

## Minutes of the NCSX Physics Meeting of 10/28/99

Hiro Takahashi discussed the field line tracing measurement on the Wisconsin Helically Symmetric Experiment (HSX), which he participated in. His presentation posted on the web contains a substantial amount of background material on HSX which is available for reference purposes, and was reviewed very quickly at the beginning of the talk. The field line tracing experiment used an electron gun and fluorescent mesh in a vacuum magnetic field. Typically about a dozen bright spots are produced on the mesh as the electron beam follows a field line multiple times around the stellarator. It is believed that the limitation on the number of spots is due to the electron beam striking the gun as it returns close to its initial poloidal location. A series of images taken as the gun was moved radially from the outboard side to the inboard side shows a sequence of well defined magnetic surfaces, and the magnetic axis. Estimates of the rotational transform using the observed intersections of the electron beam with the fluorescent mesh agree with the results of a Biot-Savart field line following calculation to within about a percent. The difference is likely accounted for by inaccuracies in the interpretation of the experimental field line tracing data, including such effects as the finite width of the observed spots on the mesh due to saturation of the CCD pixels. The image on the fluorescent mesh can also be used to resolve an island at the  $8/7$  rational surface. The island width is quite small at  $B = 1$  kG, and gets somewhat larger, as expected, when  $B$  is lowered to 100 G. Although these field line tracing experiments ultimately showed the machine to have high quality magnetic surfaces, the earliest field line tracing experiments on HSX encountered a problem. The electron beam was rapidly leaving the device, and this was subsequently identified as being caused by the fact that two of the 48 coils connected in series were carrying little or no current. A current jump was occurring at a transition section between parallel-plate busswork and coaxial busswork. A repair of these joints led to the subsequent positive results. Hiro concluded his talk with a number of recommendations for NCSX. These include the development of a stable electron gun, and the assessment of methods other than the fluorescent mesh for following the electron beam, as well as the scheduling of adequate time for measurement of the flux surfaces.