Superconductivity: Some like it hot

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On April 17, 1986 the Editor of Zeitschrift für Physik B received a manuscript entitled "Possible High T_c superconductivity in the Ba-La-Cu-O System", submitted by J. Georg Bednorz and Karl Alex Müller from IBM Zürich Research Laboratory, Rüschlikon, Switzerland. The carefully phrased manuscript reported an abrupt decrease by up to three orders of magnitude of the resistivity, and highest onset temperature in the 30 K range, vastly exceeding the maximum T_c known for superconductors of that time. The paper was quickly accepted and appeared in print in June 1986, and on 14 October 1987 The Royal Swedish Academy of Sciences awarded the authors with the Nobel Prize in Physics for this discovery. Between the publication of their paper and the announcement of the Nobel Committee the physics community had gone bananas over Bednorz and Muellers' discovery. People cast aside whatever activities they were involved in and and started mixing, grinding and cooking ceramic samples of various degrees of toxicity. By the time of the Nobel announcement this had already resulted in the discovery of superconductivity in Y-Ba-Cu-O with Tc up to 93 Kelvin. This was followed in later years by BiSrCaCuO, TlBaCaCuO and in HgBaCaO, with for the latter class of materials a record setting T_c = 134 K at ambient pressure. The extent and impact of this discovery are difficult to summarize due to the extent of the implications for science and society. Most directly there is of course the vision bringing large-scale applications of superconductivity in reach. Even if these materials are not room temperature superconductors, to make them superconducting it suffices to cool with liquid nitrogen. Not only this is easy but also, playing around with liquid nitrogen allows for setting up a great show with bubbling liquids, ice-cream, mysterious looking vapor clouds and magically levitating superconductors. This continues to speak to the imagination of people of all ages. Secondly this put research of transition metal oxides at the front stage of materials research, which contributed to strong development of, among other things, colossal magneto-resistance and multi-ferroic materials. Finally and perhaps most importantly it has acted as an eye-opener to scientists and science policy makers that condensed matter physics is far from being a closed subject: The properties of real materials are described by many-body physics, an extremely complex problem which is far from being solved. The subject is also full of opportunities for designing smart experiments, developing new materials, discovering novel properties, and making theoretical breakthroughs. It has been a captivating subject of research during the past 32 years, and will continue to be a source of inspiration for the generations to come. The condensed matter physics community hasn't found a room temperature superconductor yet. But well, nobody is perfect.

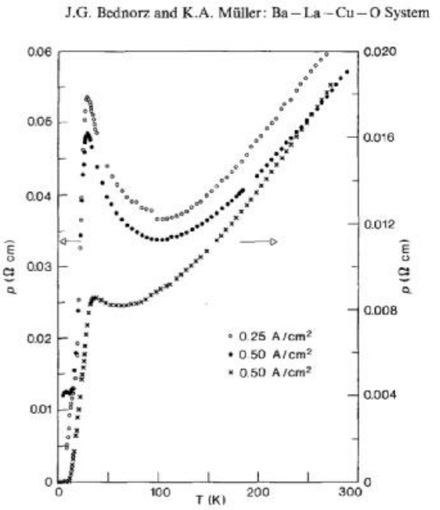

Fig. 1. Temperature dependence of resistivity in $Ba_xLa_{5-x}Cu_5O_{5(3-y)}$ for samples with x(Ba) = 1 (upper curves, left scale) and x(Ba) = 0.75 (lower curve, right scale). The first two cases also show the influence of current density

J. G. Bednorz and K.A.Müller, Zeitschrift für Physik B Condensed Matter 64, 189 (1986)