ν We Never Knew You

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In 1956, Porter and Thomas proposed a theory to explain the surprising discoveries that resonance reduced neutron widths (Γ_n^0) spanned a very wide range while radiation widths (Γ_γ) for the same resonances were nearly constant. Starting from three seemingly sound and fundamental assumptions, their theory predicted that Γ_n^0 values are distributed according to a χ^2 distribution with one degree of freedom (ν=1) and that Γ_γ values follow the same distribution, albeit with a much larger number of degrees of freedom (ν~100). Almost since that time, the overwhelming consensus has been that data and theory agree very well. In fact, faith in this theory is so strong that in the past ~30 years it has been extremely rare to find a paper in the literature in which new data have been used to test the theory. Instead, standard procedure has been to use the theory to correct new Γ_n^0 data for experimental deficiencies. In the intervening years, random matrix theory (RMT) was developed and has placed the theory on more formal footing, broadened its predictions, and provided a link to quantum chaos. As a consequence, Γ_n^0 data routinely are cited as some of the best proof of the veracity of RMT. Over the past few years, we have obtained new Γ_n^0 data at Oak Ridge and Los Alamos National Laboratories that are in stark disagreement with RMT. I also have reanalyzed the most famous Γ_n^0 data set and found that it is seriously flawed, and does not constitute a striking confirmation of RMT as is routinely claimed. Although the reasons for these disagreements presently are not understood, the most likely explanation appears to be that the highly-excited nuclear states involved are not as statistical as assumed. Further evidence for non-statistical effects appears in Γ_γ data from ORELA; several nuclides have an extra tail in their Γ_γ distributions. These results could have broad impact on basic and applied nuclear physics.