Singleton and Wilburn Reply: In [1] the authors provide some comments and additional support for the conclusion reached in [2] that the equivalence principle is violated by comparing the quantum field theory effects of Hawking radiation and Unruh radiation. Specifically by placing an Unruh-DeWitt detector in a Schwarzschild space-time and in a Rindler space-time, and requiring that the local acceleration is the same in the two space-times, one finds that the temperature measured by Unruh-DeWitt detector is higher for the Schwarzschild space-time. This allows one to locally distinguish between a gravitational field and an accelerating frame. The main comment of [1] is that in [2] the response functions of the Unruh-DeWitt detector were only calculated up to an overall proportionality constant. Even without the overall proportionality constant one could extract the temperature measured by the Unruh-DeWitt detector in the various space-times and for the various vacua. As shown in [1] if one calculates the proportionality constant of the response functions one finds that in addition to the temperatures being different the exact response rates are also different. Thus the equivalence principle is violated not only due to a difference in temperatures but also due to a difference in the exact form of the response functions. However, whether one uses the temperatures from the response functions or the exact form of the response functions the overall conclusion of [2] is the same—outside of the horizon the equivalence principle is violated.

The authors of [1] also point out that there is a difference between the 2D response functions used in [2] and the 4D response functions of [3]. Again this difference occurs only in the overall proportionality of the response function, not in the temperatures. The temperatures determined from the 4D response function is exactly the same as for the 2D response function. It was for this reason (the universality of the temperature regardless of the exact dimensionality of the space-time) as well as for simplicity that we focused on the temperature measured by the Unruh-DeWitt detector rather than the full response function. But as [1] shows if one does look at the full response function one still finds a violation of the equivalence principle.

One interesting observation of [1] is that the restoration of the equivalence principle at the horizon noted in [2] (i.e., the *horizon equivalence principle*) which occurs as the Unruh-DeWitt detector approaches the horizon, is different in 2D as compared to 4D. As shown in [2] in the 2D case the temperatures, as determined by the exponential part of the response function, approach the same value as one approaches the horizon for either Schwarzschild or Rindler space-time. However, taking into account the correct proportionality constants in the response functions one finds that the response functions in the 2D case will differ as the Unruh-DeWitt detector approaches the horizon. However, in the 4D case [3] both temperatures *and* the

full response functions approach the same value as one approaches the horizon for either Schwarzschild or Rindler space-time. Thus the horizon equivalence principle is even stronger in the realistic 4D case as compared to the 2D case.

One final comment of [1] in regard to [2] is that there is a misleading statement about the form of the metric determining the vacuum. What we meant by this statement is clearly explained in points (i)–(iii) below equation (3). It also corresponds to the discussion in chapter 4.5 of [4] and the discussion given in [5,6]. Summarizing again: a particular form of the metric will lead to a particular form of the wave equation which in turn will have specific normal modes particular to this form of the metric. These normal modes and connected creation and annihilation operators are then used to define a vacuum. One can of course choose the vacuum state to be whatever one likes independent of the specific form of the metric but there is a “natural” choice of vacuum for a chosen specific form of the metric. Again this is defined in [2] and corresponds to the more detailed discussions referenced in [4–6].

The authors of [1] have made some interesting observations on our Letter. These observations confirm and in fact strengthen the conclusion given in [2] that the equivalence principle is violated by comparing the temperatures *and* response functions of an Unruh-DeWitt detector placed, respectively, in a Schwarzschild and Rindler space-time. Also as the horizon is approached the equivalence principle is restored both in terms of the temperature (for both 2D and 4D space-times) and in terms of the exact response function (for 4D space-times only).

Douglas Singleton* and Steve Wilburn†
Physics Department
CSU Fresno
Fresno, California 93740 USA

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*dougs@csufresno.edu

†swilburn@csufresno.edu

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