Transvers Quark Spin Effects in Hard Processes[1] LEONARD GAM-
BERG, Penn State Berks — The connection between quark orbital angular mo-
mentum and final state interaction for transversely polarized quarks in unpolarized
hadrons suggests significant $\cos 2\phi$ azimuthal asymmetries in semi-inclusive deep
inelastic scattering (SIDIS), $e\ p \rightarrow e'\ H\ X$, and in inclusive charged di- hadron
production, $e^+\ e^- \rightarrow H\ H\ X$, as well as in di-lepton production in Drell Yan scat-
tering, $p\ \bar{p} \rightarrow \ell^+\ \ell^-\ X$. When the transverse momentum of the reaction P_T is
on the order of or less than Λ_{qcd}, that is where $P_T \sim k_T$, where k_T is intrinsic
transverse quark momentum, these effects are characterized in term of naive time
reversal odd (so called "T-odd") transverse momentum dependent (TMD) parton
distribution and fragmentation functions. At these moderate transverse momentum
scales we estimate the size of the $\cos 2\phi$ azimuthal asymmetry in SIDIS, Drell Yan
and $e^+\ e^-$ annihilation, within the parton motivated spectator framework. In SIDIS
and Drell Yan scattering we consider this so called "Boer-Mulders" effect for a fu-
ture experiments at the upgraded CLAS-12 GeV detector at Jefferson LAB and for
proton-proton and anti-proton experiments at RHIC,JPARC, and GSI. In $e^+\ e^-$
annihilation, we consider this asymmetry in terms of the Collins effect for kaons at
BELLE.

Leonard Gamberg
Penn State Berks

Date submitted: 02 Jul 2007   Electronic form version 1.4