

**The Phase Space Dependent Polarization Direction
in the HERA Proton Ring at High Energy,**

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K. HEINEMANN, M. VOGT, DESY - In very high energy storage rings the equilibrium spin polarization direction can vary strongly from point to point in phase space. Thus, unless counter measures are taken, the average polarization of the beam can be seriously limited. In this paper we present estimates of this limitation for the HERA proton ring as a function of beam energy and other system parameters, and discuss methods to minimize it. For this effort it has been essential to obtain a trustworthy approach to computing the polarization distribution. For this purpose we cross check the Normal Form approach in various orders with some innovative methods which deduce this quantity from spin phase space tracking data.