February 14, 2013

Dear Editor

According to the suggestions made by the referee, we modified our manuscript

AZ10865 Teles

Free expansion of Bose-Einstein condensates with a multi-charged vortex

by R. P. Teles, F. E. A. dos Santos, M. A. Caracanhas, et al.

and resubmit it to *Physical Review A*.

We have addressed all the questions raised by the referee and believe that our manuscript is now appropriate for publication in PRA. Our modifications were kept in boldface in order to facilitate the review process.

In the following we provide a short reply to the issues addressed by the referee:

Response to Referee:

We appreciate the comments and criticisms which made us modify our manuscript accordingly. With the following discussion we expect to cover all the questions risen by the referee:

1. The introduction of an extra parameter describing the dynamics of the vortex core was considered by us but it turned out to have negligible influence on the expansion of cloud. However, we observed that it is not the case if for example the collective excitations in a trapped condensate with vortices are considered. In this case, this extra parameter as well as an extra term in the phase of the condensate wave function are necessary in order to avoid unphysical results due to the violation of the continuity equation. We decided not to include this lengthy discussion here since it was out of the scope of the present paper. Another manuscript dealing in a detailed way with this issue is being prepared now.
2. As we point out in the revised manuscript, giant vortices in BECs were already produced using experimental techniques such as using a tightly focused resonant laser or using a blue-detuned laser in order to compensate the gravity. Another still theoretical proposal is the application of a Gaussian potential peak along the vortex core.
3. Although not directly related to quantum turbulence, our work provides a method to infer the multiplicity of individual charged vortices in BECs observed using time-of-flight pictures. This information can be very helpful in future experiments investigating the role of charged vortices in quantum turbulence.

Sincerely,

The authors