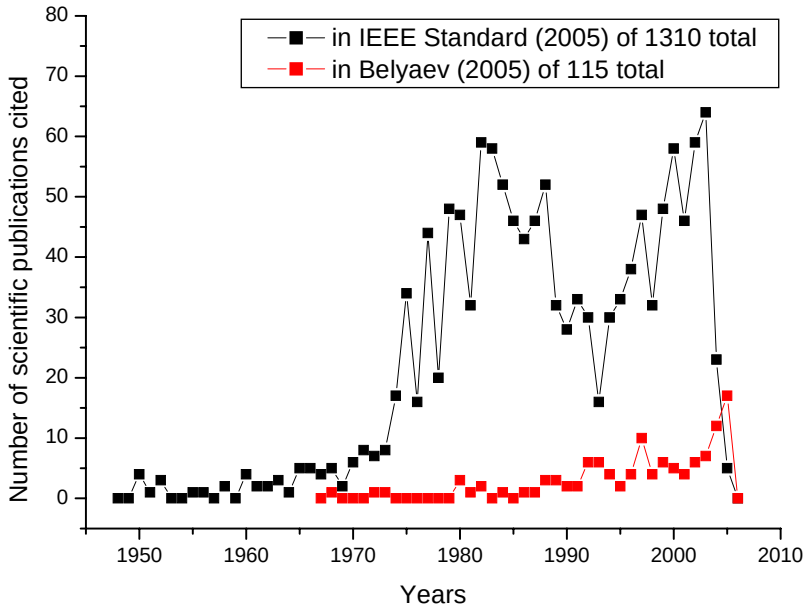
Some notes to the new IEEE electromagnetic safety standards

The new IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields (IEEE Std C95.1™-2005) has come to life in April 2006. The previous one dates to 1991, so it is an important document that is purported to have summarized all new achievements in the field. An estimate of the scientific merit of the Standard is a complex task that will take the scientific community at least some years of examining. At the same time, usual consumers of such a document consider it to be a perfect knowledge 'on trust.' All the more, it is important to point out some shortcomings in the document at once and to emphasize that the document illustrates the conflict between the two scientific 'paradigms' underlying the problem of weak electromagnetic field (EMF) interaction with human body tissues.

As for today, extensive experimental data are collected all over the world on the so-called non-thermal biological effects of weak EMFs, i.e. the effects that are not related to heating of biological tissues. The non-thermal origin of such effects follows from the facts that i) the intensity of effective EMFs is far below the limit necessary to heat tissue; and ii) these effects often take place only in certain EMF frequency bands. There are also effects observed only in certain intervals of the field amplitude. Obviously, this is in variance with the main idea underlying most of the actual electromagnetic safety standards in the world, — the idea that EMF biological effects have solely thermal origin.

The new IEEE standard is primarily based on the dismissal of nonthermal biological effects. The arguments, in short, are as follows: Theoretically, nonthermal effects are not possible since they contradict common physical knowledge. Experimental observations of such effects are artifacts, since they are not replicated in other labs, and, where they are replicated, they have simply no significance for or relation to human health. Having no task to develop a scientific discussion here, we note only that there are *a lot* of scientific articles arguing against such a biased viewpoint.



The following note is based on just a cursory acquaintance with the IEEE Standard list of references that counts about 1300 reference entries. Their distribution over years is shown on the Figure below, which displays two distinct maxima—one at around 1985 and one at 2000—relating to increased public interest in 50–60-Hz background EMFs, and to EMFs of mobile communications, respectively.

It *seems* that the scientific literature upon which the standard is based is comprehensive: it is sufficiently large and even contains the signatures of the natural scientific process. Unfortunately, that is not so. For example, a recent review of nonthermal RF effects [I. Belyaev. Non-thermal biological effects of microwaves. Microwave Review, Nov 2005, p.13–29] includes 115 references, of which only about 1/4 appear in the new IEEE standard. And 85 references, most of which are devoted to nonthermal effects, recent studies, are missed. Trusting consumers of the electromagnetic safety standards might expect a more attentive and careful attitude to human health.

Years of experience have shown that some electromagnetic fields may pose a threat to human health and should be considered as an important biotropic factor like atmospheric pressure, temperature, or humidity. The World Health Organization coordinates the efforts to develop a single system of universally acceptable international standards. Note that today safety standards for certain EMF ranges differ by tens and hundreds of times in different countries; this reflects the lack of research in theoretical magnetobiology, at least. And it looks surprising and provoking that authors of the new EM safety standard ignore new experimental and theoretical findings.

Carcinogenic properties of asbestos were revealed years ago. Imagine if some years later, a scientific team had ignored this knowledge in their public statements.

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