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Simulation of photoionized plasma in laboratory

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X-ray spectroscopy is an essential tool for comprehending the photoionization processes that drive the behavior of non-thermal equilibrium plasmas in compact astrophysical objects, such as black holes. However, the distance of these objects from the Earth and the inability to control or accurately ascertain the conditions that govern their behavior make it challenging to interpret the origin of the features in astronomical X-ray observations. An experiment is described in which a gold cavity is used to produce a blackbody radiator, and the He-like triplets and their satellite X-ray emission of the photoionized silicon plasma have been measured. These lines are reproduced by a time-dependent simulation based on the Monte Carlo method. The simulations are also used to analyze the observed spectra of the X-ray binary, Vela X-1. The wind velocities and line strength were derived by a Markov Chain Monte Carlo (MCMC) analysis based on the Metropolis - Hasting method[1] and an affine-invariant ensemble sampling algorithm[2, 3] Then plasma diagnostics were performed for three different orbital phases, which are given with fewer errors and more self-consistency.

References

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