On the effects of a massive body in close relation to the observer

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For a century it has been proposed that massive bodies have a measurable effect on their immediate vicinity, curving spacetime. Such effects have been observed in multiple experiments. In this paper we investigate these effects in the context of a very massive body in close relation to an observer.

To maintain generality we choose an arbitrary coordinate system which is constrained by the Friedmann-Robertson-Walker metric. We define a dimensionless parameter known as the Lorentz invariant proper interval distance (LIPID, hereafter referred to as λ) traced out along a geodesic and assign it the generalised function $f(\lambda)$. For reasons which will become clear later in the paper a suitable choice for λ is the global scale factor measured with respect to the observer's time, a_t.

We consider two cases in relation to each other. One is the heavy system (referred to massive object, or MO) and the other is the metric mapping apparatus, MMA, assumed to be light. We also assume that the observer has access to the MMA. In the presence of the MO the properties of the local metric can in principle be measured at various positions leading to a complete mapping of the space around the MO, determining its mass distribution with arbitrary precision. Such an operation is expressed as $MMA \leftrightarrow MO$, and is commutative.

However such an approach is not sufficient to determine the complete mapping of the metric. Locally, the MMA exerts curvature of space leading to uncertainties in the measurements made. In order to remove such uncertainties it is desirable to ensure that the MMA remains close to the MO and as such the age of the MO must be necessarily larger than that of the MMA. When the presence of the MO persists the calibration of the MMA is dominated by the presence of the MO and as such only relative measurements can be made of the metric. As a result we only consider the case of the young observer, Y_O.

Finally we must introduce a scale to gain a consistent picture. The LIPID parameter is best measured over a short interval when compared to the maximal extent of the MO. This interval, denoted as s_0, is typically on the order of several cm.

Combining our results for a young observer mapping the metric surrounding a massive body in close relation to the observer, using the observer's measurement of the scale factor as the LIPID reveals the result:

$$Y_O : MO \leftrightarrow MMA = s_0 f(a_t) \tag{1}$$

such that $Y_O : MO \leftrightarrow MMA$:

- is consistently underestimating temporal intervals
- appears red-shifted to casual observers
- may have smaller $MO \leftrightarrow MMA$ systems in near orbit

Further preliminary work indicates that although the scale is already fixed by s_0 which is small, in some cases of super massive systems this can extend as far as several light days. As such we can ignore the LIPID entirely and reach the conclusion that:

$$Y_O : MO \leftrightarrow MMA = s_0 O(ld) \tag{2}$$

Speculation on this result leads to the conclusion that the young observer approximation may no longer be valid. Properties of $Y_O MO \leftrightarrow MMA$ in this scenario can include formation predating combustive processes, and diminished interaction with radio waves, especially in early life.

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