Comment on "Spin-Polarized Auger Spectroscopy from Magnetically Ordered Solids"

In a recent Letter,[1] Landolt and Mauri presented a pioneering spin-polarized Auger study of an iron-boride glass. In their work, they showed the importance of spin-polarized Auger spectroscopy in opening up new perspectives in the study of magnetic solids. Among their major findings they detected a strongly polarized satellite of unknown origin, above the Fe $M_{2,3}VV$ transition, that had "no visible counterpart in the intensity spectrum." In the present Comment we identify this satellite as being due to *autoionization emission* corresponding to the resonant $3p$-to-$3d$ transition, and report its observation in our unpolarized intensity spectrum of polycrystalline Fe. Since this process is the electron-stimulated analog of resonant photoemission, it is of interest in providing new insights also into the role of many-body effects in electron spectroscopies.

In Fig. 1 we present our MVV Auger spectra of clean Fe taken with a 2-keV primary beam and double-pass cylindrical-mirror analyzer in a vacuum of 4×10^{-11} Torr. The $M_{2,3}VV$ and M_1VV Auger transitions appear below their corresponding thresholds. The satellite in question, although weak, is clearly visible above the $M_{2,3}$ threshold as the shoulder labeled ϵf in the intensity and derivative spectra. The inset to Fig. 1 shows the polarization results taken from Fig. 2 of Ref. 1. It is clear that the satellite which we label ϵf is especially intense with respect to the main $M_{2,3}VV$ polarization signal. We can understand nondetection of the satellite by conventional means in Ref. 1 because of its weak intensity and the strongly sloping background of the amorphous sample. Also, the Auger line shifts to lower energy in polarization detection,[1] creating a trough at ~46 eV that makes the ϵf emission more apparent.

Our autoionization identification of the satellite stems from a comparison, reported elsewhere,[2] with the following processes known to be governed by the Fano effect: (a) the $M_{2,3}$ loss spectrum,[3] (b) the resonant d-band photoemission yield,[4] and (c) the $M_{2,3}$ photoabsorption spectrum.[5] Similar such comparisons for Ti,[6] V,[2] and Cr (Ref. 2) recently have led to the identification of autoionization emission in those materials as well.

The outstanding question concerns why polarization measurements dramatically emphasize autoionization over Auger emission. An explanation is that the d-to-ϵf emission channels preferentially couple to the bottom of the d band, which is of pure majority spin.[2] In Ni the celebrated 6-eV photoemission satellite, believed to be formed from states near the bottom of the d band,[7] also undergoes strong Fano-type resonant enhancement. Polarized emission from Ni due to electron impact may help elucidate the influence of correlation effects in electron spectroscopies.

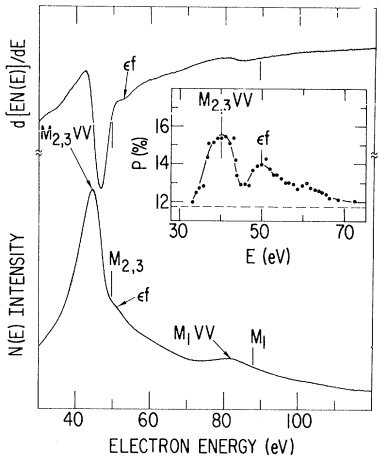

FIG. 1. The Fe MVV Auger and autoionization emission (ϵf) spectra. The polarization spectrum shown in the inset is taken from Ref. 1.

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