

'Binary Star' Instability, M. D'YACHKOV,
R. BAARTMAN, TRIUMF - A single-bunch stability threshold can be found by analyzing the Vlasov equation with respect to small perturbations. In the case of proton synchrotrons the instability is always followed by turbulent bunch lengthening, but in the case of electron storage rings where radiation damping causes the particles to be confined, the behaviour of the beam beyond the instability threshold may vary depending on the shape of the wake fields and the intensity. It was observed in simulations that in the case when the natural bunch length is smaller than the characteristic length of the wake field, at some intensity (which is typically much higher than the instability threshold found by solving the Vlasov equation) the bunch splits into two equal 'sub-bunches' and these oscillate in each other's fields so that their motion in phase space resembles that of a 'binary star'. The signature of this behaviour is strong quadrupole oscillations. Another feature is that as intensity increases, low frequency sidebands begin to appear around the quadrupole frequency. This qualitatively resembles an effect observed at LEP in 1991.