Cotton-Mouton Effect Polarimetry on EAST Tokamak

M.Y. Shen[1], J.B. Zhang[2] , Y. Zhang[2], Y.X. Jie[2] , H.Q. Liu[2], J.L. Xie[1] and W.X. Ding[1*]

[1]*School of Nuclear Science and Technology, University of Science and Technology of China, Hefei 230026, People's Republic of China*
[2]*Institute of plasma physics, Hefei Institutes of Physical Science, Chinese Academy of Science Hefei 230031, People's Republic of China*

The feasibility of electron density measurement using the Cotton-Mouton (CM) effect is systematically investigated through a combination of theoretical derivation and simulations. For laser wavelength of 432.6 μm, fringe jumps due to phase shift over 2π can be avoided to provide reliable density measurement for machine operation. The study clarifies that elliptical modulation enables the direct measurement of the phase variation of the second component s_2 of the Stokes parameters, providing information about $\delta_{CM} = C_{CM}\lambda^3\int B_\perp^2 n_e dl$. The measurement principle for heterodyne detection in the case of small CM effects is presented, along with the design of an optical setup. In a real laboratory environment, the power density of the two orthogonal light beams received by the detector may not be strictly equal. It is shown that non-equal power emission only affects the DC offset of the light intensity, and does not affect the phase variation of measured signals. It is further confirmed that the higher-order term errors introduced by the Faraday rotation effect on CM effect are small (1%) for current parameters of EAST.

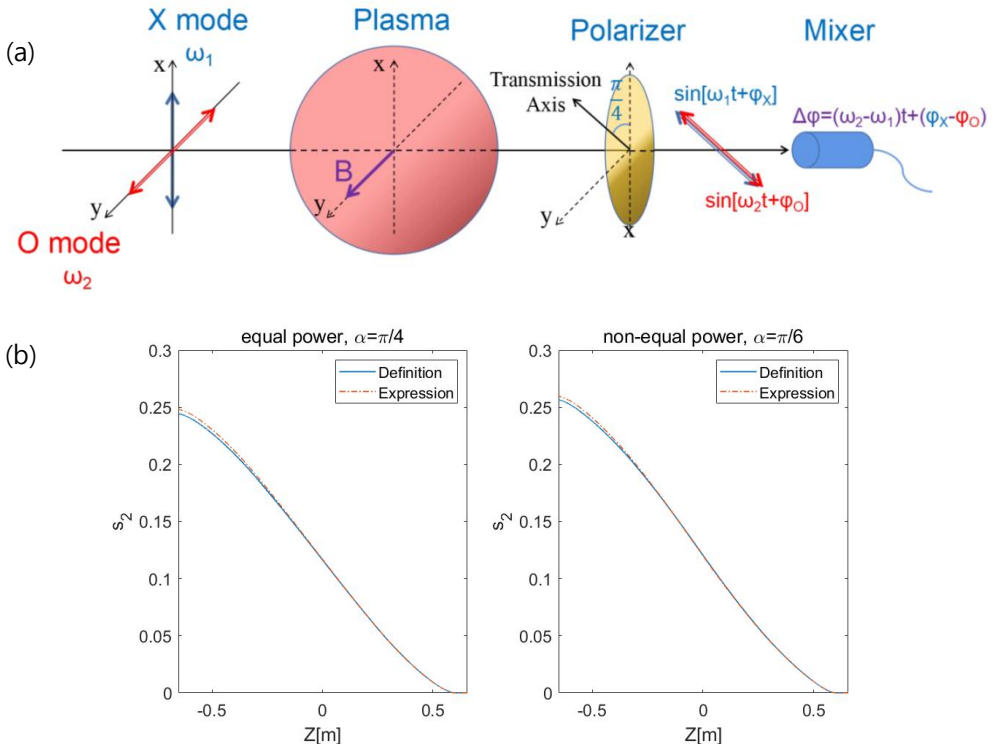

Figure 1. (a) Schematics of the optical arrangement of the CM polarimeter; (b) The comparative analysis of the simulated results for time modulation of s_2.

*Presenting author: sa21214018@mail.ustc.edu.cn