mathbf{a}_1 - x_4\,\mathbf{a}_2 - y_4\,\mathbf{a}_3 = -az_4\,\hat{\mathbf{x}} - ax_4\,\hat{\mathbf{y}} - ay_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{108}} = -z_4\,\mathbf{a}_1 + x_4\,\mathbf{a}_2 + y_4\,\mathbf{a}_3 = -az_4\,\hat{\mathbf{x}} + ax_4\,\hat{\mathbf{y}} + ay_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{109}} = z_4\,\mathbf{a}_1 + x_4\,\mathbf{a}_2 - y_4\,\mathbf{a}_3 = az_4\,\hat{\mathbf{x}} + ax_4\,\hat{\mathbf{y}} - ay_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{110}} = z_4\,\mathbf{a}_1 - x_4\,\mathbf{a}_2 + y_4\,\mathbf{a}_3 = az_4\,\hat{\mathbf{x}} - ax_4\,\hat{\mathbf{y}} + ay_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{111}} = -y_4\,\mathbf{a}_1 - z_4\,\mathbf{a}_2 - x_4\,\mathbf{a}_3 = -ay_4\,\hat{\mathbf{x}} - az_4\,\hat{\mathbf{y}} - ax_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{112}} = y_4\,\mathbf{a}_1 - z_4\,\mathbf{a}_2 + x_4\,\mathbf{a}_3 = ay_4\,\hat{\mathbf{x}} - az_4\,\hat{\mathbf{y}} + ax_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{113}} = -y_4\,\mathbf{a}_1 + z_4\,\mathbf{a}_2 + x_4\,\mathbf{a}_3 = -ay_4\,\hat{\mathbf{x}} + az_4\,\hat{\mathbf{y}} + ax_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{114}} = y_4\,\mathbf{a}_1 + z_4\,\mathbf{a}_2 - x_4\,\mathbf{a}_3 = ay_4\,\hat{\mathbf{x}} + az_4\,\hat{\mathbf{y}} - ax_4\,\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{115}} = -\left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{116}} = \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{117}} = -\left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{118}} = \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48\mathrm{l}) \qquad \text{C III}$$

$$\mathbf{B_{119}} = -\left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{120}} = \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{121}} = \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{122}} = -\left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{123}} = -\left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{124}} = -\left(z_4 - \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_4 - \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{125}} = \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_4 - \tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_4 - \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_4 - \tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_4 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

$$\mathbf{B_{126}} = \left(z_4 + \tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_4 + \tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_4 + \tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_4 + \tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_4 + \tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_4 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad (48l) \qquad \text{C III}$$

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