We developed a kinetic model for assembly of ordered quantum-dot (QD) monolayers on a 2-dimensional surface that reproduces experimental observations for a variety of QD size distributions (of Gaussian size profile). Such QD monolayers have already been utilized in a number of thin-film applications, QD-LEDs, and QD-photodetectors. However, methods of fabricating QD films are still being developed and our work focuses on developing a numerical tool to investigate methods for improving the quality of these films.

To numerically assemble a QD monolayer, we model the QDs as spheres that move on the surface with no friction but with random thermal motion added at each time-step. We apply a van der Waals attraction between QDs and hard-wall repulsion at the QD radius. When two QDs collide, their interaction is partially inelastic based on a model parameter. These conditions allow for a range of behavior encompassing many interesting phenomena. We find that a mono-disperse size distribution of QDs forms hexagonally close-packed aggregates, and the packing and aggregate stability of the QD monolayer degrades dramatically as the standard deviation of the size distribution is increased. In experimental studies [1], the instability of QD monolayers has been observed to occur for standard deviations of greater than 10% in QD diameter. We were able to reproduce these findings in our simulations (Figure 1). We have further shown that confining the same QD distributions inside a 1-dimensional hard boundary with a width of a few QD diameters can counteract this instability.

**REFERENCES**