

1 **The African Strategy of Fundamental**  
2 **and Applied Physics**

3 **Report of the 2020–2024 Community Study**  
4 **on the Future of Fundamental and Applied Physics**  
5 **in Africa**

6 **organized through Broad Grassroots**  
7 **Community Consultations**

8 **Study Conveners:**

9 Kétévi A. Assamagan, Simon H. Connell, Farida Fassi,  
10 Fairouz Malek, Shaaban I. Khalil

11 **Editorial Committee: ..**

12 **International Advisory Committee: ..**



14

## Foreword

15 In this space, the ASFAP Steering Committee will describe their view of the Study, and thank everyone who  
16 needs to be thanked.



18

## Executive Summary

19 The African Strategy of Fundamental and Applied Physics brought together over 600 participants worldwide  
20 to develop a strategic vision, with practical recommendations, to enhance physics research and education in  
21 Africa.



---

---

# Contents

22	<b>1 Summary of the 2020-2024 African Strategy of Fundamental and Applied Physics</b>	<b>1</b>
23	<b>2 Ethics in Physics</b>	<b>5</b>
24	<b>3 Observers</b>	<b>9</b>
25	<b>4 Accelerators Working Group</b>	<b>13</b>
26	<b>5 Astrophysic &amp; Cosmology Working Group</b>	<b>17</b>
27	<b>6 Atomic &amp; Molecular Working Group</b>	<b>21</b>
28	<b>7 Biophysics Working Group</b>	<b>25</b>
29	<b>8 Complex Systems Working Group</b>	<b>29</b>
30	<b>9 Computing Working Group</b>	<b>33</b>
31	<b>10 Earth Science Working Group</b>	<b>37</b>
32	<b>11 Energy Working Group</b>	<b>41</b>
33	<b>12 Fluid and Plasma Working Group</b>	<b>45</b>
34	<b>13 Instrumentation and Detectors Working Group</b>	<b>49</b>
35	<b>14 Light Sources Working Group</b>	<b>53</b>
36	<b>15 Materials Physics Working Group</b>	<b>57</b>
37	<b>16 Medical Physics Working Group</b>	<b>61</b>
38	<b>17 Nuclear Physics Working Group</b>	<b>65</b>

39	<b>18 Optics and Photonics Working Group</b>	<b>69</b>
40	<b>19 Particle Physics Working Group</b>	<b>73</b>
41	<b>20 Community Engagement Working Group</b>	<b>77</b>
42	<b>21 Physics Education Working Group</b>	<b>81</b>
43	<b>22 Women in Physics Working Group</b>	<b>85</b>
44	<b>23 Young Physicists Working Group</b>	<b>89</b>
45	<b>24 Conclusions</b>	<b>93</b>
46	<b>25 Glossary</b>	<b>95</b>



---

---

# Summary of the 2020-2024 African Strategy of Fundamental and Applied Physics

47 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
48 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
49 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
50 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
51 follow.

52 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
53 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
54 to what the best and latest authorities have laid down.

55 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
56 1820 [1].

57 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
58 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
59 whale), says Surgeon Beale, A.D. 1839 [2].

60 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
61 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
62 naturalists."

63 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

64 [ . . . ]

65 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
66 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
67 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
68 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
69 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
70 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

## 71 Bibliography

72 [1] J. Scoresby, "Journals", 1820.

73 [2] A. Beale, "Surgical Writings", 1839.

74 [3] G. Cuvier, "Le Règne Animal", Imprimerie de A. Belin, Paris, 4 Volumes, 1816.

75 [4] J. Hunter, Phil. Trans. Royal Soc. **77**, 38 (1787).

76 [5] G. Lesson, "Mammalia", 1822.





---

---

# Ethics in Physics

78 **Josephina Thabo, Koffi Tahiri**

79 John Doe, Aisha Koulibali

80 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
81 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
82 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
83 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
84 follow.

85 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
86 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
87 to what the best and latest authorities have laid down.

88 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
89 1820 [1].

90 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
91 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
92 whale), says Surgeon Beale, A.D. 1839 [2].

93 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
94 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
95 naturalists."

96 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

97 [ . . . ]

98 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
99 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
100 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
101 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
102 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
103 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

104 **Bibliography**

105 [1] J. Scoresby, "Journals", 1820.

106 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Observers

108 **Josephina Thabo, Koffi Tahiri**

109 John Doe, Aisha Koulibali

110 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
111 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
112 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
113 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
114 follow.

115 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
116 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
117 to what the best and latest authorities have laid down.

118 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
119 1820 [1].

120 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
121 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
122 whale), says Surgeon Beale, A.D. 1839 [2].

123 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
124 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
125 naturalists."

126 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

127 [ . . . ]

128 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
129 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
130 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
131 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
132 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
133 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>134</sup> **Bibliography**

<sup>135</sup> [1] J. Scoresby, "Journals", 1820.

<sup>136</sup> [2] A. Beale, "Surgical Writings", 1839.





---

---

# Accelerators Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to follow.

It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you. Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen to what the best and latest authorities have laid down.

"No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D. 1820 [1].

"It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm whale), says Surgeon Beale, A.D. 1839 [2].

"Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us naturalists."

Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

[ . . . ]

Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay, but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>164</sup> **Bibliography**

<sup>165</sup> [1] J. Scoresby, “Journals”, 1820.

<sup>166</sup> [2] A. Beale, “Surgical Writings”, 1839.







---

---

# Astrophysic & Cosmology Working Group

168 **Josephina Thabo, Koffi Tahiri**

169 John Doe, Aisha Koulibali

170 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
171 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
172 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
173 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
174 follow.

175 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
176 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
177 to what the best and latest authorities have laid down.

178 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
179 1820 [1].

180 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
181 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
182 whale), says Surgeon Beale, A.D. 1839 [2].

183 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
184 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
185 naturalists."

186 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

187 [ . . . ]

188 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
189 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
190 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
191 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
192 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
193 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>194</sup> **Bibliography**

<sup>195</sup> [1] J. Scoresby, "Journals", 1820.

<sup>196</sup> [2] A. Beale, "Surgical Writings", 1839.





# 6

---

---

## Atomic & Molecular Working Group

198 **Josephina Thabo, Koffi Tahiri**

199 John Doe, Aisha Koulibali

200 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
201 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
202 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
203 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
204 follow.

205 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
206 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
207 to what the best and latest authorities have laid down.

208 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
209 1820 [1].

210 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
211 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
212 whale), says Surgeon Beale, A.D. 1839 [2].

213 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
214 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
215 naturalists."

216 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

217 [ . . . ]

218 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
219 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
220 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
221 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
222 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
223 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

## 224 Bibliography

225 [1] J. Scoresby, "Journals", 1820.

226 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Biophysics Working Group

228 **Josephina Thabo, Koffi Tahiri**

229 John Doe, Aisha Koulibali

230 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
231 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
232 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
233 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
234 follow.

235 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
236 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
237 to what the best and latest authorities have laid down.

238 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
239 1820 [1].

240 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
241 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
242 whale), says Surgeon Beale, A.D. 1839 [2].

243 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
244 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
245 naturalists."

246 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

247 [ . . . ]

248 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
249 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
250 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
251 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
252 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
253 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>254</sup> **Bibliography**

<sup>255</sup> [1] J. Scoresby, “Journals”, 1820.

<sup>256</sup> [2] A. Beale, “Surgical Writings”, 1839.





---

---

# Complex Systems Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to follow.

It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you. Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen to what the best and latest authorities have laid down.

"No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D. 1820 [1].

"It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm whale), says Surgeon Beale, A.D. 1839 [2].

"Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us naturalists."

Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

[ . . . ]

Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay, but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

284 **Bibliography**

285 [1] J. Scoresby, "Journals", 1820.

286 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Computing Working Group

288 **Josephina Thabo, Koffi Tahiri**

289 John Doe, Aisha Koulibali

290 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
291 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
292 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
293 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
294 follow.

295 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
296 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
297 to what the best and latest authorities have laid down.

298 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
299 1820 [1].

300 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
301 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
302 whale), says Surgeon Beale, A.D. 1839 [2].

303 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
304 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
305 naturalists."

306 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

307 [ . . . ]

308 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
309 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
310 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
311 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
312 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
313 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

## <sup>314</sup> Bibliography

<sup>315</sup> [1] J. Scoresby, “Journals”, 1820.

<sup>316</sup> [2] A. Beale, “Surgical Writings”, 1839.





---

---

# Earth Science Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to follow.

It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you. Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen to what the best and latest authorities have laid down.

"No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D. 1820 [1].

"It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm whale), says Surgeon Beale, A.D. 1839 [2].

"Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us naturalists."

Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

[ . . . ]

Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay, but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>344</sup> **Bibliography**

<sup>345</sup> [1] J. Scoresby, "Journals", 1820.

<sup>346</sup> [2] A. Beale, "Surgical Writings", 1839.







---

---

# Energy Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to follow.

It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you. Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen to what the best and latest authorities have laid down.

"No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D. 1820 [1].

"It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm whale), says Surgeon Beale, A.D. 1839 [2].

"Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us naturalists."

Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

[ . . . ]

Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay, but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

## <sup>374</sup> Bibliography

<sup>375</sup> [1] J. Scoresby, “Journals”, 1820.

<sup>376</sup> [2] A. Beale, “Surgical Writings”, 1839.





---

---

# Fluid and Plasma Working Group

378 **Josephina Thabo, Koffi Tahiri**

379 John Doe, Aisha Koulibali

380 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
381 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
382 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
383 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
384 follow.

385 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
386 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
387 to what the best and latest authorities have laid down.

388 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
389 1820 [1].

390 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
391 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
392 whale), says Surgeon Beale, A.D. 1839 [2].

393 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
394 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
395 naturalists."

396 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

397 [ . . . ]

398 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
399 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
400 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
401 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
402 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
403 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

404 **Bibliography**

405 [1] J. Scoresby, "Journals", 1820.

406 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Instrumentation and Detectors Working Group

408 **Josephina Thabo, Koffi Tahiri**

409 John Doe, Aisha Koulibali

410 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
411 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
412 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
413 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
414 follow.

415 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
416 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
417 to what the best and latest authorities have laid down.

418 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
419 1820 [1].

420 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
421 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
422 whale), says Surgeon Beale, A.D. 1839 [2].

423 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
424 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
425 naturalists."

426 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

427 [ . . . ]

428 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
429 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
430 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
431 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
432 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
433 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

434 **Bibliography**

435 [1] J. Scoresby, "Journals", 1820.

436 [2] A. Beale, "Surgical Writings", 1839.





---

---

# Light Sources Working Group

438 **Josephina Thabo, Koffi Tahiri**

439 John Doe, Aisha Koulibali

440 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
441 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
442 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
443 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
444 follow.

445 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
446 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
447 to what the best and latest authorities have laid down.

448 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
449 1820 [1].

450 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
451 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
452 whale), says Surgeon Beale, A.D. 1839 [2].

453 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
454 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
455 naturalists."

456 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

457 [ . . . ]

458 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
459 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
460 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
461 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
462 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
463 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

464 **Bibliography**

465 [1] J. Scoresby, "Journals", 1820.

466 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Materials Physics Working Group

468 **Josephina Thabo, Koffi Tahiri**

469 John Doe, Aisha Koulibali

470 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
471 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
472 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
473 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
474 follow.

475 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
476 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
477 to what the best and latest authorities have laid down.

478 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
479 1820 [1].

480 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
481 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
482 whale), says Surgeon Beale, A.D. 1839 [2].

483 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
484 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
485 naturalists."

486 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

487 [ . . . ]

488 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
489 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
490 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
491 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
492 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
493 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

494 **Bibliography**

495 [1] J. Scoresby, "Journals", 1820.

496 [2] A. Beale, "Surgical Writings", 1839.





---

---

# Medical Physics Working Group

498 **Josephina Thabo, Koffi Tahiri**

499 John Doe, Aisha Koulibali

500 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
501 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
502 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
503 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
504 follow.

505 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
506 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
507 to what the best and latest authorities have laid down.

508 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
509 1820 [1].

510 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
511 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
512 whale), says Surgeon Beale, A.D. 1839 [2].

513 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
514 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
515 naturalists."

516 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

517 [ . . . ]

518 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
519 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
520 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
521 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
522 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
523 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>524</sup> **Bibliography**

<sup>525</sup> [1] J. Scoresby, “Journals”, 1820.

<sup>526</sup> [2] A. Beale, “Surgical Writings”, 1839.







---

---

# Nuclear Physics Working Group

528 **Josephina Thabo, Koffi Tahiri**

529 John Doe, Aisha Koulibali

530 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
531 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
532 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
533 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
534 follow.

535 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
536 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
537 to what the best and latest authorities have laid down.

538 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
539 1820 [1].

540 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
541 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
542 whale), says Surgeon Beale, A.D. 1839 [2].

543 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
544 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
545 naturalists."

546 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

547 [ . . . ]

548 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
549 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
550 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
551 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
552 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
553 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>554</sup> **Bibliography**

<sup>555</sup> [1] J. Scoresby, "Journals", 1820.

<sup>556</sup> [2] A. Beale, "Surgical Writings", 1839.





---

---

# Optics and Photonics Working Group

558 **Josephina Thabo, Koffi Tahiri**

559 John Doe, Aisha Koulibali

560 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
561 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
562 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
563 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
564 follow.

565 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
566 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
567 to what the best and latest authorities have laid down.

568 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
569 1820 [1].

570 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
571 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
572 whale), says Surgeon Beale, A.D. 1839 [2].

573 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
574 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
575 naturalists."

576 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

577 [ . . . ]

578 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
579 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
580 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
581 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
582 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
583 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

584 **Bibliography**

585 [1] J. Scoresby, "Journals", 1820.

586 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Particle Physics Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to follow.

It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you. Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen to what the best and latest authorities have laid down.

"No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D. 1820 [1].

"It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm whale), says Surgeon Beale, A.D. 1839 [2].

"Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us naturalists."

Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

[ . . . ]

Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished, even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay, but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>614</sup> **Bibliography**

<sup>615</sup> [1] J. Scoresby, "Journals", 1820.

<sup>616</sup> [2] A. Beale, "Surgical Writings", 1839.





---

---

# Community Engagement Working Group

618 **Josephina Thabo, Koffi Tahiri**

619 John Doe, Aisha Koulibali

620 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
621 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
622 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
623 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
624 follow.

625 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
626 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
627 to what the best and latest authorities have laid down.

628 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
629 1820 [1].

630 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
631 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
632 whale), says Surgeon Beale, A.D. 1839 [2].

633 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
634 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
635 naturalists."

636 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

637 [ . . . ]

638 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
639 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
640 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
641 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
642 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
643 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>644</sup> **Bibliography**

<sup>645</sup> [1] J. Scoresby, "Journals", 1820.

<sup>646</sup> [2] A. Beale, "Surgical Writings", 1839.







---

---

# Physics Education Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

648  
649  
650 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
651 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
652 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
653 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
654 follow.

655 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
656 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
657 to what the best and latest authorities have laid down.

658 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
659 1820 [1].

660 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
661 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
662 whale), says Surgeon Beale, A.D. 1839 [2].

663 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
664 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
665 naturalists."

666 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

667 [ . . . ]

668 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
669 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
670 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
671 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
672 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
673 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>674</sup> **Bibliography**

<sup>675</sup> [1] J. Scoresby, "Journals", 1820.

<sup>676</sup> [2] A. Beale, "Surgical Writings", 1839.





---

---

# Women in Physics Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

678  
679  
680 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
681 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
682 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
683 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
684 follow.

685 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
686 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
687 to what the best and latest authorities have laid down.

688 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
689 1820 [1].

690 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
691 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
692 whale), says Surgeon Beale, A.D. 1839 [2].

693 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
694 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
695 naturalists."

696 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

697 [ . . . ]

698 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
699 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
700 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
701 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
702 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
703 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

704 **Bibliography**

705 [1] J. Scoresby, "Journals", 1820.

706 [2] A. Beale, "Surgical Writings", 1839.







---

---

# Young Physicists Working Group

Josephina Thabo, Koffi Tahiri

John Doe, Aisha Koulibali

708  
709  
710 Already we are boldly launched upon the deep; but soon we shall be lost in its unshored, harbourless  
711 immensities. Ere that come to pass; ere the Pequod's weedy hull rolls side by side with the barnacled  
712 hulls of the leviathan; at the outset it is but well to attend to a matter almost indispensable to a thorough  
713 appreciative understanding of the more special leviathanic revelations and allusions of all sorts which are to  
714 follow.

715 It is some systematized exhibition of the whale in his broad genera, that I would now fain put before you.  
716 Yet is it no easy task. The classification of the constituents of a chaos, nothing less is here essayed. Listen  
717 to what the best and latest authorities have laid down.

718 "No branch of Zoology is so much involved as that which is entitled Cetology," says Captain Scoresby, A.D.  
719 1820 [1].

720 "It is not my intention, were it in my power, to enter into the inquiry as to the true method of dividing  
721 the cetacea into groups and families. . . . Utter confusion exists among the historians of this animal" (sperm  
722 whale), says Surgeon Beale, A.D. 1839 [2].

723 "Unfitness to pursue our research in the unfathomable waters." "Impenetrable veil covering our knowledge  
724 of the cetacea." "A field strewn with thorns." "All these incomplete indications but serve to torture us  
725 naturalists."

726 Thus speak of the whale, the great Cuvier, and John Hunter, and Lesson, those lights of zoology and anatomy.

727 [ . . . ]

728 Finally: It was stated at the outset, that this system would not be here, and at once, perfected. You cannot  
729 but plainly see that I have kept my word. But I now leave my cetological System standing thus unfinished,  
730 even as the great Cathedral of Cologne was left, with the crane still standing upon the top of the uncompleted  
731 tower. For small erections may be finished by their first architects; grand ones, true ones, ever leave the  
732 copestone to posterity. God keep me from ever completing anything. This whole book is but a draught—nay,  
733 but the draught of a draught. Oh, Time, Strength, Cash, and Patience!

<sup>734</sup> **Bibliography**

<sup>735</sup> [1] J. Scoresby, "Journals", 1820.

<sup>736</sup> [2] A. Beale, "Surgical Writings", 1839.





# Conclusions

738 We are happy and relieved to conclude.



---

---

# Glossary

- 740  **$0\nu\beta\beta$**  : Neutrinoless double-beta decay, a nuclear decay process in which two electrons and zero neutrinos  
741 are emitted.
- 742  **$2\nu\beta\beta$**  : Double-beta decay, a nuclear decay process in which two electrons and two neutrinos are emitted.
- 743 **2HDM** : Two-Higgs-Doublet Model, a model with two Higgs fields, usually with natural flavor conservation  
744 in Higgs boson couplings.
- 745 **AAAS** : American Association for the Advancement of Science.
- 746 **ACTA** : Augmented Cherenkov Telescope Array, the next-generation atmospheric Cherenkov telescope  
747 project for gamma ray detection.
- 748 **ADMX** : Axion Dark Matter Experiment, an experiment at the University of Washington searching for  
749 axions using a large electromagnetic cavity in a static magnetic field.
- 750 **ADS** : Accelerator-Driven Systems, a technology for driving nuclear reactors with particle beams.
- 751 **AGILE** : Astro-Rivelatore Gamma a Immagini Leggero, a space-based X-ray and gamma ray observatory.
- 752 **AGN** : Active Galactic Nucleus.
- 753 **AIP** : American Institute of Physics.
- 754 **ALCF** : Argonne Leadership Computer Facility.
- 755 **ALICE** : A Large Ion Collider Experiment, an experiment at the **LHC** focusing on heavy ion collisions  
756 and the quark-gluon plasma.
- 757 **ALP** : Axion-Like Particle.
- 758 **ALPS, ALPS-II** : Any Light Particle Search, a series of experiments at **DESY** searching for **axions** and  
759 similar particles using laser light conversion in a strong magnetic field.
- 760 **AMANDA** : Antarctic Muon and Neutrino Detector Array, the first-generation neutrino telescope  
761 experiment in Antarctica.
- 762 **AMR** : Adaptive Mesh Refinement.
- 763 **AMS, AMS-02** : Alpha Magnetic Spectrometer, an antimatter detector located on the International  
764 Space Station.
- 765 **ANITA** : Antarctic Transient Antenna, a balloon experiment in Antarctica for detection of radio signals  
766 of ultra-high-energy neutrino events.

- 767 **ANL** : Argonne National Laboratory.
- 768 **ANTARES** : Astronomy with a Neutrino Telescope and Abyss environmental RESearch, a neutrino  
769 telescope experiment in the Mediterranean Sea.
- 770 **APEX** : A Prime EXperiment, an experiment at **JLab** searching for the production of dark photons using  
771 an intense electron beam.
- 772 **APS** : American Physical Society.
- 773 **ARA** : Askaryan Radio Array, a radiofrequency neutrino antenna experiment at the South Pole.
- 774 **ArgoNeuT** : Argon Neutrino Teststand, a small liquid argon **TPC** experiment at **Fermilab**.
- 775 **ARIANNA** : Antarctic Ross Ice-shelf ANtenna Neutrino Array, a radiofrequency neutrino antenna  
776 experiment in Antarctica.
- 777 **ART** : An Intensity Frontier software framework developed by the **Fermilab** Scientific Computing Division  
778 and used by **NOvA**, **mu2e**, **Muon  $g - 2$** , **LArSoft**, **DarkSide**, **LArIAT**, and others.
- 779 **ASIC** : Application Specific Integrated Circuit, a silicon chip processor designed for a particular purpose.
- 780 **ASTA** : Advanced Superconducting Test Accelerator, an accelerator test facility at **Fermilab**.
- 781 **ATCA** : Advanced Telecommunications Computing Architecture.
- 782 **ATF, ATF2** : Accelerator Test Facility, an accelerator test complex at **KEK** built to study beam  
783 dynamics issues for the *ILC*.
- 784 **ATLAS** : A Toroidal LHC ApparatuS, a large experiment at the **LHC** optimized for high transverse  
785 momentum particle production.
- 786 **ATR** : Advanced Test Reactor, a research reactor at the Idaho National Laboratory.
- 787 **Auger** : Pierre Auger Observatory, experiment in Argentina that detects ultra-high-energy cosmic rays  
788 through both fluorescence and surface water Cherekov detectors.
- 789 **Axion** : A hypothetical, very light particle, with couplings to quarks that reverse under **P** transformations.  
790 Such particles could make up the dark matter of the Universe.
- 791 **BaBar** : An experiment at **SLAC**, using  $e^+e^-$  annihilation at approximately 10 GeV to study rare heavy  
792 quark and lepton decays.
- 793 **Baikal** : A neutrino telescope in Lake Baikal in Siberia.
- 794 **Baksan** : An underground laboratory in the Caucasus mountains in Russia.
- 795 **BAO** : Baryon Acoustic Oscillations.
- 796 **Baseline** : In neutrino physics, the distance between the neutrino production point, near an accelerator,  
797 and the neutrino detector.
- 798 **BELLA** : Berkeley Lab Laser Accelerator, a facility at **LBNL** for the development of laser-driven  
799 accelerators.
- 800 **Belle** : An experiment at **KEK**, using  $e^+e^-$  annihilation at approximately 10 GeV to study rare heavy  
801 quark and lepton decays.



- 802 **Belle-II** : An experiment at **KEK**, using  $e^+e^-$  annihilation at approximately 10 GeV to study rare heavy  
803 quark and lepton decays with 50-100 times the data set produced by **BaBar** and **Belle**.
- 804 **BESIII** : An experiment at **IHEP**, using  $e^+e^-$  annihilation at approximately 3-4 GeV to study charm  
805 quark and tau lepton physics.
- 806 **BEST** : Baksan Experiment on Sterile Transitions, a proposed radioactive source experiment in Russia  
807 with a gallium detector.
- 808 **BINP** : Budker Institute for Nuclear Physics, a high-energy physics laboratory in Novosibirsk, Russia.
- 809 **BNB** : Booster Neutrino Beam , a neutrino beamline at **Fermilab** using the Booster.
- 810 **BNL** : Brookhaven National Laboratory.
- 811 **Borexino** : A solar neutrino experiment at **Gran Sasso**.
- 812 **Boson** : A type of elementary particle whose intrinsic spin is an integer (0, 1, 2, ...) multiple of  $\hbar$ . Such  
813 particles can make up a macroscopic force field such as the electromagnetic field.
- 814 **BOSS** : Baryon Oscillation Spectroscopic Survey, a galaxy survey aiming to measure baryon acoustic  
815 oscillations.
- 816 **BR** : Branching Ratio, the probability that an unstable particle decays to a particular final state.
- 817 **BSM** : Beyond the Standard Model, a reference to new physics associated with an extension of the **SM**.
- 818 **C** : Charge conjugation, the interchange of particles and antiparticles.
- 819 **CALICE** : CALorimeter for Linear Collider Experiment, an experimental collaboration aimed at improving  
820 the technology of hadron calorimeters, especially with the **PFA** method.
- 821 **Canfranc Underground Laboratory** : An underground scientific facility in a former railway tunnel in  
822 the Spanish Pyrenees under Monte Tobazo in Canfranc, Spain.
- 823 **Capability** : In computing, refers to high-speed, highly parallel computing that might require a large  
824 fraction of a supercomputer.
- 825 **Capacity** : In computing, refers to computing in which many moderately parallel jobs are run alongside  
826 one another.
- 827 **CAPTAIN** : Cryogenic Apparatus for Precision Tests of Argon INteractions, a liquid argon R&D detector.
- 828 **CAST** : CERN Axion Solar Telescope, an experiment at **CERN** searching for **axions** radiated from the  
829 Sun.
- 830 **CC** : Charged Current weak interactions.
- 831 **CCD** : Charge Coupled Device, a class of pixel silicon detectors.
- 832 **CDF** : Collider Detector at Fermilab, a large experiment at the **Fermilab** Tevatron optimized for high  
833 transverse momentum particle production.
- 834 **CDM** : Cold Dark Matter, a class of dark matter models in which the dark matter particles move at  
835 nonrelativistic speeds.
- 836 **CDR** : Conceptual Design Report.

- 837 **Ce-LAND** : A  $^{144}\text{Ce}$  source to be placed in **KamLAND** to study the reactor neutrino anomaly.
- 838 **CENNS** : Coherent Elastic Neutrino-Nucleus Scattering, an **NC** neutrino process and also a proposed  
839 experiment to be sited at the **BNB**.
- 840 **CE&O** : Communication, Education, and Outreach, a topic of one of the “frontiers” in this study.
- 841 **CERN** : Conseil Européen pour la Recherche Nucleaire, the major European high energy physics  
842 laboratory, located in Geneva.
- 843 **CESR** : Cornell Electron Storage Ring, an  $e^+e^-$  colliding beam accelerator at Cornell University that  
844 operated in the energy range 3.5-12 GeV from 1979 to 2008. The accelerator is still in operation as a  
845 synchrotron light source (**CHESS**) and as an accelerator physics testbed.
- 846 **CesrTA** : CESR Test Accelerator, a configuration of **CESR** to study the design of electron damping rings,  
847 in particular, for **ILC**.
- 848 **Chameleon** : A new particle that has properties that depend on its environment.
- 849 **CHIPS** : Cherenkov detectors In mine PitS, a proposed experiment to use the **Fermilab** beams and  
850 massive Cherenkov detectors in flooded mine pits.
- 851 **CHOOZ** : A first-generation reactor neutrino experiment located in Chooz, France.
- 852 **CKM** : Cabibbo-Kobayashi-Maskawa matrix, the matrix relating the weak interaction and mass eigenstates  
853 of quarks.
- 854 **CL** : (Statistical) Confidence Level.
- 855 **CLEAN** : Cryogenic Low Energy Astrophysics with Noble gases, a cryogenic noble liquid experiment for  
856 dark matter and solar neutrinos.
- 857 **CLEO** : A general-purpose particle detector at **CESR** studying heavy quark decays and spectroscopy.
- 858 **CLFV** : Charged Lepton Flavor Violation.
- 859 **CLIC** : Compact Linear Collider, a concept for an  $e^+e^-$  linear collider, with center of mass energies up  
860 to 3 TeV, based on two-beam acceleration.
- 861 **CM** : Center of Mass, the system for viewing a particle collision or decay in which the overall system is at  
862 rest.
- 863 **CMB** : Cosmic Microwave Background, the approximately isotropic microwave radiation in the universe  
864 created in the original formation of atoms from electrons and ionized protons.
- 865 **CMS** : Compact Muon Spectrometer, a large experiment at the **LHC** optimized for high transverse  
866 momentum particle production.
- 867 **CoGeNT** : COherent GERmanium Neutrino Technology, a germanium detector for dark matter and other  
868 signals requiring low background.
- 869 **COMET** : An experiment at **J-PARC** searching for muon to electron conversion in the field of a heavy  
870 nucleus.
- 871 **COUPP** : Chicagoland Observatory for Underground Particle Physics, a dark matter detector using a  
872 bubble chamber, now located in the Sudbury Mine in Sudbury, Ontario.

- 873 **CP** : The combination of a **C** and a **P** transformation, converting particles to antiparticles, plus mirror  
874 (left-right) reflection. This is a very accurate, but not perfect, approximate symmetry of nature.
- 875 **CPAD** : Coordinating Panel for Advanced Detectors, an advisory panel on detector technology created  
876 by the **APS DPF**.
- 877 **CPT** : The combination of a **C**, and a **P**, and a **T** transformation, converting particles to antiparticles,  
878 plus mirror (left-right) reflection, plus reversal of the direction of time. Local quantum field theory predicts  
879 this to be a perfect symmetry of nature.
- 880 **CPU** : Central Processing Unit of a computer.
- 881 **CRADA** : Cooperative Research and Development Agreement, an agreement between a government  
882 laboratory and a private company to pursue R&D on a technology or project.
- 883 **CSI** : Coherent Scattering Investigations at the SNS, a proposed **CENNS** search experiment for the **SNS**.
- 884 **CTA** : Cherenkov Telescope Array, a planned large-area array of telescopes for high energy gamma rays.
- 885 **CTF3** : CLIC Test Facility 3, the most recent in a series of test accelerators for **CLIC** at **CERN**.
- 886 **CUDA** : Compute Unified Device Architecture, which defines a parallel computing architecture for NVIDIA  
887 **GPUs**.
- 888 **CUORE** : Cryogenic Underground Observatory for Rare Events, an experiment searching for neutrinoless  
889 double beta decay, located at **Gran Sasso**, Italy.
- 890 **DØ** : D-zero, a large experiment at the **Fermilab** Tevatron optimized for high transverse momentum  
891 particle production.
- 892 **DAEδALUS** : Decay At rest Experiment for  $\delta_{CP}$  studies at the Laboratory for Underground Science, a  
893 neutrino oscillation experiment based on beams created by cyclotrons.
- 894 **DAMA** : DArk MAtter experiment, a scintillator-based dark matter search experiment at **Gran Sasso**.
- 895 **DAMIC** : DArk Matter In CCD experiment, an experiment at **Fermilab** searching for light dark matter  
896 particles.
- 897 **DANSS** : Detector of the reactor AntiNeutrino based on Solid-state plastic Scintillator, a reactor neutrino  
898 experiment in Russia.
- 899 **Dark Light** : An experiment at **JLab** searching for dark photons using an **FEL**.
- 900 **DarkSide** : A dark matter search experiment at **Gran Sasso** using a liquid argon detector.
- 901 **Daya Bay** : A reactor neutrino experiment located near Daya Bay, China.
- 902 **DeepCore** : A low-energy extension to the **IceCube** experiment with a high density of photodetectors  
903 in a central region of the cube.
- 904 **DES** : Dark Energy Survey.
- 905 **DESI** : Dark Energy Spectroscopic Instrument.
- 906 **DESY** : Deutsches Elektronen SYNchrotron, the major high energy physics laboratory in Germany, located  
907 in Hamburg.

- 908 **DIRC** : Detection of Internally Reflected Cherenkov light, a detector using quartz bars for tracking and  
909 particle identification.
- 910 **DIS** : Deep Inelastic Scattering, a process of lepton scattering from a nucleon or nucleus with large  
911 momentum transfer, especially when only the lepton recoil is observed.
- 912 **DM** : Dark Matter.
- 913 **DOE** : U.S. Department of Energy.
- 914 **Double Chooz** : A reactor neutrino experiment in Chooz, France, utilizing detectors at two distances  
915 from the source.
- 916 **DPF** : Division of Particles and Fields, a division of the American Physical Society.
- 917 **DREAM** : Dual REAdout Method, a method for hadron calorimetry that corrects the charge/neutral  
918 response ratio by separate measurement of Cherenkov and scintillation light.
- 919 **Drive beam** : A high energy particle beam used to create an electromagnetic field that can then accelerate  
920 another beam to high energy.
- 921 **DSNB** : Diffuse Supernova Neutrino Background.
- 922 **dSphs** : dwarf Spheroidal satellite galaxies of the Milky Way.
- 923 **EAS** : Extensive Air Shower, produced by high energy cosmic rays in the Earth's atmosphere.
- 924 **EBL** : Extra-galactic Background Light.
- 925 **ECHo** : Electron Capture  $^{163}\text{Ho}$  experiment, a proposed neutrino mass microcalorimeter experiment.
- 926 **EDM** : Electric Dipole Moment.
- 927 **EFT** : Effective Field Theory, a method of quantum field theory in which the effects of new particles or  
928 interactions that might be present at high energies are expressed by the addition of more complex operators  
929 to the equations of motion of the **SM**.
- 930 **ESA** : European Space Agency.
- 931 **ESS** : European Spallation Source, a future facility in Lund, Sweden.
- 932 **ESS $\nu$ SB** : European Spallation Source Neutrino Super Beam, a proposal to use the **ESS** proton linac to  
933 generate a neutrino superbeam.
- 934  **$\cancel{E}_T$**  : Missing Transverse Energy, unobserved momentum in a high-energy particle collision carried away  
935 by weakly interacting neutral particles.
- 936 **Euclid** : A dark energy space mission currently under development by the European Space Agency.
- 937 **EVA** : ExaVolt Antenna, a proposed balloon-based neutrino antenna experiment in Antarctica.
- 938 **EW** : ElectroWeak interaction, the unified description of the electromagnetic and weak interactions.
- 939 **EWSB** : ElectroWeak Symmetry Breaking.
- 940 **Exascale** : Of the order of  $10^{18}$ , used in computing to refer to next-generation computation resources in  
941 memory or speed.

- 942 **EXO** : Enriched Xenon Observatory, an experiment searching for neutrinoless double beta decay of the  
943 isotope  $\text{Xe}^{136}$ .
- 944 **FACA** : Federal Advisory Committee Act, the legislation that governs questions of openness and trans-  
945 parency for certain Federal committees. The act generally covers grant review panels of the **NSF** but not  
946 those of the **DOE**.
- 947 **FACET** : Facility for advanced ACcelerator Experimental Tests, a user facility at **SLAC** for experiments  
948 on high-gradient electron accelerator technology.
- 949 **FCNC** : Flavor-Changing Neutral Current.
- 950 **FEL** : Free Electron Laser, an electron accelerator that produces high-intensity coherent synchrotron  
951 radiation.
- 952 **Fermi** : Femtometer =  $10^{-13}$  cm.
- 953 **Fermi-LAT** : Fermi Large Area Telescope, a space-based gamma-ray detector.
- 954 **Fermion** : A type of elementary particle whose intrinsic spin is a half-integer ( $\frac{1}{2}, \frac{3}{2}, \dots$ ) multiple of  $\hbar$ .  
955 Such particles can form rigid structures of matter such as atoms and atomic nuclei.
- 956 **Fermilab** : Fermi National Accelerator Laboratory, in Batavia, Illinois.
- 957 **FFAG** : Fixed-Field Alternating Gradient accelerator, an accelerator design concept with time-independent  
958 magnetic bending fields and strong focusing.
- 959 **FPGA** : Field Programmable Gate Array, a type of programmable integrated circuit.
- 960 **FNAL** : Fermi National Accelerator Laboratory, or **Fermilab**.
- 961 **FRIB** : Facility for Rare Isotope Beams, a linear accelerator at Michigan State University for isotope  
962 production and nuclear structure research.
- 963 **FrPNC** : Francium Parity Non-Conservation, at experiment at **TRIUMF** to measure **P**-violating atomic  
964 transitions in francium atoms.
- 965 **FSR** : Final State Radiation, radiation from a lepton, quark, or gluon produced in a high-energy scattering  
966 process.
- 967 **GALLEX** : GALLium EXperiment, a radiochemical solar neutrino experiment located at **Gran Sasso**.
- 968 **GammeV-CHASE** : An experiment at **Fermilab** to search for **axions** using a laser beam in a strong  
969 magnetic field.
- 970 **GAPS** : General Antiparticle Spectrometer, an experiment to detect anti-matter, especially deuterons,  
971 produced by annihilating dark matter particles.
- 972 **GC** : Galactic Center.
- 973 **GDE** : Global Design Effort, the collaboration responsible for the **ILC** Technical Design Report.
- 974 **GEANT4** : A library of simulation programs describing the passage of high-energy particles through  
975 matter.
- 976 **GEM** : Gas Electron Multiplier, a type of **MPGD** ionization detector.

- 977 **GEMMA** : Germanium Experiment for measurement of the Magnetic Moment of Antineutrino, a neutrino  
978 magnetic moment experiment at the Kalinin nuclear power plant in Russia.
- 979 **GERDA** : Ge experiment searching for neutrinoless double beta decay.
- 980 **GeV** : Giga-electron Volt ( $10^9$  eV), the energy scale of the proton mass and the subnuclear strong  
981 interactions.
- 982 **GIM** : Glashow-Iliopoulos-Maiani mechanism, a method for coupling quarks to the weak interactions that  
983 avoid flavor-changing **NC** processes, realized in the **SM**.
- 984 **GLACIER** : Giant Liquid Argon Charge Imaging Experiment, a proposed large liquid argon detector in  
985 Europe.
- 986 **GNO** : Gallium Neutrino Observatory, a radiochemical solar neutrino experiment at **Gran Sasso** (successor  
987 to **GALLEX**).
- 988 **GPU** : Graphics Processing Unit.
- 989 **GR** : General Relativity, Einstein's theory of gravity.
- 990 **Gran Sasso** : An Italian national laboratory under a mountain of the same name, about 120 km from  
991 Rome.
- 992 **Grid** : In computing, a network of distributed computer and storage resources. Typically, it refers to a  
993 network in which users need not know at which node the processor or data they are using resides.
- 994 **GUT** : Grand Unified Theory, a unified theory of all microscopic particle interactions.
- 995 **GZK neutrinos** : Greisen-Zatsepin-Kuzmin neutrinos, produced by ultra-high energy cosmic ray protons  
996 scattering off **CMB** photons.
- 997 **HALO** : Helium And Lead Observatory, lead-based supernova neutrino detector at **SNOLAB**.
- 998 **HAWC** : High-Altitude Water Cherenkov, a gamma-ray detector currently operating in Mexico.
- 999 **HE-LHC** : High-Energy LHC, a proposed stage of the **LHC** in which the bending magnets are replaced  
1000 by higher-field magnetics, to create *pp* collisions at center-of-mass energies of 26–33 TeV.
- 1001 **H.E.S.S.** : High Energy Stereoscopic System, a telescope for high-energy gamma rays seen as air showers  
1002 in Cherenkov radiation, located in Namibia.
- 1003 **HEP** : High-Energy Physics, the generic term for the areas of research described in this report.
- 1004 **HEPAP** : High-Energy Physics Advisory Panel, a panel convened by the U.S. **DOE** and **NSF** to advise  
1005 the federal government on high-energy physics research.
- 1006 **HERA** : Hadron Elektron Ring Anlage, an electron-proton and positron-proton collider at **DESY** that  
1007 operated from 1990 to 2007.
- 1008 **HETDEX** : Hobby-Eberly Telescope Dark Energy Experiment.
- 1009 **HFIR** : High Flux Isotope Reactor, reactor facility at Oak Ridge National Laboratory.
- 1010 **HHCAL** : Homogeneous Hadron Calorimeter, a concept for hadron calorimetry based on total absorption  
1011 of hadrons in large crystals equipped with dual readout (see **DREAM**).

- 1012 **HIGS** : High Intensity Gamma-ray Source, a free electron laser at Duke University.
- 1013 **HiRes** : High Resolution Fly’s Eye cosmic ray experiment in Utah.
- 1014 **HLbL** : Hadronic Light-by-Light scattering contributions to the muon anomalous magnetic moment.
- 1015 **HL-LHC** : High Luminosity LHC, the highest-luminosity phase of the **LHC** program, with plans to collect  
1016  $3000 \text{ fb}^{-1}$  of data between 2022 and 2030.
- 1017 **HPC** : High Performance Computing, such as that done using supercomputers.
- 1018 **HPS** : Heavy Photon Search, an experiment at **JLab** searching for the decay of dark photons to  $e^+e^-$ .
- 1019 **HSC** : Hyper-Suprime Cam, wide-field camera for the Subaru telescope.
- 1020 **HTC** : High Throughput Computing, i.e, data-intensive computing.
- 1021 **HTS** : High-Temperature Superconductivity.
- 1022 **Hyper-K** : Hyper-Kamiokande, a proposed large water Cherenkov detector at Kamioka in Japan.
- 1023 **IACT** : imaging Atmospheric Cherenkov Telescope.
- 1024 **IAEA** : International Atomic Energy Agency.
- 1025 **IAXO** : International Axion Observatory.
- 1026 **IBD** : Inverse Beta Decay, usually referring to the reaction  $\bar{\nu}_e + p \rightarrow e^+ + n$ .
- 1027 **ICAL** : Iron CALorimeter atmospheric neutrino experiment at **INO**.
- 1028 **ICARUS** : Imaging Cosmic And Rare Underground Signals, a liquid argon neutrino detector located at  
1029 **Gran Sasso**.
- 1030 **IceCube** : A neutrino telescope located at the Amundsen–Scott South Pole station in Antarctica.
- 1031 **IceTray** : A software framework developed and used by the IceCube experiment for both online and  
1032 offline processing.
- 1033 **IDS** : International Design Study (for the Neutrino Factory).
- 1034 **IHEP** : Institute of High Energy Physics of the Chinese Academy of Sciences, the major particle physics  
1035 laboratory in China, located in Beijing.
- 1036 **ILC** : International Linear Collider, an electron-positron linear collider with design **CM** energy 500 GeV.
- 1037 **ILD** : International Linear collider Detector, a large detector proposed for **ILC** and **CLIC**.
- 1038 **INO** : India-based Neutrino Observatory, a future underground laboratory in Tamil Nadu, India.
- 1039 **IOPS** : Input/output Operations Per Second.
- 1040 **IOTA** : Integrable Optics Test Accelerator, an electron storage ring to be constructed at **ASTA** to study  
1041 nonlinear beam optics.
- 1042 **IPPOG** : International Particle Physics Outreach Group, a network of science educators and communi-  
1043 cators based at **CERN**.

- 1044 **ISIS** : Research center at Rutherford Appleton Laboratory near Oxford.
- 1045 **IsoDAR** : Isotope Decay At Rest experiment, a proposed cyclotron-based sterile neutrino experiment.
- 1046 **ISR** : Initial State Radiation, radiation from a high-energy lepton, quark, or gluon emitted as it scatters  
1047 from another high-energy particle.
- 1048 **JLab** : Thomas Jefferson National Accelerator Facility, in Newport News, Virginia.
- 1049 **J-PARC** : Japan Proton Accelerator Research Complex, the laboratory hosting the major Japanese proton  
1050 accelerator, located in Tokai.
- 1051 **JEM-EUSO** : Extreme Universe Space Observatory onboard the Japanese Experiment Module, proposed  
1052 ultra-high energy cosmic ray detector on the International Space Station.
- 1053 **JUNO** : Jiangmen Underground Neutrino Observatory, a proposed large scintillator experiment for reactor  
1054 neutrino oscillations located in China.
- 1055 **K2K** : KEK to Kamioka, the first-generation long-baseline oscillation experiment using beam from **KEK**  
1056 to **Super-K**.
- 1057 **KamLAND** : Kamioka Liquid scintillator ANtineutrino Detector, a reactor neutrino experiment at  
1058 Kamioka in Japan.
- 1059 **KamLAND-Zen** : Zero neutrino double beta decay search, a neutrinoless double beta decay experiment  
1060 using a Xe-doped balloon deployed in **KamLAND**.
- 1061 **KATRIN** : KArlsruhe TRItium Neutrino experiment, an experiment to measure neutrino mass from the  
1062 endpoint of the tritium beta decay spectrum.
- 1063 **KEK** : Ko-Enerugi Kenkyusho, the major high energy physics laboratory in Japan, located in Tsukuba.
- 1064 **KLOE, KLOE-2** : An experiment at **LNF** studying  $e^+e^-$  annihilation at energies near 1 GeV.
- 1065 **KM3NET** : Multi-Km<sup>3</sup> Neutrino Telescope, a future deep-sea neutrino telescope in the Mediterranean  
1066 sea.
- 1067 **KOTO** : An experiment at **J-PARC** to study the rare decay  $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$ .
- 1068 **kt** : Kilotonne =  $10^6$  kilograms.
- 1069  **$\Lambda$ CDM** : The standard model of cosmology in which the Universe consists of known particles, cold dark  
1070 matter (CDM), and dark energy ( $\Lambda$ ).
- 1071  **$L/E$**  : Length (**baseline**) / Energy, a figure of merit for neutrino oscillation experiments.
- 1072 **LAGUNA** : Large Apparatus studying Grand Unification and Neutrino Astrophysics, a collaborative  
1073 project to assess the possibilities for a deep underground neutrino observatory in Europe; includes the  
1074 **GLACIER**, **MEMPHYS**, and **LENA** concepts.
- 1075 **LANL** : Los Alamos National Laboratory.
- 1076 **LANSCE** : Los Alamos Neutron Science Center.
- 1077 **LAPPD** : Large Area Picosecond Photo-Detectors project, a collaboration working to develop large-area  
1078 flat-panel photon detectors.



- 1079 **LAr** : Liquid argon.
- 1080 **LAr1** : A proposal to add additional liquid argon TPCs to the **Fermilab** Booster neutrino beamline.
- 1081 **LAr1-ND** : A proposal to add a liquid argon TPC near detector in the **Fermilab** Booster neutrino  
1082 beamline.
- 1083 **LArIAT** : Liquid Argon In A Testbeam, a liquid argon TPC test beam experiment at **Fermilab**.
- 1084 **LARP** : LHC Accelerator Research Program, a collaboration of U.S. national laboratories to develop  
1085 technology for the current and future stages of the **LHC**.
- 1086 **LBNE** : Long Baseline Neutrino Experiment: An experiment to measure neutrino oscillations, with beams  
1087 from **Fermilab** and a detector at **SURF** in South Dakota.
- 1088 **LBNL** : Lawrence Berkeley National Laboratory (formerly LBL, Lawrence Berkeley Laboratory).
- 1089 **LBNO** : Long-Baseline Neutrino Oscillation experiment, a proposed accelerator-based neutrino oscillation  
1090 experiment in Europe.
- 1091 **LCF** : Leadership Computing Facility, one of the **DOE**'s high-performance computing centers.
- 1092 **LENA** : Low Energy Neutrino Astronomy, a proposed next-generation liquid scintillator detector.
- 1093 **LENS** : Low Energy Neutrino Spectroscopy, a low-energy indium-based solar neutrino experiment.
- 1094 **LEP, LEP-2** : The Large Electron-Positron collider at **CERN**, which performed precision studies of the  
1095  $Z$  meson and searches for new phenomena from 1989 from 2000.
- 1096 **LHC** : Large Hadron Collider, a large proton-proton collider at **CERN**, with design **CM** energy 14 TeV.
- 1097 **LHCb** : LHCb, an experiment at the Large Hadron Collider specialized to measure the production in the  
1098 forward direction of hadrons containing heavy quarks.
- 1099 **LHeC** : Large Hadron-electron Collider, a proposal for a high-energy electron beam colliding with the  
1100 proton beam of the **LHC** at **CERN**.
- 1101 **LNF** : Laboratori Nazionali di Frascati, the leading particle physics laboratory in Italy, located in Frascati,  
1102 near Rome.
- 1103 **LO** : Leading Order, applied to the level of a quantum field theory calculation (see also **NLO**).
- 1104 **LPA** : Laser Plasma Acceleration.
- 1105 **LSND** : Liquid Scintillator Neutrino Detector, an experiment at Los Alamos National Laboratory searching  
1106 for sterile neutrinos.
- 1107 **LSO** : Lutetium Silicate ( $\text{Lu}_2\text{SiO}_5$ ).
- 1108 **LSST** : Large Synoptic Survey Telescope.
- 1109 **LUX** : Large Underground Xenon detector, a large dark matter detector using liquid Xenon.
- 1110 **LVD** : Large Volume Detector, a neutrino observatory at **Gran Sasso** studying low-energy neutrinos from  
1111 gravitational stellar collapse.
- 1112 **LXe** : Liquid Xenon.

- 1113 **LYSO** : Lutetium Yttrium OxyorthoSilicate ( $\text{Lu}_2(1-x)\text{Y}_2(x)\text{SiO}_5$ ).
- 1114 **LZ** : LUX-Zeplin, a next-generation xenon TPC dark matter detector.
- 1115 **MAGIC** : Major Atmospheric Gamma-ray Imaging Cherenkov telescope, a telescope for high-energy  
1116 gamma rays seen as air showers in Cherenkov radiation, located in the Canary Islands.
- 1117 **MAJORANA** : An experiment searching for neutrinoless double-beta decay in Ge, located at **SURF**.
- 1118 **MAMI** : MAInzer MIcrotron, a low-energy electron accelerator at the University of Mainz.
- 1119 **Many-core** : Refers to computer chips that contain many more cores than **multi-core CPUs**, i.e., more  
1120 than than 16 **CPUs**.
- 1121 **MAPS** : Monolithic Active Pixel Sensor.
- 1122 **MCP** : Micro-Channel Plate.
- 1123 **MEG** : MuEGamma experiment, an experiment at **PSI** searching for the decay  $\mu \rightarrow e\gamma$ .
- 1124 **MEMPHYS** : MEgaton Mass PHYSics, a large water Cherenkov detector proposed for **CERN** or **ESS**.
- 1125 **MESA** : Mainz Energy-Recovering Superconducting Accelerator, a proposed electron accelerator at the  
1126 University of Mainz.
- 1127 **MicroBooNE** : Liquid argon TPC experiment in the Booster neutrino beamline at **Fermilab**.
- 1128 **MicroMegas** : Micro-Mesh gas detector, a type of **MPGD** ionization detector.
- 1129 **Milagro** : A water Cherenkov gamma-ray telescope located near **LANL**.
- 1130 **MINER $\nu$ A** : Main Injector Experiment for  $\nu$ -A, a neutrino scattering experiment in the NuMI beamline  
1131 at **Fermilab**.
- 1132 **MiniBooNE** : A short-baseline neutrino oscillation experiment using a mineral oil-based Cherenkov  
1133 detector in the Booster neutrino beamline at **Fermilab**.
- 1134 **MIND** : Magnetised Iron Neutrino Detector, a proposed neutrino factory detector.
- 1135 **MINOS** : Main Injector Neutrino Oscillation Search, a neutrino oscillation experiment located at **Soudan**  
1136 using the NuMI beamline at **Fermilab**.
- 1137 **MKID** : Microwave Kinetic Inductance Detector.
- 1138 **MNS** : Maki-Nakagawa-Sakata matrix (see **PMNS**).
- 1139 **MOLLER** : An experiment at **JLab** to measure the **P**-violating asymmetry in electron-electron scattering.
- 1140 **MPGD** : Micro-Pattern Gas Detector.
- 1141 **MPPC** : Multi-Pixel Photon Counter.
- 1142  $\overline{MS}$  : Modified Minimal Subtraction, a prescription for removing divergences commonly used in high-  
1143 precision quantum field theory calculations.
- 1144 **MS-DESI** : Mid-Scale Dark Energy Spectroscopic Instrument.

- 1145 **MSSM** : Minimal Supersymmetric Standard Model, the simplest (though, not very simple) model that  
1146 extends the **SM** by the addition of **SUSY**.
- 1147 **MSW** : Mikheyev-Smirnov-Wolfenstein effect, the modification of the neutrino oscillation probability as  
1148 neutrinos pass through matter.
- 1149 **Multi-core** : Refers to computer chips that contain up to about 16 **CPUs**.
- 1150 **Muon  $g - 2$**  : An experiment at **Fermilab** to measure the anomalous magnetic moment of the muon.
- 1151 **mwe** : Meters water-equivalent, a measure of the depth of an underground detector.
- 1152 **NA62** : An experiment proposed at **CERN** to measure the rare kaon decay  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ .
- 1153 **NC** : Neutral Current weak interactions.
- 1154 **NERSC** : National Energy Research Scientific Computing Center.
- 1155 **NESSiE** : Neutrino Experiment with SpectrometerS in Europe, a proposed experiment to search for sterile  
1156 neutrinos using the **CERN** SPS beam and the **ICARUS** detector.
- 1157 **NEXT** : Neutrino Experiment with Xenon TPC, a neutrinoless double beta decay experiment at the  
1158 **Canfranc Underground Laboratory**.
- 1159 **NF** : Neutrino Factory.
- 1160 **NH** : Normal Hierarchy.
- 1161 **NIST** : National Institute of Standards and Technology.
- 1162 **NLCTA** : Next Linear Collider Test Accelerator, an accelerator at **SLAC** now used for tests of advanced  
1163 accelerator concepts.
- 1164 **NLO, NNLO** : Next-to-Leading Order, Next-to-Next-to-Leading Order, terms designating a quantum  
1165 field theory calculation with two and three terms, respectively, in the power series in the coupling constant.
- 1166 **NLWCP** : New, Light, Weakly-Coupled Particles.
- 1167 **NNbarX** : An experiment proposed at **Fermilab** to search for neutron-antineutron oscillations.
- 1168 **NOMAD** : Neutrino Oscillation MAgnetic Detector, a neutrino oscillation experiment at **CERN**.
- 1169 **NO $\nu$ A** : NuMI Off-Axis electron-neutrino Appearance experiment, a neutrino oscillation experiment in  
1170 the **NuMI** beamline at **Fermilab**.
- 1171 **NREN** : National Research and Education Network, a high performance network designed for large scale  
1172 data movement.
- 1173 **NSF** : U.S. National Science Foundation.
- 1174 **NUFO** : National User Facility Organization, the umbrella group for U.S. national user facility users'  
1175 organizations.
- 1176 **NuMAX** : Neutrinos from Muon Accelerators at Project X, a proposed neutrino oscillation experiment  
1177 using a muon-storage ring as a source of neutrinos.

- 1178 **NuMI** : Neutrinos at the Main Injector, a neutrino beamline at **Fermilab** using the Main Injector,  
1179 extending to **Soudan** and Ash River, Minnesota.
- 1180 **nuSTORM** : Neutrinos from STORed Muons, a proposed short-baseline neutrino experiment to study  
1181 sterile neutrinos using a muon storage ring as a source of neutrinos.
- 1182 **NVRAM** : Non-Volatile Random Access Memory.
- 1183 **OHEP** : Office of High Energy Physics of the U.S. **DOE**.
- 1184 **OLCF** : Oak Ridge Leadership Computing Center.
- 1185 **OPERA** : Oscillation Project with Emulsion-tRacking Apparatus, an emulsion- and tracker-based neutrino  
1186 oscillation experiment at **Gran Sasso**.
- 1187 **ORCA** : Oscillation Research with Cosmics in the Abyss, a proposed experiment to measure the neutrino  
1188 mass hierarchy using the **KM3NeT** neutrino telescope.
- 1189 **ORKA** : A proposed **Fermilab** experiment to measure the rate of the decay  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ .
- 1190 **ORNL** : Oak Ridge National Laboratory.
- 1191 **OscSNS** : Oscillations at the Spallation Neutrino Source, a proposed sterile neutrino search using the SNS  
1192 facility.
- 1193 **P** : Parity, the inversion of all spatial coordinates.
- 1194 **PAMELA** : Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics, space-based anti-  
1195 matter detector.
- 1196 **PANDA** : antiProton ANnihilation at Darmstadt, a proposed experiment at the GSI Helmholtzzentrum  
1197 in Darmstadt, Germany, studying proton-antiproton annihilation at few-GeV energies.
- 1198 **PandaX** : A liquid xenon dark matter experiment to be located in the Jin-Ping Underground Laboratory  
1199 in Sichuan, China.
- 1200 **PB** : PetaByte, equal to  $10^{15}$  bytes of information.
- 1201 **PDF** : Parton Distribution Function, a function that describes the internal structure of the proton by  
1202 giving the momentum distribution of a particular constituent, for example, the up quark or gluon.
- 1203 **PEN** : An experiment at **PSI** to measure the ratio of decay rates  $\pi^+ \rightarrow e^+ \nu / \pi^+ \rightarrow \mu^+ \nu$ .
- 1204 **Persistency management** : Management of persistent data on disk, tape, or other media. This includes  
1205 reducing the risk of loss to an appropriate level.
- 1206 **PEP-II** : An  $e^+e^-$  collider operated at **SLAC** from 1998 to 2008 in the center-of-mass energy region of  
1207 10 GeV.
- 1208 **PF** : PetaFlop,  $10^{15}$  floating point operations (usually, per second).
- 1209 **PFA** : Particle Flow Analysis, a method for hadron calorimetry based on separate measurement of the  
1210 components of a hadronic shower with charged particles, photons, and neutral hadrons.
- 1211 **PFS** : Prime Focus Spectrograph, wide-field multi-object spectrograph for the Subaru telescope.
- 1212 **PIENU** : An experiment at **TRIUMF** to measure the ratio of decay rates  $\pi^+ \rightarrow e^+ \nu / \pi^+ \rightarrow \mu^+ \nu$ .

- 1213 **PINGU** : Precision IceCube Next Generation Upgrade, a proposed low-energy extension to **IceCube**.
- 1214 **Pipeline computing** : Data analysis that proceeds in stages.
- 1215 **pMSSM** : phenomenological Minimal Supersymmetric Standard Model, a 19-parameter subspace of the  
1216 full MSSM.
- 1217 **PMNS** : Pontecorvo-Maki-Nakagawa-Sakata matrix, the matrix linking the mass and flavor eigenstates of  
1218 neutrinos.
- 1219 **PMT** : PhotoMultiplier Tube.
- 1220 **Port** : To adjust and test a computer program to run on a new architecture, or the result of this process.
- 1221 **PQ** : Peccei-Quinn symmetry, an approximate symmetry of quark-Higgs boson interactions, which must  
1222 also be spontaneously broken, that allows the possible **CP**-violating term in **QCD** to be set to zero. A  
1223 consequence of this symmetry is the existence of the **axion**.
- 1224 **PREM** : Preliminary Reference Earth Model, a model for the Earth's density distribution.
- 1225 **PREP** : Physics Research Equipment Pool.
- 1226 **Project 8** : A proposed tritium-based neutrino mass experiment.
- 1227 **Project X** : A planned upgrade of the proton accelerator injector complex at **Fermilab**, with a super-  
1228 conducting proton linear accelerator capable of producing multi-megawatt beams.
- 1229 **PROSPECT** : Precision Reactor Neutrino Oscillation and Spectrum Experiment, a U.S.-based reactor  
1230 short-baseline oscillation search experiment.
- 1231 **PSI** : Paul Scherrer Institute, a national laboratory and accelerator center in Switzerland.
- 1232 **PTOLEMY** : Princeton Tritium Observatory for Light Early-universe Massive neutrino Yield, a proposed  
1233 relic Big Bang neutrino background experiment.
- 1234 **PWFA** : Plasma Wake Field Acceleration.
- 1235 **QCD** : Quantum Chromodynamics, the well-established theory describing the strong subnuclear interac-  
1236 tions.
- 1237 **QE** : Quasi-Elastic scattering. In neutrino physics, a reaction such as  $\nu n \rightarrow \mu^- p$  in which no mesons  
1238 are produced. In other contexts, a quasi-elastic reaction on a nucleon can involve production of a low-lying  
1239 nucleon resonance.
- 1240 **QED** : Quantum ElectroDynamics.
- 1241 **Qweak** : An experiment at **JLab** to measure  $Q_{weak}$ , the charge with which the proton couples to the  $Z$   
1242 boson at very low momentum transfer.
- 1243 **RADAR** : R&D Argon Detector at Ash River, proposal to add a **LAr TPC** to the **NO $\nu$ A** far detector  
1244 building in Ash River, Minnesota.
- 1245 **RAT** : A simulation and analysis package for optical detectors developed for the Braidwood project and  
1246 now used within **SNO+**, **MiniClean**, and **DEAP**.

- 1247 **REAPR** : Resonantly Enhance Axion Photon Regeneration, an experiment at **Fermilab** to search for  
1248 **axions** using a laser beam in a strong magnetic field, the successor to **GammeV-CHASE**.
- 1249 **RENO** : Reactor Experiment for Neutrino Oscillations, a reactor neutrino experiment in South Korea.
- 1250 **RENO-50** : A proposed reactor-based experiment with **baseline**  $\sim 50$  km to measure the neutrino mass  
1251 hierarchy with a large scintillator detector.
- 1252 **RF** : Radio Frequency.
- 1253 **RHIC** : Relativistic Heavy Ion Collider, a colliding beam accelerator for protons and heavy ions at **BNL**.
- 1254 **RICE** : Radio Ice Cherenkov Experiment, neutrino detector in Antarctica.
- 1255 **RICOCHET** : A proposed bolometric sterile neutrino search using **CENNS**.
- 1256 **RICH** : Ring Imaging Cherenkov detector.
- 1257 **RIKEN** : Rikagaku Kenkyujo, a major Japanese research institute covering physics, chemistry, and  
1258 engineering, operating multiple research groups in Japan and one in the U.S. at **BNL**.
- 1259 **ROI** : Region Of Interest. In neutrino physics, the region of a measured energy spectrum where the signal  
1260 (typically a peak or dip from an oscillation) lies. In collider physics, a region of a detector whose data is  
1261 used in trigger calculations.
- 1262 **RPC** : Resistive Plate Chamber, a type of particle tracking detector.
- 1263 **SAGE** : Soviet American Gallium Experiment, a solar neutrino experiment in the **Baksan** Neutrino  
1264 Observatory in Russia.
- 1265 **SBIR** : Small Business Innovation Research, a grant category of the **DOE** for collaboration of small  
1266 businesses with experimental projects.
- 1267 **SciDAC** : Scientific Discovery through Advanced Computation, a program of the **DOE**.
- 1268 **Science DMZ** : A portion of a computer network designed for high-performance scientific applications  
1269 rather than general-purpose computing such as web browsing.
- 1270 **SciNO $\nu$ A** : A proposed neutrino scattering experiment adding a fine-grained scintillator detector at the  
1271 **NO $\nu$ A** near detector site.
- 1272 **SDSS** : Sloan Digital Sky Survey, a survey of more than a quarter of the sky using the 2.5-meter telescope  
1273 at Apache Point Observatory, New Mexico.
- 1274 **SiD** : Silicon Detector, a detector with silicon tracking proposed for **ILC** and **CLIC**.
- 1275 **SIMD** : Single Instruction Multiple Data style of parallel programming.
- 1276 **SiPM** : Silicon PhotoMultiplier, a silicon-based photodetector operated in Geiger mode.
- 1277 **SKA** : Square Kilometer Array radio telescope.
- 1278 **SLAC** : Stanford Linear Accelerator Center, a U.S. national laboratory in Menlo Park, California, featuring  
1279 a 3 km electron linear accelerator.
- 1280 **SLC** : SLAC Linear Collider, an electron-positron collider operated at **SLAC** from 1989 to 1998 to study  
1281 the  $Z$  boson and develop the technology of linear colliders.

- 1282 **SM** : Standard Model of particle physics, which describes the strong, electromagnetic, and weak interactions  
1283 as mediated by vector fields.
- 1284 **SNO** : Sudbury Neutrino Observatory, a solar neutrino experiment located in Sudbury, Ontario, Canada.
- 1285 **SNO+** : A successor to the **SNO** experiment aimed at the measurement of neutrinoless double-beta  
1286 decay of tellurium.
- 1287 **SNOLAB** : Underground science laboratory in the Vale Creighton Mine located near Sudbury, Ontario.
- 1288 **SNS** : Spallation Neutron Source, at Oak Ridge National Laboratory.
- 1289 **Soudan** : An underground laboratory in northern Minnesota, housing **MINOS** and low-background  
1290 experiments.
- 1291 **SOX** : A chromium and/or cesium source used with the **Borexino** detector to study the reactor neutrino  
1292 anomaly.
- 1293 **SRF** : Superconducting Radio Frequency (**RF**) cavities and associated technology.
- 1294 **STTR** : Small business Technology TRansfer, a **DOE** program for this purpose.
- 1295 **STAR** : Solenoidal Tracker at RHIC, a relativistic heavy ion collider experiment at Brookhaven.
- 1296 **STEM** : Science, Technology, Engineering, and Mathematics, typically describing a domain of education.
- 1297 **STEREO** : Search for Sterile Neutrinos at ILL reactor, a reactor short-baseline oscillation search in France.
- 1298 **SPS** : Super Proton Synchrotron at **CERN**.
- 1299 **Subaru** : An optical/infrared telescope on Mauna Kea operated by the National Observatory of Japan.
- 1300 **Super-K** : Super-Kamiokande experiment, water Cherenkov detector in the Kamiokande mine in Japan  
1301 studying proton decay as well as solar, atmospheric, and accelerator-produced neutrinos.
- 1302 **SuperKEKB** : A high-luminosity electron-positron collider, with **CM** energy about 10 GeV, at **KEK**.
- 1303 **Super-NEMO** : Super Neutrino Ettore Majorana Observatory, a neutrinoless double beta decay experi-  
1304 ment in the Fréjus underground laboratory in France.
- 1305 **SURF** : Sanford Underground Research Facility: An underground laboratory in the former Homestake  
1306 Mine in Lead, South Dakota.
- 1307 **SUSY** : SUperSYmmetry, a symmetry that links together **fermions** and **bosons**. In any realistic theory,  
1308 supersymmetry requires a new space-time structure extending and generalizing that of relativity.
- 1309 **T** : Time reversal, the transformation of reversing the direction of time.
- 1310 **T2K** : Tokai to Kamiokande experiment, a neutrino oscillation experiment in Japan, using the **J-PARC**  
1311 neutrino beam and the **Super-K** detector.
- 1312 **TA** : Telescope Array, ultra-high-energy cosmic ray detector in Utah.
- 1313 **TCA** : Telecommunications Computing Architecture.
- 1314 **TeV** : Tera-electron Volt ( $10^{12}$  eV), the order-of-magnitude energy scale of Higgs boson physics.

- 1315 **TDR** : Technical Design Report.
- 1316 **TES** : Transition Edge Sensor, a cryogenic sensor based on the very small amount of energy needed to  
1317 destroy superconductivity in a thin film painted on the surface of a detector.
- 1318 **TLEP** : Triple Large Electron-Positron collider, a proposed  $e^+e^-$  collider in a large circular tunnel, with  
1319 **CM** energies from 90 to 350 GeV.
- 1320 **TPC** : Time Projection Chamber, a type of particle detector in which ionization from a track flows to a  
1321 wall of a detector and the arrival time and location are measured, producing a 3-dimensional image of the  
1322 track.
- 1323 **TREK** : Time Reversal Experiment with Kaons, an experiment at **J-PARC** to search for **T**-violating  
1324 muon polarization in the decay  $K^+ \rightarrow \pi^0 \mu^+ \nu$ .
- 1325 **TRIUMF** : TRI-University Meson Facility, the national accelerator laboratory of Canada, located in  
1326 Vancouver. It is now operated by a consortium of 15 universities.
- 1327 **UHE** : Ultra High Energy, typically applied to cosmic rays with energies  $> 10^{18}$  eV.
- 1328 **VCSEL** : Vertical Cavity Surface Emitting Laser.
- 1329 **VEPP** : One of a series of electron-positron colliders at the Budker Institute of Nuclear Physics in  
1330 Novosibirsk, Russia.
- 1331 **VERITAS** : Very Energetic Radiation Imagine Telescope Array System, a telescope for high energy  
1332 gamma rays seen as air showers in Cherenkov radiation, located in Arizona.
- 1333 **Vev** : Vacuum expectation value, the value of a condensed field, such as the Higgs field, at every point in  
1334 space.
- 1335 **VLHC** : Very Large Hadron Collider, a concept for a proton-proton collider with center of mass energy  
1336 approximately 100 TeV.
- 1337 **Volunteer computing** : A distributed computing effort in which computer resources are donated by the  
1338 owner, for example, the SETI At Home project.
- 1339 **Wakefield** : The electromagnetic field trailing a bunch of high-energy particles in an accelerating structure.
- 1340 **WATCHMAN** : WATer CHerenkov Monitoring of Anti-Neutrinos, a collaboration of U.S.-based univer-  
1341 sities and laboratories conducting a site search for an advanced water Cherenkov demonstration detector.
- 1342 **WFIRST-AFTA** : Wide-Field InfraRed Survey Telescope-Astrophysics Focused Telescope Assets
- 1343 **WIMP** : Weakly Interacting Massless Particle, a category of particle that might make up the dark matter  
1344 of the universe.
- 1345 **WIPP** : Waste Isolation Pilot Plant, an underground facility located in New Mexico.
- 1346 **YBCO** : Yttrium Barium Copper Oxide,  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ , one of the first high-temperature superconductors.