Journal of Physics B: Atomic, Molecular and Optical Physics

ERRATUM

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IOP Publishing Journal of Physics B: Atomic, Molecular and Optical Physics
J. Phys. B: At. Mol. Opt. Phys. 48 (2015) 249601 (2pp) doi:10.1088/0953-4075/48/24/249601

Erratum: Generating continuous variable entangled states for quantum teleportation using a superposition of number-conserving operations (2015 *J. Phys. B: At. Mol. Opt. Phys.* 48 185502)

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The erratum has been written to correct a few misprints in equations (A.3) and (A.4) of appendix A, in our manuscript [1].

These equations, including the intervening text, should read as follows:

The general expression can be written as

$$\begin{aligned}
&\langle n, m|\, \hat{D}_a(\xi)\hat{D}_b(\eta)|n-l, m-l'\rangle \\
&= \exp\left[-\frac{1}{2}\left(|\xi|^2+|\eta|^2\right)\right]\langle n, m|\exp\left(\xi\hat{a}^\dagger\right) \\
&\quad\times \exp\left(-\xi^*\hat{a}\right)\exp\left(\eta\hat{b}^\dagger\right)\exp\left(-\eta^*\hat{b}\right)|n-l, m-l'\rangle \\
&= \exp\left[-\frac{1}{2}\left(|\xi|^2+|\eta|^2\right)\right]\langle n, m|\exp\left(\xi\hat{a}^\dagger\right) \\
&\quad\times \exp\left(-\xi^*\hat{a}\right)\exp\left(\eta\hat{b}^\dagger\right)\exp\left(-\eta^*\hat{b}\right)\hat{a}^l\hat{b}^{l'}\,|n, m\rangle \\
&\quad\times\sqrt{\frac{(n-l)!\,(m-l')!}{n!\;m!}} \\
&= \exp\left[-\frac{1}{2}\left(|\xi|^2+|\eta|^2\right)\right]\sqrt{\frac{(n-l)!\,(m-l')!}{n!\;m!}} \\
&\quad\times\left(-\frac{\partial}{\partial\xi^*}\right)^l\left(-\frac{\partial}{\partial\eta^*}\right)^{l'} \\
&\quad\times\langle n, m|\exp\left(\xi\hat{a}^\dagger\right)\exp\left(-\xi^*\hat{a}\right) \\
&\quad\times\exp\left(\eta\hat{b}^\dagger\right)\exp\left(-\eta^*\hat{b}\right)|n, m\rangle \\
&= \exp\left[-\frac{1}{2}\left(|\xi|^2+|\eta|^2\right)\right]\sqrt{\frac{(n-l)!\,(m-l')!}{n!\;m!}} \\
&\quad\times(-\xi)^l(-\eta)^{l'}\left(-\frac{\partial}{\partial|\xi|^2}\right)^l\left(-\frac{\partial}{\partial|\eta|^2}\right)^{l'} \\
&\quad\times\langle n, m|\exp\left(\xi\hat{a}^\dagger\right)\exp\left(-\xi^*\hat{a}\right) \\
&\quad\exp\left(\eta\hat{b}^\dagger\right)\exp\left(-\eta^*\hat{b}\right)|n, m\rangle.
\end{aligned} \tag{A.3}$$

We now need to evaluate the term $\langle n, m|\exp(\xi\hat{a}^\dagger)\exp(-\xi^*\hat{a})\exp(\eta\hat{b}^\dagger)\exp(-\eta^*\hat{b})|n, m\rangle$ for all m, n.

$$\begin{aligned}
&\langle n, m|\exp\left(\xi\hat{a}^\dagger\right)\exp\left(-\xi^*\hat{a}\right) \\
&\exp\left(\eta\hat{b}^\dagger\right)\exp\left(-\eta^*\hat{b}\right)|n, m\rangle \\
&= \langle n, m|\sum_{s=0}^{\infty}\frac{\xi^s\hat{a}^{\dagger s}}{s!}\sum_{t=0}^{\infty}\frac{\left(-\xi^*\right)^t\hat{a}^t}{t!} \\
&\quad\times\sum_{s'=0}^{\infty}\frac{\eta^{s'}\hat{b}^{\dagger s'}}{s'!}\sum_{t'=0}^{\infty}\frac{\left(-\eta^*\right)^{t'}\hat{b}^{\dagger t'}}{t'!}\,|n, m\rangle \\
&= \sum_{s,t,s',t'=0}^{\infty}\frac{\xi^s\left(-\xi^*\right)^t\eta^{s'}\left(-\eta^*\right)^{t'}}{s!\;t!\;s'!\;t'!}\langle n, m|\,\hat{a}^{\dagger s}\hat{b}^{\dagger s'}\hat{a}^t\hat{b}^{t'}\,|n, m\rangle \\
&= \sum_{s,t,s',t'=0}^{\infty}\frac{\xi^s\left(-\xi^*\right)^t\eta^{s'}\left(-\eta^*\right)^{t'}}{s!\;t!\;s'!\;t'!}\sqrt{\frac{n!\;m!}{(n-s)!\,(n-t)!}} \\
&\quad\times\sqrt{\frac{n!\;m!}{(m-s')!\,(m-t')!}}
\end{aligned}$$

$$\times \underbrace{\langle n-s, m-s'|n-t, m-t'\rangle \delta_{st}\delta_{s't'}}$$
$$= \sum_{s,s'=0}^{\infty} \frac{\left(-|\xi|^2\right)^s \left(-|\eta|^2\right)^{s'}}{(s!\,s'!)^2} \left(\frac{n!}{(n-s)!}\right)\left(\frac{m!}{(m-s')!}\right)$$
$$= L_n\left(|\xi|^2\right) L_m\left(|\eta|^2\right), \tag{A.4}$$

where $L_n(x)$ are the Laguerre polynomials.

Reference

[1] Dhar H S, Chatterjee A and Ghosh R 2015 *J. Phys. B: At. Mol. Opt. Phys.* **48** 185502