# Kasagi et al. Reply:

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**Kasagi *et al.* Reply:** The two experiments, [1] and [2], measured $\alpha - \gamma$ coincidences with different $\alpha$-particle sources and with different detector solid angles. The questions our colleagues Eremin, Fazio, and Giardina [3] raise are "What is the difference in our measured results?" and "What difference do we expect?" [They also point out that inadvertently, and to our regret, we reported rates for the two sources that were used in reverse order. Fortunately, this misquote does not affect the Comment or our Reply.] We deal with these two questions in order.

Since both papers assume an angular correlation, basically a $\sin^2\theta = 1 - P_2(\cos\theta)$ distribution, a measurement at a single angle is sufficient to determine the angle-integrated bremsstrahlung rate. With this simple dipole distribution, it is to be expected that the ratio of the rates at 15° and 90° should have, as stated above, a value of the order of $10^{-1}$. However, because every experiment uses finite solid angles, the measured angular correlation is reduced from that of the pure dipole, and the expected distribution becomes $1 - A(\Omega)P_2(\cos\theta)$. In [1] the average angle is 90° and $A(\Omega) = 0.86$, whereas in [2] the average angle is 25° and $A(\Omega) = 0.22$. From consideration of angles and solid angles, the ratio of the expected rates in the two experiments changes from $(\sin^2 90°)/(\sin^2 25°) = 5.6$ to only 1.7.

The angle-integrated rate can still be determined from a measurement at one angle—in [1] by multiplying the measurement at 90° by $4\pi \times 0.70$ and in [2] by multiplying the measurement at 25° by $4\pi \times 1.19$. The results are presented in our Fig. 1. Both sets of data have been treated in the same manner. The data of [1] are larger than the data of [2], by a factor of 10 at low $\gamma$-ray energies to a factor of 100 at higher energies.

Should we expect these large factors? When [2] was published, the Coulomb acceleration (CA) model was available to suggest an answer to this question. The CA predictions are included in our Fig. 1, where we see that they did not, and do not, explain the differences. Other calculations of bremsstrahlung in $\alpha$ decay have now appeared, such as the full quantum mechanical calculation in [4]. Our colleagues use the energy dependence in [4] to see if that dependence explains the differences in the two experimental results, and they conclude that it does. We have used the same paper for the same purpose, but we reach the opposite conclusion. For example, at $E_\gamma = 0.3$ MeV, we find that [4] predicts a higher rate for $^{214}$Po in comparison to $^{210}$Po by a factor of 5, whereas the data of our Fig. 1 show a factor of ~100. Likewise at the low end of the common data, $E_\gamma = 0.15$ MeV, the predicted ratio is 2, whereas the data of our Fig. 1 show 10, and at $E_\gamma = 0.45$ MeV, the prediction is 14, and the observed ratio is ~60.

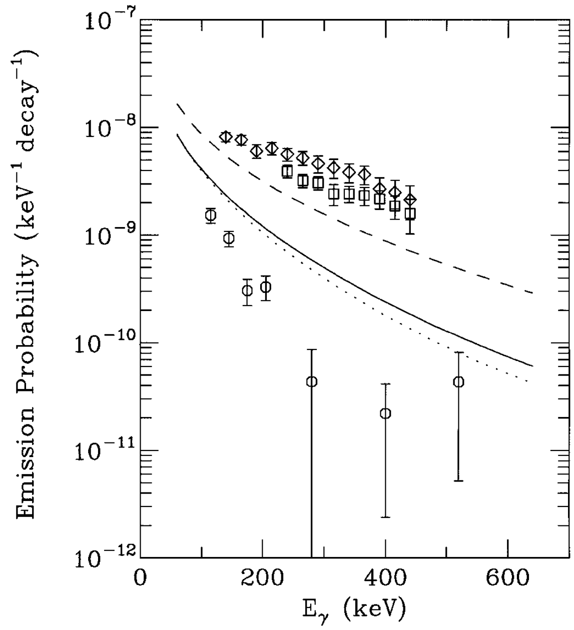


FIG. 1. Emission probabilities of bremsstrahlung photons for $\alpha$ decay of $^{210}$Po (circles) deduced from Ref. [2] and $^{214}$Po (diamonds) and $^{226}$Ra (squares) deduced from Ref. [1]. The results of the CA model calculations are also plotted with the solid line for $^{210}$Po, the dashed line for $^{214}$Po, and the dotted line for $^{226}$Ra.

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