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Data-driven study on density limit and radiation collapse in stellarator-heliotron plasmas on LHD[1] TATSUYA YOKOYAMA, Graduate School of Frontier Science, UTokyo, HIROSHI YAMADA, SUGURU MASUZAKI, JUNICHI MIYAZAWA, KIYOFUMI MUKAI, BYRON PETERSON, NAOKI TAMURA, NIFS, NINS, LHD EXPERIMENT GROUP TEAM — The boundary between stable-state and radiation collapse in stellarator-heliotron plasmas has been discussed using machine learning methods based on the experiment data in LHD. The density limit in stellarator-heliotron plasmas is defined by radiation collapse and the Sudo scaling provides brief physics picture. It should be noted that there are much more parameters than in the Sudo scaling involved in physics of radiation collapse and density limit. In this study, a linear SVM, which is one of machine learning technique, has been used to divide stable and collapse regions. The key parameters of density limit in LHD have been extracted using a sparse modeling, which exploits the inherent sparseness in all high-dimensional data and extracts the maximum amount of information from the data. Among about 20 physical parameters, several parameters such as line averaged electron density, heating power, and neutral gas pressure have been extracted as key parameters. With these parameters, 95% of stable-state data and 82% of radiation collapse data were classified correctly. Density-limit scaling using the extracted key parameters and likelihood of radiation collapse is discussed.

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