eliminate in any practical apparatus. The production of intense cold cluster ion beams, therefore, is no easy trick.

Nonetheless, this problem has now been solved -- and solved in a general way that actually will allow us to study negative cluster ions as well!

Only a few weeks ago we found that our new developments in intense pulsed nozzle operation permit sufficient helium density in the beginning of the expansion to thermalize not only the positive ions produced by excimer exitation in the nozzle, but the associated photoelectrons as well. The result is the production of a dense, cold plasma. Since this plasma is neutral over-all, the cluster ions experience the full cooling of the supersonic helium expansion just as efficiently as a neutral cluster. There is no net charge imbalance so there is no space charge; even extremely high cluster ion densities remain stable. Finally, since the Debye screening length in such dense plasmas is so short (less than .01 cm in our case), stray electric and magnetic fields have little effect on the cold plasma beam. Even very slow cluster ion beams can then be routed through various differential pumping chambers and electrode assemblies without beam loss from stray fields.

This new technique does wonders for our positive cluster ion experiments, and the entire cluster ion apparatus has been rearranged to take advantage of this new development. More exciting, however, is the fact that this new ion-production scheme also allows us to study negative cluster ions as well. It turns out that an intense shower of slow photoelectrons is