CORRIGENDUM

Corrigendum: An educational path for the magnetic vector potential and its physical implications

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Corrigendum: An educational path for the magnetic vector potential and its physical implications

2013 Eur. J. Phys. 34 1209

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Equation (3) of Barbieri et al (2013 Eur. J. Phys. 34 1209) is incorrect since it has been written in terms of the retarded time $t'$ instead of the present time $t$.

Therefore, in place of the following:

\[
\mathbf{B}(\mathbf{r}, t) = \frac{\mu_0}{4\pi} \int_{V'} \left[ \mathbf{J}(\mathbf{r}', t') + \varepsilon_0 \frac{\partial \mathbf{E}(\mathbf{r}', t')}{\partial t} \right] \times \frac{\Delta \mathbf{r}}{(\Delta r)^3} dV',
\]

(3)

where $V'$ is the region containing the currents and

\[
\Delta \mathbf{r} \equiv \mathbf{r} - \mathbf{r}', \quad \Delta r \equiv |\Delta \mathbf{r}|, \quad t' \equiv t - \frac{\Delta r}{c},
\]

(4)

where \( t' \) is the retarded time. If we now adopt the quasi-static approximation, that is if we consider only fields that are slowly varying in time, we can neglect all the time derivative multiplied by $1/c$ (but not time-dependent terms alone). Therefore the contribution of the displacement currents in equation (3) can be disregarded, thanks to the presence of the constant $\varepsilon_0 \mu_0 = 1/c^2$ that multiplies the time derivative of $\mathbf{E}$. Moreover, the retarded time $t'$ of equation (4) also can be considered equal to $t'$.

please read:

\[
\mathbf{B}(\mathbf{r}, t) = \frac{\mu_0}{4\pi} \int_{V'} \left[ \mathbf{J}(\mathbf{r}', t) + \varepsilon_0 \frac{\partial \mathbf{E}(\mathbf{r}', t)}{\partial t} \right] \times \frac{\Delta \mathbf{r}}{(\Delta r)^3} dV',
\]

(3)

where $V'$ is the region containing the currents and

\[
\Delta \mathbf{r} \equiv \mathbf{r} - \mathbf{r}', \quad \Delta r \equiv |\Delta \mathbf{r}|.
\]

(4)
If we now adopt the quasi-static approximation, that is if we consider only fields that are slowly varying in time, we can neglect all the time derivatives multiplied by $\varepsilon_0\mu_0 = 1/c^2$ (but not time-dependent terms alone). The contribution of the displacement currents in equation (3) can, therefore, be disregarded.

The mistake in equation (3) of Barbieri et al (2013 *Eur. J. Phys.* 34 1209) does not influence any of the results or conclusions of the original paper.