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Tomography of ion flow and temperature measured by a coherence imaging spectroscopy using Gaussian processes KENJI UEDA, Univ. of Tokyo, MASAKI NISHIURA, NAOKI KENMOCHI, NIFS, RT-1 TEAM — Coherence Imaging Spectroscopy (CIS) is a new type of doppler spectroscopy to obtain the velocity and temperature of ions and enable us to acquire two-dimensional spatial information through a fringe pattern analysis. Since an interferogram measured with a CIS camera system becomes a line-integrated quantity of line spectra, the tomographic technique containing spectra with a doppler shift and broadening is required to reconstruct the local profiles. In this research, a Gaussian process (GP) was applied to the tomographic method. A GP is a statistical model, which represents non-parametric functions with probabilistic behavior, and provides smooth solutions to inverse problems even with bad conditions. The method consists of two steps: a formulation of the transformation process from the local profiles to the original interferogram of the CIS, and an inverse transformation by the Bayesian inference based on GP. In this case, we determined the hyperparameters from a marginal likelihood optimization and imposed physical constraints. The proposed method demonstrated the reconstruction of the local ion flow velocity and temperature in the magnetospheric plasma of the RT-1 device. The substantial origin of drift forces is discussed to explain the toroidal ion flow.

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