1016-53-99   **Huijun Fan*** (`fanhj@math.pku.edu.cn`), School of mathematical sciences, Peking University, 100871 Beijing, Peoples Rep of China, and **Tyler Jarvis** and **Yongbin Ruan**. *Classification of the singularities of Witten equation.* Preliminary report.

Witten equation is a nonlinear Cauchy-Riemann system defined on W-spin curves. It was proposed by E. Witten to construct the virtual cycle of the moduli space of W-spin curves, where $W = W(x_1, \cdots, x_t)$ is a non-degenerate quasi-homogeneous polynomial. The construction of the virtual cycle is essencial in the generalized Witten conjecture. Recently, we also found it can provide quantum invariants to classical singularity theory. To define Witten equation, there are two natural different choices of metrics on Riemann surfaces, which correspond respectively to "Smooth theory" and "Cylindric theory". when we take the smooth metric, the properties of Witten equation resemble more like the properties of semi-elliptic equations. It was proved by our previous paper that the marked points are the only blow-up points of the system. To construct the moduli theory corresponding to smooth metric, it is necessary to classify all the possible singularities of the Witten equation. In this lecture, We will discuss the "Smooth theory" and propose the classification problem of the singularities of Witten equation. As a first step, we discuss the simplest case-$W = A_r$ case. (Received February 07, 2006)