# Detection of orbital angular momentum-induced beam shifts by weak measurement

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**Abstract:** Weak measurement for orbital angular momentum (OAM)-induced spatial shifts of vortex beams are still confusing. The beam shift will be amplified by selecting the appropriate pre-selected and post-selected states. Here the maximum shifts are theoretically predicted and experimentally verified with optimal preselection and postselection states.
**KeyWords:** orbital angular momentum; beam shifts; weak measurement

## 1. Experimental and theoretical comparison of the amplified OAM-induced shifts

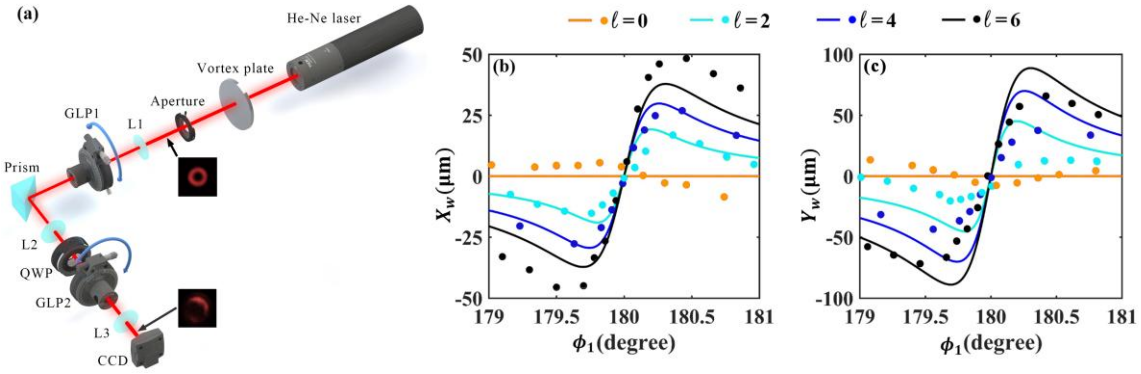


Fig. 1. (a) Experiment setup for the measurement of OAM-induced shifts by weak technique. The experiment (dots) and theoretical (lines) results of the amplified OAM-induced GH (b) and IF (c) shifts changing with the angle of GLP $\phi_1$.

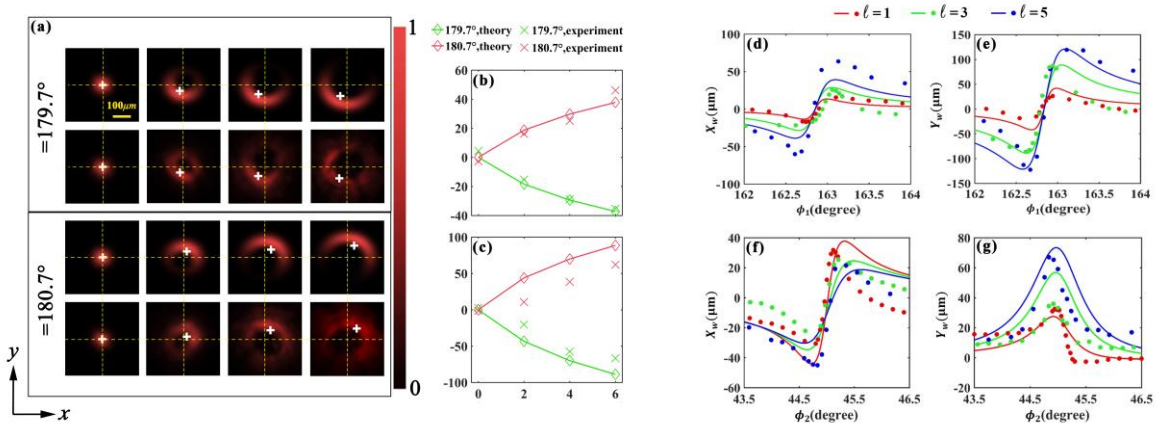


Fig. 2. (a) Comparisons of the experiment (first and third rows) and theoretical (second and forth row) intensity patterns of transmitted beam from GLP2. The amplified OAM-induced GH (b) and IF (d) shifts changing with the incident OAM for $\phi_1$=179.7° and 180.7°. (d) The experiment (dots) and theoretical (lines) results of the amplified OAM-induced GH (d,f) and IF (e,g) shifts changing with $\phi_1$ for $\phi_2$=45° (d,e) and $\phi_2$ for $\phi_1$ =163.3° (f,g).

## 2. Conclusions

By properly choosing the preselection and postselection states, the OAM-induced GH and IF shifts can be maximized. Specially, the IF shifts can always be maximized for an arbitrary angle larger than 15°. The IF shift is up to 121.16 μm of for $\ell$=5, $\phi_1$=163.3°,$\phi_2$=45°. The maximum shifts increase with the incident OAM gradually, thus can be used to identify the OAM precisely.