

# Physics of Low-Dimensional Systems

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**Shik A Ya, Bakueva L G, Musikhin S F, Rykov S A** *Physics of Low-Dimensional Systems* (Under the general editorship of V I Il'in, A Ya Shik) (St.-Petersburg: Nauka, 2001) 156 pp.

The monograph *Physics of Low-Dimensional Systems* by A Ya Shik et al. is topical and, by and large, successful. However, it is not its content but rather some aspects of its bibliography and certain priority issues that are the focus here.

We are aware that *Physics of Low-Dimensional Systems* is to a large measure a textbook, which arguably determines the way in which the relevant literature is selected and presented. Still, because the book's extensive bibliography contains many references to original research (including the present authors), it appears some rules should be followed when handling them. Now what do we mean by that?

Electron phenomena in solid-state systems of reduced dimension were first discussed in the theoretical works of I M Lifshits and A M Kosevich [1, 2] in 1953. Their subject was the oscillations of thermodynamic variables with metal film thickness. This is a generally known fact, and one unlikely to be questioned by the authors. Yet there is no single word on it in the book.

Phenomena in semiconductor films were theoretically treated in papers published almost simultaneously by B A Tavger and V Ya Demikhovskii [3] and V B Sandomirskii [4, 5] (all submission dates being in 1962). Paper [3] discusses the special features of the electronic states in such films and examines the effects these features produce, whereas Refs [4, 5] state that the kinetic variables of degenerate films undergo oscillations and that the width of the band gap is thickness-dependent. While *Physics of Low-Dimensional Systems* has a reference to Tavger and Demikhovskii's 1968 review paper [6], the work of Sandomirskii is not mentioned at all.

The book by Shik et al. gives much attention to resonance tunneling problems. The idea of this phenomenon was first put forward in 1963 papers by L V Iogansen [7] and R H Davis and H H Hosack [8]. However, neither these publications nor their authors are mentioned in the monograph.

For semimetals, the quantum phenomenon of a metal–insulator transition with decreasing film thickness was considered in a 1965 paper by V N Lutskiĭ [9]. This work is not given a single word of attention in the book — even though it is in a semimetal that dimensional quantization was first observed. [Later on, researchers at the RAS Institute of Radio and Electronic Engineering (IRE) discovered this effect.]

So much for the theoretical part. The first experimental observations of the dimensional quantum effect were made by V N Lutskiĭ, D N Korneev, Yu F Ogrin, and M I Elinson at IRE [10, 11], and by A B Fowler, F F Fang, W E Howard, and P J Stiles at IBM [12]. The paper [10] was submitted in 1965, and papers [11, 12] a few months later, in 1966. Work [10] examines the way the kinetic coefficients in Bi films vary with film thickness<sup>1</sup>, and Ref. [11] reports the observation of dimensional quantization (also in Bi films) using a tunnel spectroscopy technique. In Ref. [12], the dimensional quantum effect was observed in Si MIS structures.

In the book, neither Refs [10] and [11]<sup>2</sup> nor the names of their authors are mentioned. But then, ironically, on page 89 there is a figure from Ref. [10] that illustrates the first observation of dimensional quantization — which we are told is taken from the review paper by B A Tavger and V Ya Demikhovskii [6]. Fowler and his co-workers are more luckier: not that their paper [12] is mentioned, but at least a book of 1985 co-authored by Fowler is cited in the bibliography.

To summarize, with a bibliography of 74 studies, of which many (including A Ya Shik's) are original works, the authors' failure to mention the studies of Refs [1–5, 7–12] — ones that pioneered the field of low-dimensional systems — is egregious, in our view.

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<sup>1</sup> The results of the studies involving the prediction and observation of the quantum dimensional effect are protected by discovery certificate No. 182 (the authors: I M Lifshits, V N Lutskiĭ, M I Elinson, A M Kosevich, Yu F Ogrin, V B Sandomirskii).

<sup>2</sup> Let us note (in the spirit of the book's authors) that in the work [11] the vacuum tunneling gap was first created and also resonant tunneling was observed for the first time.