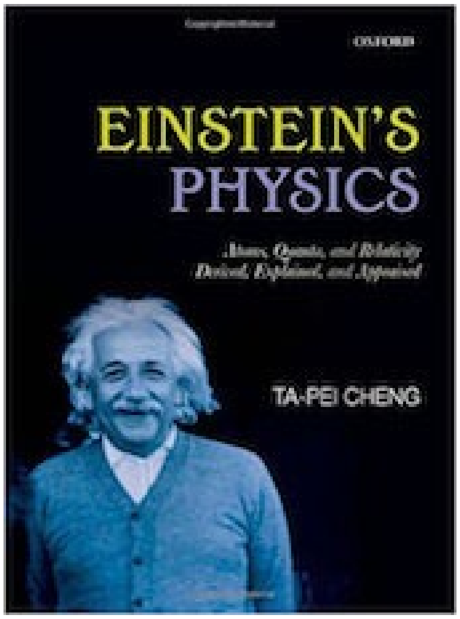
From the website, dedicated to Hermann Weyl, by William O. Straub, one finds the 10.22.2015 entry, http://www.weylmann.com/2015archive.shtml

Good Book — Posted Thursday, 22 October



I often receive emails from people wanting to learn physics who are or have been engineers, chemists, and other science majors but don't know where to turn for physics texts that are truly readable. I've long found myself in that same position, seeking books and papers that I can really follow and comprehend, and when I find something useful, it's been my habit to pass along what I've found, especially when it involves the work of Hermann Weyl. My focus has always been on the undergraduate and beginning graduate student who finds abstruse, impenetrable physics and related mathematics to be a waste of time and effort as far as learning anything is concerned, and I've known enough physics professors who've expressed the same frustration over realizing that not every physics PhD can expect to become a genius when it comes to this stuff.

The most recent book I've read is by Dr. Ta-Pei Cheng, Professor Emeritus at the University of Missouri at St. Louis, whose 2013 book Einstein's Physics: Atoms, Quanta, and Relativity — Derived, Explained, and Appraised genuinely represents a breakthrough in readability and comprehension with regard to both the Standard Model and gravitation. In particular, the book gives full recognition to Weyl for having discovered the *gauge invariance* concept, which oddly enough provides a nearly complete theoretical basis for all quantum physics but not gravitation, as Weyl originally hoped.

Last year I tried to simplify the five-dimensional Kaluza-Klein theory as a purely extra-dimensional, proposed unification of gravitation and electromagnetism carried out in the same Riemannian geometrical framework that Einstein utilized. I went to so far as to derive many of the mathematical terms resulting from the theory, but Cheng goes much further, detailing the various steps needed to derive each term in the theory. As Cheng notes in the very last paragraph of his book (prior to the appendices), Remarkably, with the Kaluza postulate for the 5D metric $\hat{g}_{MN}$ of (17.11), the resultant 5D Ricci scalar (17.86) reduces to the simple expression of (17.20):

$$\hat{R} = R - \frac{1}{4}F_{\mu\nu}F^{\mu\nu}. \qquad (17.89)$$

Some people call this the **Kaluza–Klein miracle.**

Yes, the Kaluza-Klein idea, originally proposed in 1919, appears to be a true miracle. At last, a text has appeared that makes this miracle understandable to the undergraduate student, who to date may have had to take the results of this theory for granted.

Regrettably, the Kaluza-Klein concept of extra dimensions has progressed (if that's the right word) to the point where today the mathematics is comprehensible only to to a relatively few experts who, despite a lot of arm-waving on popularized cable television science programs, have been unable to break down their 10- and 11-dimensional theories into something that most physics PhDs can follow. True, there was a common (though incorrect) belief in the early 1920s that there were fewer than a dozen scientists who could claim to understand Einstein's general theory of relativity. But that was then, and this is now — we live in an age when even high school students understand stuff that was far over the heads of scientists a century before.

Cheng's 2013 book serves as one of the best overviews of modern physics today. Buy the book, or borrow it from a friend (as I did).