# The amiable Einstein and Nordström FREE

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letters

# The amiable Einstein and Nordström

**In his review** of my book, *A Passion for Discovery* (PHYSICS TODAY, August 2008, page 56), Engelbert Schucking questions my decision to include a version from Subrahmanyan Chandrasekhar of a story about a strain in the early relationship between Finnish physicist Gunnar Nordström and Albert Einstein. As I recall, the story is based on a letter of Nordström's, which I, unlike Chandra, have never seen. Schucking says Chandra's story is "nonsense" to be doubted by "anybody familiar with the amiable young Einstein." I do not claim to be more familiar with Einstein than is the guy next door, but I doubt that I am less familiar. In fact, the story was briefly mentioned previously, with Chandra's explicit approval, even his urging, on page 10 of the book *Modern Kaluza–Klein Theories* (Addison-Wesley, 1987), which I coedited with Tom Appelquist and Alan Chodos. Being familiar with the amiable and very careful Chandra, I believe that his version is not nonsense. It seems to be at odds with what I was told by Helsinki physicists and by Nordström's daughter Saga, who speak, as I mention in the book, of a harmonious early friendship of the two men. But the evidence they point to consists of letters exchanged years later. On the upside, what everybody can agree on is that later a friendly tone was established between Einstein and Nordström.

As I say in *A Passion for Discovery*, "human relations can and often do fluctuate," no matter how amiable and brilliant those involved. More importantly for physics, Chandra's version of that relationship throws some light on why it took so long for Nordström's important and extremely original idea of five-dimensional unification to gain recognition.

One final clarification: When I was able to leave Romania in 1959, contrary to Schucking's assertion, the odious Nicolae Ceaușescu was still biding his time on the sidelines. He waited until 1965 to grab power, by which time he could be sure that I had been appointed to the University of Chicago faculty.

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**Schucking replies:** The uncharitable story that Albert Einstein refused to see physicist Gunnar Nordström, who had traveled from Finland to Zürich, Switzerland, to discuss his theory of gravitation, does not accord with the events as recounted by Paul Ehrenfest. For almost a month in June and July 1913, Ehrenfest stayed with Einstein in Zürich. In his diary for 13 June through 1 July of that year,[1] particularly in the entry for 29 June, Ehrenfest says that Einstein and Nordström discussed their gravitational theories during Nordström's visit. Based on those discussions, Nordström published an improved version of his theory, dated Zürich, July 1913, in which he thanked Einstein directly. In his September 1913 lecture in Vienna, Einstein extensively discussed Nordström's new version and made it clear that it was a viable alternative to his own then unfinished theory. The relationship between Einstein's and Nordström's theories is analyzed in *The Genesis of General Relativity*.[2] The volume also contains English translations of Nordström's papers.

## References

1. P. Ehrenfest, diaries, Papers 1902–1933, ENB 4-15, Museum Boerhaave, Leiden, the Netherlands; microfilm copy at Archives for the History of Quantum Physics, Ehrenfest Notebooks, EHR-12, American Institute of Physics, Niels Bohr Library and Archives, College Park, Maryland.
2. J. D. Norton, in *The Genesis of General Relativity*, vol. 3, J. Renn, ed., Springer, Dordrecht, the Netherlands (2007), p. 413.

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# BCS-to-BEC evolution details

Again an article in PHYSICS TODAY (by Carlos Sá de Melo, October 2008, page 45) has incorrectly implied that Anthony Leggett was the first person to study the crossover from Bardeen-Cooper-Schrieffer to Bose–Einstein condensation. On page 47 of the article, it states that "a clear picture of the BCS-to-BEC evolution at zero temperature didn't emerge until 1980, when Anthony Leggett realized that the physics could be captured by a simple description in real space of paired fermions with opposite spins." Although the model I considered in my 1969 paper[1] is slightly different from Leggett's, figure 4 in my paper clearly shows regions where pairing without superconductivity occurs and where superconductivity is limited by the Bose- condensation temperature of pairs, and on page 458 I discuss a limit at which the diameter of pairs is small compared with the distance between them.

I also disagree with a statement in the box on page 47 of Sá de Melo's article that "the evolution from a Bardeen-Cooper-Schrieffer superfluid to a Bose–Einstein condensation superfluid cannot be studied in . . . superconductors." At least in ceramic samples of $SrTiO_3$ with 3% of the titanium replaced by zirconium, the transition has been studied by varying the carrier concentration via differing heat treatments to produce different concentrations of oxygen vacancies.[2] It is possible that such a transition may be found in other superconducting semiconductors when people start to search for suitable materials. However, in three dimensions the pairing strength has to be above some threshold value to obtain the possibility of reaching the Bose-gas regime. Also, many authors think that the BEC regime occurs in underdoped cuprates,[3,4] while