Lowest Temperatures in Cooled Heavy Ion Beams at the ESR, K. BECKERT, H. EICKHOFF, B. FRANZKE, F. NOLDEN, H. REICH, M. STECK, T. WINKLER, GSI Darmstadt - The temperature of electron cooled ion beams usually exceeds the electron beam temperature by orders of magnitude. Intrabeam scattering is a strong heating source for the dense, cold ion beam limiting the achievement of very low temperatures. At particle numbers below a few thousand ions a suppression of intrabeam scattering has been observed for electron cooled heavy ions in the storage ring ESR. A phase transition like reduction of the momentum spread evidences the disappearance of intrabeam scattering. Heavy ion beams with momentum spreads below 1 ppm and transverse emittances below 1 nm provide unprecedented possibilities for high precision experiments with the stored heavy ion beam. The determination of the true momentum spread by Schottky noise detection is obviously limited by the stability of the magnet power supplies.